ORIGINAL ARTICLE

Effects of an interactive teaching method on perceived disaster nursing competencies of undergraduate nursing students

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Abstract
Aim: Nurses are healthcare personnel who play an important role in disaster management in all phases of a disaster. However, research findings have pointed out that there is a lack of necessary preparedness for disasters as well as development of nursing competencies. This research aimed at investigating the effects of an interactive teaching method on nursing students’ learning achievement and nursing competencies of prevention and mitigation, preparedness, and response based on the framework of disaster nursing competencies of the International Council of Nurses.

Methods: Based on the International Council of Nurses’ framework of disaster nursing competencies and interactive teaching method, this course was designed and implemented with third-year nursing students at the Thai Red Cross College of Nursing who were enrolled in an emergency and disaster nursing course. The experimental group and control group were asked to complete the learning achievement test and the perceived competencies of prevention and mitigation, preparedness, and response questionnaires. Data was analyzed using an independent-sample t-test and a paired-sample t-test.

Results: The mean achievement score of the experimental group was statistically significantly higher than that of the controlled group (p < 0.05). The mean scores of nursing competencies of prevention and mitigation, preparedness, and response of the subjects in the experimental group were statistically significantly higher than those of the subjects in the control group (p < 0.001).

Conclusion: It is noteworthy that theoretical teaching via an integrative teaching method can enhance students’ achievement, perceived competencies and motivation to learn about nursing actions in response to disasters.

Key words: achievement, competencies, disaster nursing, interactive teaching method

INTRODUCTION
At present, people all over the world are facing drastic changes, including movement of plate tectonics, global warming, changing weather patterns, and an increase in the world population, which require adaptation. In addition, the needs for basic necessities for living are rising, and such needs can lead to conflicts of interest. These factors can contribute to the impact of a disaster. According to the existing statistics, between 2003 and 2012, the incidence of natural disasters continued to increase in severity and intensity. In 2011, a total of 101 countries were hit by natural disasters. The 332 reported natural disasters resulted in the death of more than 30,770 people, resulted in 244.7 million victims, and caused a record US$366.1 billion worth of damage (Centre for Research on the Epidemiology of Disaster, 2014). In Thailand, the more commonly occurring disasters are seasonal natural disasters; therefore, the public’s preparedness for a large-scale disaster is not always available. However, according to the statistics between 2002 and 2008, the incidence of natural disasters in Thailand continued to rise (National Disaster Prevention and Mitigation Committee, 2010).

The most important factor in disaster management is prevention of a disaster, if it is preventable. In contrast, if a
disaster is not preventable, the goal is to reduce or mitigate the disaster. Preparedness for a disaster is also deemed necessary. Nurses constitute the majority of healthcare personnel in each country, so they have an important role in all phases of disaster management. In Thailand, after the 2004 Indian Ocean tsunami disaster, it became evident that nurses’ training lacked planning for disaster management. Their provision of nursing care practices was mostly aimed at solving immediate problems. Furthermore, their screening and treatment of patients were not up to standard, and there was also the problem of staff shortages (Yamanon, 2007). Simply put, a large number of nurses have never undergone training to ensure preparedness for disaster management when facing different types of disasters, or they may have had some training but the training is not sufficient to equip them with all the necessary knowledge and skills for effective disaster management. When considering existing nursing curricula, it can be seen that most of Thai nurses are trained at the undergraduate level. In general, the courses in an undergraduate nursing curriculum that are related to disaster nursing are mainly courses on basic medical care, community health nursing, adult nursing, emergency nursing, and critical care nursing. In some programs, only theoretical teaching is given, with no practical training that enables nurses to develop skills necessary to provide care to victims (Juthaisong, 2006). Evidently, such content is not sufficient to develop necessary disaster nursing competency (Siripul & Sakdithanan, 2012). As for nurses, the International Council of Nurses has determined the framework of disaster nursing competency as a nursing practice guideline in all phases of a disaster (World Health Organization and International Council of Nurses, 2009). Moreover, as the emphasis of disaster management of different countries all over the world has shifted from “mitigation and operation” to “reduction and preparedness,” the International Council of Nurses, with support from WHO/Western Pacific Regional Office (WPRO), has confirmed the significance of nurses’ disaster preparedness and specified disaster nursing competency and a body of knowledge on disaster nursing be incorporated into disaster nursing curricula. The new specification of disaster nursing competency leads to nursing curriculum revision, training, and continuing education to enable nurses to more clearly understand their roles in disaster situations. It also leads to development of nursing training and education to ensure consistency in responding to the needs of the global community during times of disaster. Disaster nursing competencies that are specified by the International Council of Nurses consist of four areas of competency:

