

# Teachers' Conceptions as a Basis for the Design of an Educational Application: Case Perioperative Nursing

Antti Pirhonen and Minna Silvennoinen

**Abstract**—The only relevant basis for the design of an educational application are objectives of learning for the content area. This study analyses the process in which the real – not only the formal – objectives could work as the starting point for the construction of an educational game. The application context is the education of perioperative nursing. The process is based on the panel discussions of nursing teachers. In the panels, the teachers elaborated the objectives. The transcribed discussions were analysed in terms of the conceptions of learning and teaching of perioperative nursing.

The outcome of the study is first the elaborated objectives, which will be used in the implementation of an educational game for the needs of pre-, intra and post-operative nursing skills learning. Second, the study shows that different views of learning are necessary to be understood in order to design an appropriate educational application.

**Keywords**—Perioperative nursing, conceptions of learning, educational applications.

## I. INTRODUCTION

PERIOPERATIVE nurses' work in operating department and their role at hospital is independent and responsible patient caregiver. The work can be divided according to temporal phases of care, such as preoperative, intraoperative, and postoperative periods, which means that these nurses provide care and support to patients before, during, and after surgery and other invasive procedures. Perioperative nurses responsibilities prior and during surgery are for example instrument and sterile environment preparation and maintenance and assisting surgeons during the operation [1]. Perioperative nursing skills include cognitive, social and technical components. Sometimes highly automatised technical skills are needed; sometimes fast reasoning and reaction which should be applied to constantly changing treatment situations and a wide variety of patients. In addition, operating room technology continues to expand which increases the complexity of perioperative nursing and raises new ethical and legal questions [2]. Nurse education is a central means to reduce or prevent noticeable risks and errors in perioperative work [2], [3].

Antti Pirhonen and Minna Silvennoinen are with department of Computer Science and Information Systems P.O.Box35 FI-40014 University of Jyväskylä, Finland. (e-mail first name.last name@jyu.fi)

The work is funded by European Social Fund (ESF) in Finland.

Computer based educational games, such as web-based courses including quizzes, examinations and reviews have been used in healthcare to teach nursing skills [4], [5]. There is some demonstration about the learning benefits of this kind of game-like interactive educational applications. Even though much of the published research in the area suffers from uncritical hype around digital technology, there is a lot of potential in the interactive technologies to be utilised in education. Due to the extremely diversified contents of perioperative nursing skills, it is highly relevant to consider the application of computers in this education.

The purpose of constructing an educational application is – or at least should be – to promote learning. Therefore, learning objectives should be the primary criteria in all stages of the development. However, it is far from clear what the objectives when educating perioperative nurses are. What do we mean by learning objectives? Do we refer to formal objectives which are written in curricula, or the objectives that the teacher is implementing and which arise from numerous sources, of which formal documents are only one part? In the current study, we seek to go to the very core of the implemented curriculum – or the so called 'hidden curriculum' – if we wish to stress the difference with the formal curriculum.

The organisation of teaching is a complicated process, in which learning is the primary objective. Typically, the role of individual teacher is central – his or her conception about what learning is and how it could be promoted. Also, the teacher's view of curriculum is obviously pivotal: What content is important and what is not. The conclusion is obvious: More important than what is told in the formal curricula is the teacher's interpretation or conception of them. Therefore, we tackled in the current study:

1. the curriculum
2. conceptions about learning

We argue that both of these have to be clarified before being able to consider practical implication of educational application.

### A. The Perspective to the Concept of Learning

Different learning paradigms can be argued to be incommensurable, which means that there is only one perspective to learning at a time; the one representing the prevailing paradigm. We have, however, previously applied [3] the approach of Merriam & Caffarella [6], who have

created a framework which covers different learning paradigms. In practice, we mean that one single person may refer to quite different kinds of phenomena in different contexts when she or he talks about learning. For instance, learning multiplication tables by heart has – as a learning task – nothing in common with learning the significance of mathematics in the development of western culture. Still we can call both learning.

When classifying different approaches to learning, we use in the current study the typical division to behaviouristic, cognitivist and constructivist views:

### 1. Behaviouristic View

In the behaviouristic view, the focus is in the overt behaviour. In other words, we are not that interested why learner is behaving like he or she behaves, only in the behaviour as such. For instance, if the aim is to learn the use of certain tool, we are only interested in what can be observed when the student is actually using it. If the use looks acceptable, the skill is learned.

