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## Original article

# Diversified teaching methods in nursing: Using animal experimentation to promote core professional competencies in basic nursing training<sup>☆</sup>

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## ARTICLE INFO

## Article history:

Received 28 July 2015

Received in revised form

31 July 2015

Accepted 27 October 2015

Available online 23 January 2016

## Keywords:

Core professional competencies in nursing

Basic nursing

Experimentation on animals

Diversified teaching methods

## ABSTRACT

**Objectives:** The aim of this project was to train highly professional and specialized nursing students from medical colleges to adapt to bedside clinical care by exploring and discussing various methods of injection and IV infusion in animal experimentation to hone the core professional nursing competencies.

**Methods:** Two classes from the 2012 senior graduating nursing class were randomly selected by a computer to conduct the diversified practical teaching methods based on animal experimentation. A hospital environment was simulated by requiring students to perform different types of injections and practical IV infusion techniques. A comprehensive evaluation of the core professional competencies, as well as other integrated competencies, was conducted to determine the effectiveness of the teaching methods.

**Results:** Two-sampled, pairwise *u*-tests were performed between the scores of the experimental (nursing class 2) and control (nursing class 1) groups. These findings showed that the overall test scores were significantly higher in the experimental group compared to the control group and that the average *p*-values for the competencies in various categories were <0.01, which indicated statistically significant results.

**Conclusions:** Based on the data from this project, diversified teaching methods for basic nursing training founded on animal experimentation can help nursing students perfect their core professional competencies and improve their overall professional standing. The introduction of animal experimentation requires further verification, and an increased acknowledgement of its benefits through the widespread dissemination of this information.

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## 1. Introduction

International research conducted by Lenburg in the past 20 years established the core competencies for nursing in the Competency Outcomes and Performance Assessment (COPA), which include the ability to assess and intervene and to teach and integrate knowledge as well as communication skills, critical thinking skills, interpersonal skills, management skills, and leadership skills.<sup>1</sup> Soon afterwards, China began to emphasize this aspect of

training. In 2003, the core competencies in nursing were first mentioned in the government plan issued by the Ministry of Education (MoE) and the Ministry of Health (MoH) of the People's Republic of China, which was titled the "Three year guidance and strategy for tackling higher professional training in the field of nursing due to shortage of skilled personnel".<sup>2</sup> Since 2005, experts in the field of nursing, both within China and abroad, have explored and experimented with many teaching methods and models in an attempt to improve nursing students' core competencies.<sup>3</sup> To date, Shen<sup>3</sup> and Liu et al<sup>4</sup> conducted research on reforming the model for teaching core competencies in nursing, but no one has addressed the practical element of nursing in an experimental setting.

In this instance, the authors are in agreement with the current trend of improving the core competencies in nursing and have placed particular emphasis on discussing the essential criteria and

<sup>☆</sup> This work was supported by 2012 Jiangxi Province Higher Education Reform Research Provincial Research Project (No. JXJG-12-29-3).

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Peer review under responsibility of Shanxi Medical Periodical Press.

feasibility of using rabbits as experimental animals for the practice of various clinical techniques and skills, including injections, IV infusions, venipunctures, and so on. Upon completion of the research, the outcomes were in line with the expectations, taking into account the occurrence of the experiment in combination with core competencies training. This research attempted to use animal experimentation as a foundation, with injection and IV infusion techniques as stepping stones, to consolidate the present teaching methods and curriculum while reforming the existing assessment format. This research addressed the present gap in traditional nursing teaching methods, resolved the problem of the lack of realism during clinical skills practice training, and avoided the ethical implications students experience when practicing clinical skills on simulated patients. A description of the specific methods and outcomes follows.

## 2. Material and methods

### 2.1. General information

Members of the research group: The group was composed of two clinical tutors with long-term experience in basic nursing training and teaching and who were proficient in basic clinical skills; in addition, the group had two tutors with abundant work experience in animal laboratories from the department of physiology. The tutors from the physiology department were responsible for the animal experimentation preparation in the beginning phase, as well as for providing students with the additional knowledge and appropriate training in health and safety when working with animals, selecting suitable animal candidates before the experiment, and indicating the appropriate injection sites during the experiment.