- Competency area 1: Prevention and Mitigation;
- Competency area 2: Preparedness;
- Competency area 3: Response; and
- Competency area 4: Recovery/Rehabilitation

Within the four areas, 10 domains were identified: 1) risk reduction, disease prevention and health promotion; 2) policy development and planning; 3) ethical practice, legal practice and accountability; 4) communication and information sharing; 5) education and preparedness; 6) care of the community; 7) care of individuals and families; 8) psychological care; 9) care of vulnerable population; and 10) long-term recovery of individuals, families and communities. (World Health Organization and International Council of Nurses, 2009). The core competencies that all nursing students have to learn and all registered nurses have to possess are: Competency 1: Prevention and Mitigation; Competency 2: Preparedness; and Competency 3: Response. Therefore, the researchers who are responsible for teaching the subject of disaster nursing to nursing students at the Thai Red Cross College of Nursing have realized the significance of instruction to promote disaster nursing competencies, particularly core competencies specified by the International Council of Nurses.

Professional competence determines the productivity of professional tasks. It includes knowledge, skills, as well as professionally significant personal qualities, experiences, and value orientation. The traditional methods of the educational process such as lectures, explanation, discussion, etc. are certainly important for professional development, but limit learning and improvement of skills (Yakovleva & Yakovlev, 2014). For this reason, the interactive teaching methods, which encourage interest in the profession, promoting students’ independent activities, and enhancing knowledge and skill acquisition, seem to be a promising alternative. Interactive teaching includes development of knowledge and skills through drills, educational games, scenarios, role plays, and table top exercises, etc., all of which can be adopted in the courses offered by the Thai Red Cross College of Nursing. In general, interactive teaching requires the instructors to change their teaching strategies, as lecturing is not emphasized (Panich, 2012; Santipracha, 2013; Sessoms, 2008). Instead, the focus of the instruction is on the learning process and participatory learning in the form of small group discussions, demonstrations, and questions and answers, involving formulation of hypotheses, prediction, solution to problems, and analytical reasoning. When the interactive teaching method is utilized, nursing students are expected to be better equipped with the knowledge and skills they need.
Research objective
The present research investigated the effects of the interactive teaching method on nursing students’ learning achievement and nursing competencies of prevention and mitigation, preparedness, and response based on the framework of disaster nursing competencies of the International Council of Nurses.

Research hypotheses
1. The learning achievement of nursing students who are taught with the interactive teaching method is higher than that of nursing students who receive the traditional lecture-teaching method.
2. The mean scores of perceived competencies of prevention and mitigation, preparedness, and response of nursing students who are taught with the interactive teaching method are higher than those of nursing students who receive the traditional lecture-teaching method.

METHODS
The two-group, pre-test, post-test design was used in the present experimental study. The study sample consisted of 92 third-year nursing students enrolled in an emergency and disaster nursing course who were recruited on a voluntary basis and gave their informed consent to participate in the study. The subjects were randomly assigned into the experimental group or control group based on their cumulative grade point averages, with 46 subjects in each group.

Development of the course, the content, and teaching methods
The disaster nursing course design included teaching objectives, content, teaching materials, and teaching methods. The disaster nursing lessons were designed as follows:

Step 1: The researchers reviewed the competencies of prevention and mitigation, preparedness, and response of nursing students based on the disaster nursing competencies specified by the International Council of Nurses from the following sources:

1.1 The researchers studied documents and researches related to nursing competencies, nursing competencies in the International Council of Nurses’ framework, teaching methods, and teaching materials.
1.2 The researchers organized a meeting to elicit opinions of nursing instructors from various educational institutions regarding disaster nursing instruction for nursing students. The researchers also organized a meeting to ask for opinions of nursing experts who had work experience in the field of disaster nursing related to disaster nursing competencies of nursing students.
1.3 The researchers consulted specialists in disaster nursing at the Japanese Red Cross College of Nursing.