### 2. Cognitivist View

In the cognitivist view, we are interested not only the behaviour but also the mental events that resulted in the observed behaviour. Supporting learning (=teaching) is based on the support of the assumed mental processes. Making assessments about whether learning has taken place or not, is not as straight forward as in behaviouristic view.

### 3. Constructivist View

Constructivism differs from the previous ones in that it does not represent objectivism. While behaviouristic and cognitivist views assumed an objective truth, constructivists stress the subjective interpretation of it. Knowledge does not exist in constructivist view in physical entities like words, but is always a subjective, mental construction. The implications to education typically stress personal elaboration of information in terms of existing knowledge.

In addition, we used the traditional division of knowledge to procedural (“knowing how”) and declarative (“knowing what”) knowledge [7], [8]. This was done in order to figure out the conceptions of teachers about the nature of perioperative nurses’ profession’s characteristics.

#### B. The Organisation of the Study

In the current study, we combined the handling of curriculum and learning conceptions in one single empirical setting.

We first prepared a tentative set of learning objectives for perioperative nursing. This tentative set was based on the formal objectives of the local school which educates nurses (JAMK University of Applied Sciences, see <http://www.jamk.fi/>).

The tentative set of objectives was then elaborated by two expert panels, each of which consisted of three experienced teachers of nursing from JAMK. The panels were moderated by a researcher, who recorded the discussions. In the panel sessions, the objectives were discussed in the order of

objective categories. Each panel session took about 60 minutes. After the panel sessions, the objective table was finalised by the researcher.

The recordings of the discussions were transcribed. The transcriptions were analysed in terms of conceptions of learning. The expressions that the teachers used were classified according to the perspective of learning that they reflected; behaviourist, cognitivist, or constructivist.

This set was then presented to two independent teacher panels, in order to discuss and elaborate the proposed objectives.

## II. TEACHING AND LEARNING PERIOPERATIVE SKILLS

Perioperative nursing includes versatile working tasks within surgical environment. Patient safety and patient care are core elements in this profession as well as team working with other nurses and also within multi-professional teams. Decision making skills and adaptation to new situations as well as competence to evaluate situations are important. Perioperative work environment is also stressful and often physically straining.

Perioperative nurses competences should be developed through clinical learning activities as knowledge, skills and values presented in TABLE I [9].

TABLE I  
 PERIOPERATIVE NURSE'S COMPETENCIES

Knowledge	Applying knowledge on anatomy, physiology, and pathophysiology to understand the procedure, its effects to patient and patient needs
	Recognizing ethical and legal responsibilities, nurse's accountability to the patient, the profession of nursing and team
	Applying research findings to planning and implementing effective perioperative care
Skills	Learning and refining aseptic technique
	Improving patient assessment, communication, organization, coordination, critical thinking, and decision making skills in an environment where such activities must be performed quickly and accurately
	Providing opportunities to assess own interest and talents
Values	Developing the role of advocate for the patient by identifying the patient's expressed and unexpressed needs
	Responding to those needs through the action of facilitating or mediating among all providers involved in the care process
	Recognizing diverse career opportunities in perioperative settings
	Participating as member of multi-professional health care team that develops and promotes the continuity of patient care in an environment that reinforces an understanding of nurse's independent and interdependent function

Perioperative nurse's core competences are critical thinking and sound clinical judgment which should be used effectively to meet patient needs [5]. Critical thinking and clinical decision making skills are essential components which are acquired in perioperative work and these can be educated for example with concept mapping which is a tool for efficiently perceiving relationships between concepts [10]. Critical thinking and decision making skills could also be educated with educational games which foster collaboration and critical

thinking among peers and associates [5].

Experiential learning has been used as framework in perioperative teaching as active learning techniques [11], [5]. To use games to teach, learn, and reinforce perioperative material is an innovative teaching strategy which can promote critical thinking. However, it requires an engaged participation and learner's activity; only critical thinking does not automatically create clinical judgment, rather supports it [5]. The appropriateness of different teaching strategies, computer-assisted ones in particular, have previously been analysed by Pirhonen and Silvennoinen [3]. In the current paper, however, we focus on the content rather than form. In other words, we concentrate in curricula-related issues.

