

Development of EREC IF Model to Increase Critical Thinking and Creativity Skills of Undergraduate Nursing Students

Kamolrat Turner, Boontuan Wattanakul

Abstract—Critical thinking and creativity are prerequisite skills for working professionals in the 21st century. A survey conducted in 2014 at the Boromarajonani College of Nursing, Chon Buri, Thailand, revealed that these skills within students across all academic years was at a low to moderate level. An action research study was conducted to develop the EREC IF Model, a framework which includes the concepts of experience, reflection, engagement, culture and language, ICT, and flexibility and fun, to guide pedagogic activities for 75 sophomores of the undergraduate nursing science program at the college. The model was applied to all professional nursing courses. Prior to implementation, workshops were held to prepare lecturers and students. Both lecturers and students initially expressed their discomfort and pointed to the difficulties with the model. However, later they felt more comfortable, and by the end of the project they expressed their understanding and appreciation of the model. A survey conducted four and eight months after implementation found that the critical thinking and creativity skills of the sophomores were significantly higher than those recorded in the pretest. It could be concluded that the EREC IF model is efficient for fostering critical thinking and creativity skills in the undergraduate nursing science program. This model should be used for other levels of students.

Keywords—Critical thinking, creativity, undergraduate nursing students, EREC IF model.

I. INTRODUCTION

IN the 21st century, rapid changes in socioeconomics, the environment, and information technology, affect people's life styles and the nature of health problems. Dramatic alterations in the nature of health problems demand changes in the health care system and the practice of nursing. Nurses practice in an increasingly complicated healthcare environment driven by the growth of the global health burden. Nursing educators need to rethink how they prepare nurses to meet the needs of a complex society and to work effectively in the current health care system. Critical thinking and creativity skills are considered the most imperative skills for nursing and medical education professionals [1]. Nursing education therefore needs to be managed in ways that develop these skills in nursing graduates.

K. Turner is with the Boromarajonani College of Nursing Chon Buri, Praboromarajchanok Institute of Health Workforce Development, Ministry of Public Health, 20000 Thailand (phone: +66 81-757-9387; fax: +66 38-285-533; e-mail: kmrtturner@gmail.com, kamolrat@bnc.ac.th).

B. Wattanakul is with the Boromarajonani College of Nursing Chon Buri, Praboromarajchanok Institute of Health Workforce Development, Ministry of Public Health, 20000 Thailand (phone: +66 86-323-1664; fax: +66 38-285-533; e-mail: lexicom8@gmail.com, boontuan@bnc.ac.th).

Critical-thinking skills are often referred to as 'higher order cognitive skills, to differentiate them from simpler (i.e., lower order) thinking skills. Higher order skills are relatively complex; require judgment, analysis, and synthesis; and are not applied in a rote or mechanical manner. Higher order thinking is thinking that is reflective, sensitive to the context, and self-monitored'. These skills are needed when dealing with complex situations [2]. The development of critical thinking skills is therefore often listed as the most important task for education, as these skills are essential for success in the complex contemporary world where new knowledge is constantly emerging [3].

Chan argues that critical thinking and creativity are crucial in nursing education. She conducted a study in Hong Kong with a sample of 100 nursing students using the problem-based learning approach combined with innovative activities. The findings revealed that problem-based learning could significantly increase students' critical thinking and problem-solving skills. Innovative activities, such as composing songs, writing poems and using role plays, could increase students' awareness of the relationship between critical thinking, creativity and nursing care. It was suggested from the research results that nursing educators should include more types of creative activities in their teaching to prepare nurses for future clinical practice [1].

Although critical thinking and creativity skills are recognized as the most important skills required for working in today's world, studies in Thailand and other countries revealed that these skills were neither high in either nursing students, nor in students or adults in general. The study by Turner, entitled: '21st Century Skills of Nursing Students of Boromarajonani College of Nursing, Chonburi', found that students rated their skills of critical thinking and creativity lower than other categories among 21st century skills [4]. Halpern [1] and Emily R. Lai [5] reviewed many research studies and concluded that critical thinking skills were low in both children and adults. Van Gelder also supported that a majority of adults lack reasoning skills [6].