Step 2: The researchers studied the concept of interactive teaching methods.

Step 3: The researchers designed lessons and teaching materials including interactive games, magnetic dolls, and scenarios.

Step 4: The researchers conducted the main study using experimental research with the two-group, pre-test, post-test design.

Step 5: Recommendations were made for subsequent revision.

The experimental course in emergency and disaster nursing included three domains of disaster nursing competencies: prevention and mitigation, preparedness, and response. In brief, the course content covered the following topics: (1) disaster and disaster management; (2) disaster nursing; (3) nursing care for prevention, mitigation, and preparedness; (4) triage; (5) first aid; (6) casualty handling and referral; and (7) psychological care in a disaster situation.

Interactive teaching methods were used, including group discussions; think-pair-share, in which students worked together to solve a problem or answer a question about an assigned reading; role plays, scenarios, table top exercises, and drills. Formal lecturing was the method least used.

Evaluation
1. The learning achievement test (knowledge test) comprised 50 items that covered nursing competencies of prevention and mitigation, preparedness, and response. The test was given as multiple-choice questions. The test items were selected from the test item bank (360 items), and all of them were critiqued by the instructors who were teaching the emergency and disaster nursing course. The test items were analyzed using the pass difficulty index and discriminant index. The scoring criteria were as follows: correct answers were equal to one point, whereas incorrect answers were equal to zero points.
2. The perceived competencies of the prevention and mitigation, preparedness, and response questionnaire consisted of 41 items to cover the competencies of prevention and mitigation, preparedness, and response, as perceived by nursing students. The
questionnaire was developed by the researchers based on the framework of disaster nursing competencies of the International Council of Nurses. The questionnaire was self-administered, and the nursing students assessed their perceived competencies of prevention and mitigation, preparedness, and response. The responses were arranged in five levels, from 1 “no knowledge at all” to 5 “able to apply knowledge, skills, and decision-making.” As for validation of the questionnaire, the questionnaire was submitted to a panel of three experts who were nursing instructors teaching courses on emergency and disaster nursing and nursing research methodology to confirm content validity and language appropriateness. The questionnaire was subsequently revised and improved based on the experts’ comments and suggestions before it was administered to 30 third-year nursing students who were not the subjects of the main study.

3. The attitudes of students towards disaster nursing was divided into two parts in the questionnaire. The first part elicited nursing students’ attitudes toward disaster nursing, totaling five items, while the second part explored nursing students’ opinions toward the instruction, totaling five items as well. The response choices were arranged in a five-point scale ranging from 1 “strongly disagree” to 5 “strongly agree.”

**Ethical considerations**

Protection of human subject approval was obtained from the Institutional Review Board on Research Involving Human Subjects of the Thai Red Cross College of Nursing. The researchers approached third-year students to explain the research objectives, contents, and teaching methods. The researchers asked the nursing students for consent to participate in the study and discussed protection of their rights. They were informed that participation in the present study was on a voluntary basis and that they had the right to decide to participate or to refuse to participate in the study. They were also told that they were able to withdraw from the study at any time if they wished without any impact on the emergency and disaster nursing course they were enrolled in. The students were asked to sign the informed consent form to indicate their willingness to participate in the study.

**Data collection**

Before teaching commenced, the researchers asked students in the experimental and control groups to complete the perceived competencies of prevention and mitigation, preparedness, and response questionnaire and the attitudes toward disaster nursing questionnaire.

During the first class, the researchers gave an explanation to the experimental group concerning the course objectives, contents, and teaching methods. The course contents covered the following topics: (1) disaster and disaster management; (2) disaster nursing; (3) nursing care for prevention, mitigation, and preparedness; (4) triage; (5) first aid; (6) casualty handling and referral; and (7) psychological care in disaster situations. Interactive teaching methods were used, including group discussion, think-pair-share, role play, scenario, table top exercises, and drills, with formal lecturing being the method least used. In contrast, the subjects in the control group were taught the same contents as the experimental group after receiving explanation about the course objectives, contents, and teaching methods, but only traditional teaching methods comprising mainly lectures were used, with PowerPoint presentations, oral explanation, and class discussions. Drills were also used but only when teaching about first aid and casualty handling.