### III. CASE STUDY: LEARNING OBJECTIVES IN PERIOPERATIVE NURSING

The tentative table of objectives was elaborated by two expert panels. The structure of table follows the widely used categorisation: Knowledge, skills and attitudes, each of which is handled concerning theoretical, professional, social and ethical aspects. We now present the elaborated version of the objectives in four separate tables: theoretical (Table II), professional (Table III), social (Table IV), and ethical (Table V). The objectives in the tables should be read by starting each objective with "After studying perioperative nursing, the student..."

TABLE II  
THEORETICAL ASPECTS

Theoretical	
Knowledge	Has acquired the core concepts of perioperative nursing in a level required for the construction of theoretical knowledge in the area. (13)
Skills	Utilises relevant literature in the area of expertise in order to construct knowledge. Is capable of critically assess references and is able to apply the constructed knowledge in an appropriate manner. (10)
Attitudes	Is interested in nursing practices and science related issues in diverse contexts. Understands the significance of continual construction of new knowledge in the development of him/herself and his/her expertise, as well as in the securing and promoting of the function of his/her group and the whole organisation. (1)

TABLE III  
PROFESSIONAL ASPECTS

Professional	
Knowledge	Is aware of his/her professional strengths and recognises areas which require further development. (31)

Skills	Is able to work by applying the approaches, methods and principles of perioperative nursing, in terms of his/her own role, in a patient-centric manner, taking care of patient safety. Applies his/her professional skills and knowledge, such as clinical skills, medication, infection prevention, pain treatment and decision making skills in an appropriate way. Detects problems and uses creative problem-solving in decision-making. Stands pressure well. Monitors, assesses and reflects his/her own work critically. Promotes with his/her own activity both mental and physical well-being in work and occupational health and safety. (27)
Attitudes	Is willing to learn new things in the domain of nursing. Understands the importance of his/her expertise from the point-of-view of work community and the whole society, and is proud of it. Understands his/her own personal responsibility as an expert of nursing. (24)

TABLE IV  
SOCIAL ASPECTS

Social	
Knowledge	Conceptualises nursing as human-centred and, in particular, patient-centred work, in which social interaction is in central role. Understands the aspects of group forming and functioning. (6)
Skills	Is able to all-round work and interact as a member of diverse groups. Is able to work in different kinds of patient related situations in an interactive manner, taking the individuality of a patient into account. Is capable of contributing constructively to the forming of a group, as well as to the achieving of objectives of the group. Is able to act according to his/her own role in a group work context. Is able to utilise and provide feedback. Recognises phenomena relating to group dynamics, and reacts to them appropriately (context sensitivity). (20)
Attitudes	Understands his/her personal role as a member of a group and the significance of working together in order to achieve the common objectives. Understands his/her role from the patient's perspective. Accepts differing viewpoints. (7)

TABLE V  
ETHICAL ASPECTS

Ethical	
Knowledge	Is aware of the ethical issues and perspectives of nursing. Knows the commonly agreed and contradictory values relating to nursing. Understands the challenges and opportunities of multicultural setting from the point-of-view of own work community. (6)
Skills	Recognises and is able to analyse ethical issues of nursing, and is able to solve and apply them appropriately. Follows the widely accepted ethical principles of nursing. Is able to assess his/her own work in ethical criteria. Dares to tackle the detected flaws and solve them constructively. (3)
Attitudes	Considers ethical issues pivotal for nursing. Is willing to promote from his/her part in his/her work community discussion about ethical issues. Interprets the treating of patients, colleagues and other members of the work community primarily as ethical issue. (1)

The numbers in the parentheses in the end of each category in Tables II-V indicate the number of comments in the transcription. As can be seen, professional knowledge, skills

and attitudes evoked clearly most conversation. It appears that other attitudes than purely professional ones did not get much attention. On the basis of our data it is difficult to say whether this indicates lower prioritisation or is it simply an area that is more difficult to verbalise, thus difficult to discuss about. Ethical issues induced surprisingly little discussion – again, the reason is difficult to see on the basis of the current data.