Experiment participants: Two classes from the 2012 senior professional nursing class were selected: nursing class 1 (control group: 80 students) did not have the additional animal experimentation class that was taken by nursing class 2 (experimental group; 82 students). All of the students were in the second year of their bachelor degrees, experienced nursing as a profession for the first time, had limited nursing experience, and had no experience with animal experimentation in a nursing context.

Status of experiment animals: A batch of house rabbits was purchased by the school, with no particular selection for sex. A total of 16 rabbits were obtained, weighing an average of  $1.5 \pm 0.5$  kg; no abnormalities were observed upon examination.

### 2.2. Method

#### 2.2.1. Additional animal experimentation teaching methods

On the basis of traditional practical training for nurses, the concept of animal experimentation was introduced in a class on foundational nursing experimental teaching methods that used IV infusions and various injection techniques as examples, including: (1) Intra-dermal injections: choose an area posterior to the pinna, such as the back or either side of the abdomen; (2) Intramuscular, subcutaneous injections: choose an area where the rabbit has well-developed muscle groups, such as the hip, and; (3) Intravenous (IV) injection, IV infusion, or venipuncture: choose the rabbit's auricular vein, vena epigastric, or major veins in the limbs.

An improvement of the animal experimentation method was to anaesthetize the house rabbit, fix the body in a position using restraints, and choose the above injection sites as points for practicing the action of a needle puncture. A benefit of this method was that the action could be repeated, providing an actual experience of the action, hence promoting the transition to bedside practice.

However, the damage that would be inflicted on the house rabbits presented a problem.

#### 2.2.2. Teaching theoretical knowledge based on diverse methods

Apart from the reform of using animal experimentation, we have also employed diverse methods to facilitate the teaching of IV infusions and a variety of injection techniques. Examples of these flexible and varied methods of teaching include the following: multimedia-based situation simulation, problem-based learning (PBL), group-based learning, and role-play methods. The practice of IV infusion in different groups provides an illustrative example. After a member of the group selects a case study and analyzes it, the group then designs a scenario that simulates the case study in a hospital setting. Each member of the group plays a particular role, such as "nurse," "patient," or the "patient's relative," in the scenario, with additional practical procedures implemented on the house rabbit as part of the simulation experience for real practice. Use of the scenario results in each participant effectively accumulating communication skills and experience and reducing the gap between clinical training and bedside practice as well as enabling the students to have a comprehensive, deep understanding and firm grasp of the competence and proficiency for the practical skills that they experienced firsthand and the theoretical knowledge behind the practice.

#### 2.3. Reform of the format of assessment and evaluation

Previously, assessments and evaluations were primarily conducted using a grading system to assess the test scores. In this project, we attempted to use the core professional competencies in nursing as the basis for change in the format of assessment and evaluation. We simulated the hospital setting, adding house rabbits as part of a real practical element, and assessed the clinical skills of the two student groups based on their experimental technical proficiency. The content examined included: situation evaluation (appropriate selection of the case study, logical design and layout of the scene, and appropriate preparation for animal experimentation); practical proficiency (success rate of animal experiments, various practical competencies completed and connected appropriately, with all of the actions appropriate to the standard of practice); and interpersonal communication (appropriate language used throughout the scenario, and appropriate responses and actions in the role-play). Then, the examiner evaluated the student's interpretation of the situation, taking into account the comments by other assessors, assessing the student's critical thinking and ability to respond under pressure. A score was given based on the student's performance in all five areas, with a maximum score of 100 points (80–89 indicating a pass, 90–94 as merit, and 95 or above as a distinction).

#### 2.4. Statistical method

SPSS 19.0 statistical analysis software was used to calculate the mean and standard deviation ( $\bar{x} \pm SD$ ) for each variable and to perform *t*-tests with  $p < 0.05$  indicating statistically significant results.

## 3. Results

### 3.1. Basic assessment and evaluation of the two 2012 graduating classes

There were 80 students (79 females and 1 male) in the control group. The average overall assessment score for nursing class 1 was 85.61 (range: 70–95). There were 82 students (78 females and 4

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