After the teaching was completed, the experimental and control groups were asked to respond to the perceived competencies of prevention and mitigation, preparedness, and response questionnaire and the attitude toward disaster nursing questionnaire. Their learning achievement was tested 1 week later.

After the experiment ended, to ensure equal opportunity to study subjects, the researchers offered additional teaching to the control group 2 weeks before the final examination of the emergency and disaster nursing course was administered.

**Data analysis**

Analyses were conducted using IBM SPSS Statistics Version 22.0 (IBM Corp., 2013). Descriptive statistics of mean and standard deviation were used to analyze the scores of perceived competencies of prevention and mitigation, preparedness, and response and attitude toward disaster nursing for both the experimental and the control subjects. Furthermore, normal distribution was tested as the data were measured at the interval level. A paired-sample t-test was used to compare the mean scores of perceived competencies of prevention and mitigation, preparedness, and response within groups obtained before and after the instruction. An independent-sample t-test was also used to compare the mean scores of perceived competencies of prevention and mitigation, preparedness, and response between the experimental and the control subjects. A p value of < 0.5 was considered statistically significant.
RESULTS

The subjects in the experimental and the control groups were third-year nursing students at the researcher’s institution in the academic year 2013. They were enrolled in the emergency and disaster nursing course, totaling 92 students (46 in each group). All of the study subjects had already been equipped with fundamental knowledge of nursing science after taking courses such as conceptual bases of nursing, nursing process, fundamentals of nursing, pediatric and adolescent nursing, family nursing and midwifery, adult nursing, and geriatric nursing. The majority of them were female (94.57%), with an average age of 20.48 years. The cumulative grade point average of the subjects in the experimental group was 2.74, while that of the subjects in the control group was 2.86.

Learning achievement

After the end of the instruction, the subjects completed the learning achievement test, which covered the specified content and objectives of the instruction. The findings showed that the mean score of learning achievement of the subjects in the experimental group (mean = 36.000) was higher than that of the subjects in the control group (mean = 33.780). The mean score of learning achievement of the experimental group who were taught with the interactive teaching method was higher than that of the control group who were taught with the traditional teaching method, with statistical significance at the 0.05 level, as shown in Table 1.

Perceived nursing competencies of prevention and mitigation, preparedness, and response of the nursing students in the experimental and control groups before and after instruction (within groups)

Both the subjects in the experimental group and the control group had higher mean scores of prevention and mitigation, preparedness, and response competencies after the instruction, with statistical significance at the 0.001 level.

Perceived nursing competencies of prevention and mitigation, preparedness, and response of the subjects in the experimental and control groups before and after instruction (between groups)

With regard to perceived prevention and mitigation, preparedness, and response competencies of nursing students in the experimental and the control groups, the study findings indicated that before the instruction there was no statistically significant difference in the mean scores of perceived prevention and mitigation, preparedness and response competencies between the subjects in both groups. However, after the instruction, the mean scores of perceived prevention and mitigation, preparedness, and response competencies of the experimental group were higher than those of the control group in all three competencies, with statistical significance at the 0.001 level, as detailed in Tables 2 and 3.

When it came to attitude towards disaster nursing, it was discovered that the subjects in both the experimental and the control groups had higher mean scores of attitude toward disaster nursing after the instruction ended, but the mean scores of the experimental group were still higher than those of the control group. When investigating their opinions toward the disaster nursing instruction, the findings showed that the subjects were satisfied with the instruction, as they perceived that the instruction stimulated their learning and helped develop their analytical thinking skills, and this made them more confident to carry out the practices. Also, the subjects felt that the

Table 1 Comparison of differences in mean scores of learning achievement of the experimental subjects and the control subjects after the instruction

| Subject          | Mean | Standard deviation | t     | p-value |
|------------------|------|--------------------|-------|---------|
| Control group    | 33.783 | 4.908             | -2.424 | 0.017   |
| Experimental group | 36.000 | 3.795             |       |         |