#### A. Emerged Types of Learning

As explained above, we then classified the expressions of the teachers in terms of how they reflect different learning paradigms and whether they concern procedural or declarative knowledge. In Table VI, the results have been summarised. In the table, the abbreviations are as follows:

Be = behaviouristic view

Cg = cognitivist view

Cn = constructivist view

The distinction to procedural and declarative knowledge is indicated by “Pro” and “De”, respectively.

The numbering of teachers refers to session and teacher; e.g. 1/3 means session 1, teacher 3.

TABLE VI  
 SUMMARY OF THE INTERPRETATIONS

Session/Teacher	Be	Cg	Cn	Pro	De
1/1	8	5	8	8	9
1/2	2	4	5	3	5
1/3	12	14	12	13	22
2/1	7	1	5	4	9
2/2	3	5	2	3	6
2/3	10	12	4	5	13
Sum	42	41	36	36	64

In the table, the following conclusions can be drawn:

1. The distribution among learning paradigms (Be/Cg/Cn) was surprisingly even. It was surprising since having noticed that most of the discussions concerned the professional skills and knowledge, we expected that behaviouristic view would dominate. Only after analysis of expressions and simple count we realised that the conceptions of teachers were much more diverse than what we expected.
2. The fairly large proportion of declarative knowledge (vs. procedural) indicates that the teachers expect the development of capability to analyse nurses own work, not only perform it.

It has to be noted, however, that the categorisation of teachers’ expressions was a subjective process. In it, two researchers tried to find an agreement about the correct interpretation. Therefore, the distribution of interpretations to different categories may look somewhat different with different interpreters.

#### IV. FORMULATING OBJECTIVES TO AN INTERACTIVE APPLICATION FOR LEARNING PERIOPERATIVE NURSING

Since the primary purpose of the current study is to form a

basis for an educational application, we will now need to interpret the outcome of the study in terms of requirements for the forthcoming application.

This study only concerned the pedagogical issues, so we won’t handle any other objectives in this report.

The objectives of perioperative nursing education should either be the basis of the whole application. However, if the application only covers a portion of objectives of the education, the minimum requirement would be that the application is not in contradiction with the objectives. In other word, it is overly ambitious to aim at covering the whole content of education with one single application, but still it should follow the principles that the over-all objectives indicate.

What kinds of objectives then are even realistic to be set for an interactive application, running in a computer? We have previously analysed this issue [3], and the summary can be seen in Table VII. The classification of different types of computer-assisted learning (CAL) is a traditional one:

- *Tutorial instruction.* Tutorial instructions are typically based on behavioural strategies and are more or less direct successors of what we used to know as programmed learning of the 1960s. Tutorial usually presents information, asks a question and provides feedback. In the learning of skills relevant in perioperative work, tutorials are probably applicable if the skill can be articulated as a sequence of actions, for instance, preparing a patient to an operation.
- *Drills* (also referred to as drill & practice). As computer applications, drills have been found to be effective in the development of skills that need a lot of repetition to be learned. It is easy to argue that drills are based on behavioural strategies. However, when justifying the use of drills by using concepts of neural system (like “strengthening neural connections”), the underlying strategy can be characterised as cognitive. In perioperative work, drills would be useful in the learning of e.g. insertion of cannula.
- *Simulations.* In the context of education, simulations usually include instructional content. However, the essence of simulations is obviously in the imitation of a given phenomenon. In the context of this study, the foremost rationale for using simulations instead of real environment is that the expensive OR time should not be used for training basic technical skills.
- *Instructional games.* The use of games in CAL is usually justified with an assumption of increased motivation. For acquiring perioperative nursing skills, game approach could be used to increase motivation for repetitive training. On the other hand, games should be relatively easy to use and should not contain serious usability problems to decrease motivation.