It is not easy to develop the skills of critical thinking and creativity in nursing students in Thailand as their baseline for these skills was low, as evidence from the Programme for International Student Assessment (PISA) shows. When PISA (2003) was conducted on 15-year-old students in Thailand it was found that the skills of critical thinking and problem solving ranked Thai students at 34th place from a total of 40 countries [7]. The results highlight the weakness in critical

thinking skills among Thai students. This skill needs to be addressed because it is one of the most important learning skills. Furthermore, critical thinking skills are related to creativity. Those students who have a low ability in critical thinking will have low skills of creativity too. The pedagogic approach will need to shift from the traditional model of lecture-based to student center-based learning, which can enable students to better develop their critical thinking [8].

Boxer & Goldfarb state that creativity is a crucial competency of nurses because they work in complicated situations associated with health problems and health services. Creative skills enable nurses to explore various choices of problem solving leading to a higher quality of nursing care [9]. However, a study of Sangdee Preechapraparnwong in Thailand revealed that Thai students had only a moderate level of creativity. She also reported that learning patterns influence creativity skills [10]. These findings suggest that Thai nursing students should be better prepared to develop creativity skills through appropriate educational designs and management.

Although it is known that the development of critical thinking and creative thinking skills are important for nursing graduates and a lot of effort has been put into nursing education, little empirical evidence has been provided to help educators decide how to teach in ways that promote these skills. The author and team therefore conducted an action research study entitled; 'Development of a teaching/learning model to promote 21st century skills of nursing students at Boromarajonani College of Nursing Chonburi (BNC)' aimed at developing a pedagogical model to increase skills essential for today's nurses. This article is part of that action research study. The presentation and discussion in this paper will focus only on critical thinking and creativity skills.

II. RESEARCH QUESTIONS AND OBJECTIVES

A. Research Questions

1. What kind of pedagogical model is suitable for promoting critical thinking and the creativity skills of nursing students at BNC?
2. What are the outcomes of using the developed pedagogical model with regard to critical thinking and creativity skills of nursing students at BNC?

B. Research objectives

The research objectives were:

1. To develop a pedagogical model to promote critical thinking and creativity skills; and
2. To examine the effectiveness of the model.

C. Framework of the Study

The framework of critical thinking and creativity skills used in this study was part of the framework of 21st century skills introduced by the group called, Partnership for 21st Century Skills [11] and Trilling & Fadel [12]. An action research study was designed to develop a pedagogical model to promote the critical thinking and creativity skills of nursing students. The model was then implemented, evaluated, and improved.

III. RESEARCH METHODOLOGY

A. Research Design

An action research study was designed with qualitative and quantitative approaches for data collection.

B. Study Sample

A purposive sampling technique was used to recruit 75 sophomores of the undergraduate nursing science program and 40 nursing instructors of the BNC.

C. Research Procedures

The study was divided into three phases:

Phase 1: Current situation analysis

- 1.1 Survey of the critical thinking and creativity skills of the sophomores, and
- 1.2 Identify the current teaching/learning situations through a survey questionnaire and focus group discussion with faculty members and students.

Phase 2: Development of a pedagogical model using an action research approach

A literature review was performed to identify effective teaching and learning methods used in the 21st century. Experts attended two workshops to share their experience and ideas with the instructors. A pedagogical model was developed according to the data analyses of Phase I and after discussion among researchers, instructors, and experts. This model was implemented with the sophomores of the nursing science program and two nursing subjects were selected. Course designs and lesson plans for these two subjects were then developed in line with the concepts of the model. Actual instructions were carried out in the second semester of the 2014 academic year.

The instructors who participated in teaching the selected subjects were prepared for various methods of teaching including reflective thinking, role play, problem-based learning, simulation-based learning, and project-based learning. Similarly, the selected students participated in a workshop so as to help them prepare for the project. In particular, they were made aware of the active learning concept and the kinds of learning activities they would participate in.

Phase 3: Assess the effectiveness of the developed model

At the end of the second semester, the sophomores were asked to rate their critical thinking and creativity skills along with their ideas toward the teaching/learning model developed and used with them. Suggestions were given to improve the model and the modified model was implemented in the next two semesters.