Table 2 Comparison of differences in mean scores of nursing competencies of prevention and mitigation, preparedness, and response as perceived by nursing students before the instruction of the experimental group and the control group

| Competency 1: Prevention and mitigation | Control Group | Experimental Group | t     | p-value |
|----------------------------------------|---------------|--------------------|-------|---------|
| Control Group                          | 22.522        | 23.065             | -0.380 | 0.705   |
| Experimental Group                     | 23.065        | 23.065             |       |         |

| Competency 2: Preparedness              | Control Group | Experimental Group | t     | p-value |
|----------------------------------------|---------------|--------------------|-------|---------|
| Control Group                          | 16.913        | 16.391             | 0.470 | 0.639   |
| Experimental Group                     | 16.391        | 16.391             |       |         |

| Competency 3: Response                  | Control Group | Experimental Group | t     | p-value |
|----------------------------------------|---------------|--------------------|-------|---------|
| Control Group                          | 49.522        | 54.760             | -1.654 | 0.102   |
| Experimental Group                     | 54.760        | 54.760             |       |         |
The results show that the mean score for learning achievement of the experimental subjects was higher than that of the control subjects, with statistical significance at the 0.5 level. In addition to this, the mean scores of prevention and mitigation, preparedness, and response competencies of the experimental subjects were higher than those of the control subjects for all competencies, with statistical significance at the 0.001 level. The interactive teaching methods had impact on self-perceived learning achievement, prevention and mitigation, preparedness, and response competencies, and attitude toward disaster nursing. In the current research, interactive teaching methods were used, including group discussions, think-pair-share activities, role plays, scenarios, table top exercises, and drills. Formal lecturing was the method least used. For example, group discussions and think-pair-share, in which students worked together to solve a problem or answer a question about an assigned reading, gave the students an unique opportunity to learn from one another, with an exchange of knowledge taking place at a student-to-student level under close direction and supervision of instructors. Besides this, interactive teaching encourages the students to become active learners, hence more retention of knowledge and skills compared to traditional lectures. When considering the learning pyramid, it could be seen that participatory learning activities such as group discussions yield the average retention rate of 50%, and actual practices yield the average retention rate of 70%, while the average retention rate of traditional lectures is only 5%. In particular, drills, role plays, scenarios, and table top exercises in disaster management, triage, first aid and basic cardiac life support, and psychological support have been cited as essential educational activities that should be incorporated into courses in order to enable nursing students to be prepared for disasters. This is because nurses are one of the largest groups of emergency responders during a disaster, but it became evident that nurses are unprepared to respond due to a lack of knowledge or skills. Likewise, Fung, Loke and Lai (2008) emphasized that protocols for disaster management and disaster drills were important in the preparation for disasters. This interactive teaching allows students not only to effectively solve problems of practice-focused learning, but also to develop their own way to achieve a comprehensive solution. Such findings have suggested that the instruction with the interactive teaching method can stimulate the thinking and analysis process, as well as promote learning skills (Bhoopat, Mahakknaukrauh, & Tapanya, 2013; Sessoms, 2008). Thus, it can be concluded that this type of interactive teaching method is appropriate for instruction to meet the undergraduate nursing qualification standards, which have specified the learning outcomes and desirable characteristics of nursing graduates to consist of the following: (1) ethics and morale; (2) knowledge; (3) cognitive skills; (4) interpersonal skills and responsibility; (5) numerical analysis, communication, and information technology skills; and (6) practical professional skills (Office of the Higher Education Commission, 2015). Simply put, the integrative teaching method enables nursing students to achieve the specified learning outcomes and desirable characteristics of nursing graduates. It is noteworthy that theoretical teaching with the

Table 3  Comparison of differences in mean scores of nursing competencies of prevention and mitigation, preparedness, and response as perceived by nursing students after the instruction of the experimental group and the control group

| Subject groups       | Mean  | Standard deviation | t     | p-value |
|----------------------|-------|--------------------|-------|---------|
| Competency 1: Prevention and mitigation |
| Control Group       | 35.130| 4.787              | –11.328| 0.000   |
| Experimental Group  | 44.717| 3.167              |       |         |
| Competency 2: Preparedness |
| Control Group       | 28.674| 4.238              | –8.896| 0.000   |
| Experimental Group  | 35.261| 2.695              |       |         |
| Competency 3: Response |
| Control Group       | 83.696| 11.510             | –9.498| 0.000   |
| Experimental Group  | 102.913| 7.471             |       |         |

instructors motivated them to learn and were available to assist them when they had problems with their learning. They also shared their opinion that the instruction was beneficial and they believed they could apply what they had learned to themselves and their family.