TABLE VII  
SKETCH ABOUT THE APPLICABLE STRATEGIES AND CAL TYPES (\*\*\*=HIGH, \*=LOW, EMPTY=N/A)

Objective areas	Applicable strategy			Applicable type of CAL			
	Behavioural	Cognitive	Constructivist	Tutorial	Drill	Simulation	Game
Technical skills	***	**	**	***	***	***	***
Situation awareness	*	*				***	***
Decision making			***	*		**	**
Teamwork						**	**
Communication			**			**	*
Leadership			**	*		**	*
Task management			**	**		**	**
Stress management	**	*	**		**	**	***

In the project, part of which this study is, there is an intention to discover the opportunities of an educational game to teach perioperative nursing. Therefore, we primarily focus on the last column of the table. As can be seen, probably all of the objective areas presented in the table, are relevant to perioperative nursing, but not all of them are appropriate to be studied with the help of a game. In terms of learning paradigms, it can be seen, that games are at their best in training technical skills, situation awareness and stress management. However, some essential content areas are left outside the means of games.

#### V. DISCUSSION AND CONCLUSIONS

This study is background work for the design of an education application. Since the objectives of an instructional, interactive application cannot contradict with the objectives of the educational whole, we had to start by figuring out the 'real' objectives of the education of perioperative nursing. By 'real' we mean the related conceptions of the teachers.

When we first prepared a tentative set of objectives on the basis of formal curriculum and then elaborated it with the teachers, we found that teachers conceptions were quite well in line with the formal objectives. In other words, this study did not reveal a dominant hidden curriculum, but the formal curriculum has been developed in parallel with practical needs, thus making a lot of sense for the teachers. On the other hand, we analysed from the expressions that the teachers used, their conceptions about learning. The results show that the teachers' conceptions covered equally behavioural, cognitive and constructive approaches to learning. While the discussions concerned the existing learning objectives, it can be concluded that the teachers think that perioperative nurses need several sort of skills, ranging from highly automatised routines to the ability to act creatively when necessary.

When we reflected the objectives with the strengths of educational games, it became evident that only certain kind of

objectives can be covered with a game, however sophisticated it may be technically or pedagogically. The widely acknowledged strength of an educational game is that it is a motivating means to train skills which require a large amount of repetitions. As discussed above, perioperative nursing include this kind of skills, typically highly automatised routines. At least in the training of them, games have potential.

From the point-of-view of the application to be designed, this would mean that it is perhaps not appropriate to include in the pedagogical requirements of the forthcoming application all the objectives of perioperative nursing education.

#### REFERENCES

- [1] L. Mitchell and R. Flin, "Non-technical skills of the operating theatre scrub nurse: literature review", *Journal of Advanced Nursing*, vol. 63, no. 1, pp. 15-24, July 2008.
- [2] E. McConnell and A. Hillbig, "A National Study of Perioperative Nurse Education in Two Technologies", *AORN Journal*, vol 72, no. 2, pp.254-264, August 2000.
- [3] A. Pirhonen and M. Silvennoinen, "Aims vs. Technology: Pedagogical view to the use of educational applications in safety critical contexts", In proceedings of IEEE 1st International Conference on Serious Games and Applications for Health (SEGAH 2011), November 16-18 2011, Braga, Portugal, 2011, pp. 88-94.
- [4] M. Huff, "Web-enhanced learning for perioperative nurses", *SSM*, vol 9, no. 3, pp. 53-55, Jun 2003.
- [5] L. Cafira and H. Janiszewski Goodin, "Using games to provide interactive perioperative education" *AORN Journal*, vol 94, no. 4, pp. 370-248, Oct 2011.
- [6] S. Merriam and R. S. Caffarella, *Learning in adulthood: A comprehensive guide*. San Francisco, CA: Jossey-Bass, 1999.
- [7] P. M. Fitts and M. I. Posner, *Human performance*. Belmont, CA: Brooks/Cole, 1967.
- [8] J. R. Anderson, *The architecture of cognition*. Cambridge, MA: Harvard University Press, 1983.
- [9] "AORN Guidance Statement: The value of clinical learning activities in the perioperative setting in undergraduate nursing curricula", *AORN Journal*, vol 86 issue 2, pp.265-269, Aug 2007.
- [10] P. Noonan, "Using Concept Maps in Perioperative Education", *AORN*, Vol. 94, no. 5, pp. 469-478, Nov 2011.
- [11] D. Sewchuk "Experiential Learning-A Theoretical Framework for Perioperative Education", *AORN*, Vol. 81, issue 6, pp. 1311-1317, Jun 2005.