D. Research Instruments

A self-administered questionnaire asking about the items relevant to critical thinking and creativity skills was developed according to Trilling & Fadel's framework of 21st Century Skills (2009) [12]. The critical thinking category was composed of 8 items and creativity category was composed of 6 items. Content validity of questionnaire was approved by 5

experts, and Cronbach's alpha coefficients were 0.94 for critical thinking and 0.81 for creativity.

IV. DATA ANALYSIS

All quantitative data were entered into and analysed with SPSS. Descriptive statistics were used to present the demographic information of participants, which included percentages, means, and standard deviations. The measurements of critical thinking and creativity skills were compared by repeated measures ANOVA. The qualitative data were summarized and partly presented in this paper.

V. RESULTS

A. Demographic Data

Most of the participants were female (93.33%), their age ranging from 19 to 23 years old, and the majority of their grade point averages were over 2.50 in a four-point system.

B. Situations before Implementation of the Model

The overall mean scores of critical thinking and creativity skills were at the moderate level. On a scale of 1 – 5, the mean scores ranged from 2.90 – 3.08 for critical thinking and 2.67-3.41 for creativity skill (see Tables VI and VII in the Appendix).

Lectures are the main method used for teaching and learning activities. A majority of students expressed their preference with lecture-based teaching. However, they preferred instructors who displayed a sense of humor and made fun in the classes. The instructors expressed their difficulties in shifting from traditional methods of teaching to active learning approaches. Both students and instructors were worried about not getting enough content.

C. Development of Pedagogical Model

A three-day workshop was organized to bring researchers, instructors, and experts together to analyze the situation. Together they developed the 'EREC IF Model' to guide teaching/learning activities to enhance critical thinking and creativity skills of the students.

- *E = Experience*: Instruction is organized in ways that provide students with direct or indirect experience relevant to learning issues.
- *R = Reflection*: The reflection process is to incorporate, wherever available, through questioning, discussion, and writing or journal keeping.
- *E = Engagement*: Instruction is designed to engage students to be active in the teaching and learning activities.
- *C = Culture and Language*: Issues regarding individual differences, cross culture understanding and English language are integrated in the lesson where available.
- *IF = Instruction* needs to get the students to use information, computer and technology. The concepts of fun and flexibility are considered to be included in all classes.

D. Assess Effectiveness of the Developed Model

The students were asked to rate their critical and creativity skills after four and eight months. The data analyses are presented in Tables I-V as follows:

TABLE I
MEAN AND STANDARD DEVIATIONS OF THE MEASURE OF CRITICAL THINKING AND CREATIVITY IN NURSING STUDENTS AT BEFORE, IN-BETWEEN, AND AFTER THE USE OF EREC IF MODEL (N=75)

Variables	Measuring Times		
	Before Mean (SD)	4 Months MEAN (SD)	8 Months MEAN (SD)
<i>Critical thinking</i>	2.97 (.49)	3.42 (.55)	3.75 (.57)
<i>Creativity</i>	2.91 (.52)	3.34 (.64)	3.69 (.67)

TABLE II
ONE WAY REPEATED MEASURES ANALYSIS OF VARIANCE OF CRITICAL THINKING SKILL IN NURSING STUDENTS AT BEFORE, IN-BETWEEN, AND AFTER THE USE OF EREC IF MODEL (N=75)

Sources	df	SS	MS	F	p	Greenhouse-Geisser	Huynh-Feldt
<i>Teaching effects</i>	1	21.96	21.96	234.82	< 0.001	< 0.001	< 0.001
<i>Error</i>	74	6.73	.09				

Partial Eta square = .765

TABLE III
ONE WAY REPEATED MEASURES ANALYSIS OF VARIANCE OF CREATIVITY IN NURSING STUDENTS AT BEFORE, IN-BETWEEN, AND AFTER THE USE OF EREC IF MODEL (N=75)

Sources	df	SS	MS	F	p	Greenhouse-Geisser	Huynh-Feldt
<i>Teaching effects</i>	1	22.12	21.12	140.00	< 0.001	< 0.001	< 0.001
<i>Error</i>	74	11.34	.16				

Partial Eta square = .661

TABLE IV
POST HOC COMPARISONS OF CRITICAL THINKING IN NURSING STUDENTS AT BEFORE, IN-BETWEEN, AND AFTER THE USE OF EREC IF MODEL (N=75)

I	J	Mean difference (I-J)	Sig	95% CI
8 Month	4 Month	.325	< .001	.268 - .382
	<i>Before</i>	.776	< .001	.675 - .877
<i>4 Month</i>	<i>Before</i>	.450	< .001	.370 - .530

The mean difference is significant at the .05 level.

Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

TABLE V
POST HOC COMPARISONS OF CREATIVITY IN NURSING STUDENTS AT BEFORE, IN-BETWEEN, AND AFTER THE USE OF EREC IF MODEL (N=75)

I	J	Mean difference (I-J)	Sig	95% CI
8 Month	4 Month	.352	< .001	.276 - .428
	<i>Before</i>	.779	< .001	.648 - .909
<i>4 Month</i>	<i>Before</i>	.427	< .001	.328 - .526

The mean difference is significant at the .05 level.

Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

The mean scores of critical thinking and creativity were moderate at the baseline and gradually increased after running the EREC IF model for four months and eight months. The scores fall in the moderate range (Table I).

Table II presents the significant differences between the critical thinking skill recorded at the baseline level, compared

to the findings recorded at four months and eight months after the methods of teaching employing the EREC IF model were introduced to the classroom.

Table III presents the significant differences of creativity between the baseline and the results recorded at four months and eight months after the methods of teaching with the EREC IF model were launched in the classroom. After employing teaching methods that supported the EREC IF Model, both critical thinking and creativity were boosted significantly. This case was greater at four months and eight months (Table IV and Table V).

Analysis of the qualitative data found that at the beginning both the students and instructors felt unsatisfied with the learning activities guided by the EREC IF Model, as they were not accustomed to the active learning approach. Both the instructors, and the students themselves, were not confident in their own ability to perform in an active learning environment, and were worried that not all content could be adequately covered. However, both the students and instructors gradually increased their confidence and had a positive attitude toward the use of the EREC IF Model. By the end of the implementation, both expressed their satisfaction with the pedagogical activities based on the EREC IF Model concepts.

VI. DISCUSSION

Statistical analyses showed that the mean scores of both critical thinking and creativity skills of the students at four months after implementation were significant higher than those of the pretest. The mean scores of critical thinking and creativity skills of the students at eight months were also higher than those collected at four months and the pretest. An explanation of these results could be that the EREC IF Model that was developed in Phase II could help in guiding the BNC instructors to select teaching/learning methods and design teaching/learning activities that enhance students' 21st century skills, including the skills of critical thinking and creativity.

With the concepts of the EREC IF Model, namely Experience, Reflection, Engagement, Culture & Language, ICT, and Flexibility & Fun the instructors in this study included a variety of activities that encourage students to think, analyze concepts and discuss their thoughts with other students and instructors. Various methods of active learning activities such as problem-based learning, role-play, and participatory learning were designed and implemented. These instructional methods not only increased the students' critical thinking and creativity skills but also the students' sense of satisfaction with the learning activities. The findings of this study are consistent with those of a study in China [1], which showed that students who participated in the methods of innovative teaching of problem-based learning increased their critical thinking and creativity. The study in China also revealed a close relationship between creativity, critical thinking, and nursing practice. That means students who have high critical thinking skills will have high ability in creativity and nursing practice. Therefore, instructors should consider introducing a variety of creative activities to develop innovation in their teaching methods.

Reflective thinking activities used in this study also supported the growth of creativity skills of the students. Silva, Alves, and Rodrigues recommended that reflection promotes creative thinking in nursing education. In their study they found that positive learning outcomes resulted from a creative, critic, and reflexive teaching-learning process. Silva and colleagues [13] assert that reflection allows students to analyze information that enhances creativity in professional performance of nursing. Therefore, teachers need to be creative in designing courses that facilitate students to learn actively and convert their ideas into actions. In addition, the learning environment for teaching creativity should expose students to diverse learning experiences in a relaxed atmosphere. In particular, group work should be encouraged as it is helpful for developing creativity. Reflective teaching activities and active learning have the advantage of developing creativity in nursing students [14].