According to the study findings, the mean score for self-assessed learning achievement of the experimental group was higher than that of the control group, with statistical significance at the 0.05 level. In addition to this, the mean scores of prevention and mitigation, preparedness, and response competencies of the experimental group were higher than those of the control group in all competencies, with statistical significance at the 0.001 level.

DISCUSSION

The results show that the mean score for learning achievement of the experimental subjects was higher than that of the control subjects, with statistical significance at the 0.5 level. In addition to this, the mean scores of prevention and mitigation, preparedness, and response competencies of the experimental subjects were higher than those of the control subjects for all competencies, with statistical significance at the 0.001 level. The interactive teaching methods had impact on self-perceived learning achievement, prevention and mitigation, preparedness, and response competencies, and attitude toward disaster nursing. In the current research, interactive teaching methods were used, including group discussions, think-pair-share activities, role plays, scenarios, table top exercises, and drills. Formal lecturing was the method least used. For example, group discussions and think-pair-share, in which students worked together to solve a problem or answer a question about an assigned reading, gave the students an unique opportunity to learn from one another, with an exchange of knowledge taking place at a student-to-student level under close direction and supervision of instructors. Besides this, interactive teaching encourages the students to become active learners, hence more retention of knowledge and skills compared to traditional lectures. When considering the learning pyramid, it could be seen that participatory learning activities such as group discussions yield the average retention rate of 50%, and actual practices yield the average retention rate of 70%, while the average retention rate of traditional lectures is only 5%. In particular, drills, role plays, scenarios, and table top exercises in disaster management, triage, first aid and basic cardiac life support, and psychological support have been cited as essential educational activities that should be incorporated into courses in order to enable nursing students to be prepared for disasters. This is because nurses are one of the largest groups of emergency responders during a disaster, but it became evident that nurses are unprepared to respond due to a lack of knowledge or skills. Likewise, Fung, Loke and Lai (2008) emphasized that protocols for disaster management and disaster drills were important in the preparation for disasters. This interactive teaching allows students not only to effectively solve problems of practice-focused learning, but also to develop their own way to achieve a comprehensive solution. Such findings have suggested that the instruction with the interactive teaching method can stimulate the thinking and analysis process, as well as promote learning skills (Bhoopat, Mahakknaukrauh, & Tapanya, 2013; Sessoms, 2008). Thus, it can be concluded that this type of interactive teaching method is appropriate for instruction to meet the undergraduate nursing qualification standards, which have specified the learning outcomes and desirable characteristics of nursing graduates to consist of the following: (1) ethics and morale; (2) knowledge; (3) cognitive skills; (4) interpersonal skills and responsibility; (5) numerical analysis, communication, and information technology skills; and (6) practical professional skills (Office of the Higher Education Commission, 2015). Simply put, the integrative teaching method enables nursing students to achieve the specified learning outcomes and desirable characteristics of nursing graduates. It is noteworthy that theoretical teaching with the
integrative teaching method, whether in small groups or in large groups, can enhance students’ learning to achieve the specified learning outcomes and desirable characteristics of nursing graduates through the use of discussions, simulated situations, games, and teaching materials where emphasis is placed on the analytical thinking process and practices (Chan, Chan, Cheng, Fung, Lai, Leung, et al., 2010; Kaplan, Connor, & Ferranti, 2012; Popattanachai, Sarakshetrin, Chantra, & Chipan, 2011; Silenas, Akins, Parrish, & Edwards, 2008). However, active learning methods modify the role of the teacher from the lecturer who mainly imparts knowledge to a facilitator who promotes the efficient acquisition of knowledge, making it possible for students to accomplish complex competences via student activities that manifest as closely as possible to the expectations of the profession.

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AUTHOR CONTRIBUTIONS

W. I. was responsible for the study conception, study design and data collection; S. C. performed the data analysis and drafted the manuscript; W. I. and S. C. made critical revisions to the paper for important intellectual content; and W. I. supervised the study.

DISCLOSURE

No conflicts of interest have been declared by the authors. None of the authors of this paper have any interest, financial or otherwise, that may have biased the planning, execution, analysis or write up of this research study.

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