Project-based learning was found to be one of the effective teaching methods for fostering creativity skills. These kinds of activities encourage student to feel free to think, and therefore to be more creative. Creative methods of teaching can encourage students to be more relaxed and participate more willingly in classroom discussions [15], [16]. Bell also recommended that students in the 21st century use technology as a means to sharing ideas and brainstorming for all aspects of project-based learning. This promotes creativity and lateral thinking [15].

The instructors in this study were able to implement various active learning methods because they were willing to engage in the study and were also prepared for teaching in Phase II. They attended a workshop to enhance their teaching abilities in various active learning methods. The preparation stage was crucial to the success of the study. The impetus for these training workshops included the recommendation by the World Health Organization that health professional education and training institutions should consider designing and implementing continuous development programmes for faculty and teaching staff that is relevant to the evolution of the health-care needs of their communities. Faculty development should include the issues of principles of adult learning, instructional design, and a diversity of educational methods [17]. Many educators, for example Bayer [18] and Smunty [19], also argued that it is essential to train teachers in various creative thinking and teaching skills that include flexibility, authenticity, and problem solving. The teacher who has these skills will be able to reflect them in their teaching and therefore promote the development of the students' creative thinking skills. The study of Ibrahim on 'A Program Based on Task-Based Teaching Approach to Develop Creative Thinking Teaching Skills for Female Science Teachers in the Kingdom of Saudi Arabia (KSA)' also confirmed that a training program could help develop critical and creative thinking teaching skills for teachers. He recommended that a follow up with teachers should be carried out to assess their readiness to implement critical thinking and creative teaching skills and ensure that they can effectively apply these teaching and learning strategies to the students [20].

In this study, teachers were able to facilitate an improvement in the critical thinking and creativity in nursing education and practice through a variety of teaching methods guided by the EREC IF model.

VII. CONCLUSION

In conclusion, the use of the EREC IF Model to guide pedagogic activities at BNC could help increase the critical thinking and creativity skills of nursing students. This model should be expanded across all academic years of the nursing science program.

APPENDIX

TABLE VI

MEAN AND STANDARD DEVIATIONS OF THE MEASURES OF CRITICAL THINKING IN NURSING STUDENTS BEFORE EXPERIMENT (N=75)

Critical Thinking	Mean (SD)
1. Identify problems based on knowledge and rational with evidence of analysis process	2.92 (.64)
2. Use various and trusted sources of information for problem solving	3.08 (.70)
3. Collect and analyze information for a work plan, problem solving, or decision making	3.11 (.64)
4. Identify a whole interaction including causes and consequences of study matters and overall complex impacts or outcomes	2.90 (.60)
5. Identify and ask significant questions that clarify various points of view and lead to better solutions	2.90 (.56)
6. Perform decision making or problem solving based on data analysis and evidence	2.94 (.64)
7. Use various processes or techniques including knowledge of nursing and relevant sciences for problem solving	2.90 (.68)
8. Make learning conclusions from experience or explain learning outcome of their own or group	3.01 (.70)
9. Overall average	2.97 (.49)

Note 1- 1.50 = very low, 1.51 - 2.50 = low, 2.51 - 3.50 = moderate, 3.51 - 4.50 = good, 4.51 - 5.00 = very good

TABLE VII

MEAN AND STANDARD DEVIATIONS OF THE MEASURE OF CREATIVITY IN NURSING STUDENTS BEFORE EXPERIMENT (N=75)

Creativity	Mean (SD)
1. Demonstrate new ideas or ideas for better nursing care	2.73 (.67)
2. Develop inventions, new techniques or new processes for nursing care	2.71 (.66)
3. Use new knowledge, research results, and innovations in nursing for classroom learning and clinical practice	2.67 (.67)
4. Be positive and demonstrate readiness in learning for better outcomes in problem solving or dealing with difficulties	3.16 (.78)
5. Be able to modify things for learning and/or nursing development	2.78 (.61)
6. Demonstrate belief in the success of group work and collaboration	3.41 (.83)
7. Overall average	2.91 (.52)

Note 1- 1.50 = very low, 1.51 - 2.50 = low, 2.51 - 3.50 = moderate, 3.51 - 4.50 = good, 4.51 - 5.00 = very good

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