

Comparing the Effect of Concept Mapping and Conventional Methods on Nursing Students' Practical Skill Score

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Background: Development of practical skills in the field of nursing education has remained a serious and considerable challenge in nursing education. Moreover, newly graduated nurses may have weak practical skills, which can be a threat to patients' safety.

Objectives: The present study was conducted to compare the effect of concept mapping and conventional methods on nursing students' practical skills.

Patients and Methods: This quasi-experimental study was conducted on 70 nursing students randomly assigned into two groups of 35 people. The intervention group was taught through concept mapping method, while the control group was taught using conventional method. A two-part instrument was used including a demographic information form and a checklist for direct observation of procedural skills. Descriptive statistics, chi-square, independent samples t-tests and paired t-test were used to analyze data.

Results: Before education, no significant differences were observed between the two groups in the three skills of cleaning ($P = 0.251$), injection ($P = 0.185$) and sterilizing ($P = 0.568$). The students mean scores were significantly increased after the education and the difference between pre and post intervention of students mean scores were significant in the both groups ($P < 0.001$). However, after education, in all three skills the mean scores of the intervention group were significantly higher than the control group ($P < 0.001$).

Conclusions: Concept mapping was superior to conventional skill teaching methods. It is suggested to use concept mapping in teaching practical courses such as fundamentals of nursing.

Keywords: Students; Nursing; Practical Skills; Concept Mapping; Conventional Teaching Method

1. Background

Nursing education aims to provide an appropriate level of knowledge and skills in nursing students. Improving the quality of nursing care requires obtaining high levels of knowledge and skills during nursing training period (1). However, skills acquisition is a complex process and needs students to acquire a combination of psychomotor, cognitive and affective skills and incorporate such skills with their theoretical knowledge, procedural skills and critical thinking. Several studies in different countries reported that nursing education does not always prepare its students for the demands of working as a professional registered nurse (2, 3). Newly graduated nurses may have weak practical skills, which can be a threat to patients' safety (4). A meta-analysis concluded that clinical skills training in nursing had not led to deep learning (5). Papastavrou et al. investigated student nurses' experience of learning in clinical environments and reported similar findings (6). Shah et al. studied the process of motor skill acquisition and reported that most students

complain about their problems in transferring what they learned at clinical skills centers to the real clinical setting (7). Several factors are involved, among them education methods play a crucial role (8). Therefore, it is imperative for nurse trainers to use the best methods to promote learning and skill acquisition in their students (4).

Concept mapping is a modern educational strategy based on the Ausubel's learning assimilating theory. According to Ausubel, meaningful learning occurs when newly learned materials can be linked to the information previously stored in the brain. Concept mapping helps learners to organizing their knowledge through series of graphical maps. Novak and Govin defined concept mapping as a graphical method for presenting a set of concepts placed in a thematic framework (9). In this perspective, we think and learn the concepts by linking new concepts to previously known concepts in a systematic manner (10). Hence, meaningful learning is enhanced and performance is improved. In fact, concept mapping

is an active teaching method, which helps nurse educators to develop critical thinking and problem solving capabilities in graduates (11).

Several studies in the field of medical education used concept mapping in teaching theoretical courses (11, 12), teaching and evaluation of creativity skills (13), teaching students to develop and record care plans (14). However, most studies used grades and students' academic achievement to measure the effect of concept mapping (15). Moreover, some studies had weaknesses in their design and methodologies. For example, Adlaon compared the effect of a three-week teaching course using concept mapping and traditional teaching methods on students' performance in responding multiple choice questions and reported that concept mapping was superior to traditional teaching method. However, the short duration of intervention, the small sample size, the small numbers of concept maps used and the type of evaluation made the results difficult to be generalized (16). In another study, Hsu and Hsieh used concept maps as an assessment tool in a nursing course. However, the intervention did not affect students' outcome significantly (14). Clayton et al. reported that contradictory results of concept mapping technique might be attributed to small sample size, inappropriate gauges, non-random selection and lack of control group in different studies (17). Most studies assessed the effects of concept mapping on students cognitive learning domain (18, 19) and the effect of this method on students skill acquisition had not been assessed so far. Then, we cannot generalize the results of these studies to the psychomotor domain.

2. Objectives

This study was performed to compare the effects of training using concept mapping and traditional teaching methods on practical skills of nursing students.

3. Patients and Methods

3.1. Design and Participants

This quasi-experimental pretest and post-test study was conducted on 70 students enrolled for the first time in a practical course on fundamentals of nursing. The study was conducted in the second semester of the academic year 2013 - 2014 in the clinical skills center at Tehran university of medical sciences (TUMS). The inclusion criterion was having no previous experience on concept mapping and direct observation of procedural skills (DOPS) methods. An absence of more than three sessions from the training sessions was the exclusion criterion.

The sample size was calculated using the results of a previous study by Karimi-Moneghi et al. in which s_1 , s_2 , μ_1 and μ_2 were respectively 1.5, 1, 16.2, and 15.25 (20). Then, with a type I error of 0.05 and a power of 0.80, the sample size was estimated as 29 students for each group.

However, we recruited 35 students with inclusion criteria in each group to compensate for possible attritions. Then, among a total of 140 students, 70 students with inclusion criteria who consented to participate in the study were recruited. Then, the students were randomly assigned in the intervention ($n = 35$) or the control group ($n = 35$) using a random numbers table (Figure 1).

Before commencing the intervention, all the students were invited to the clinical skills center. Then, a pre-test was performed in both groups using the DOPS method. Afterward, each group was though 14 sessions of 45 minutes, two sessions per week, through either concept mapping (intervention group) or the traditional method (control group).

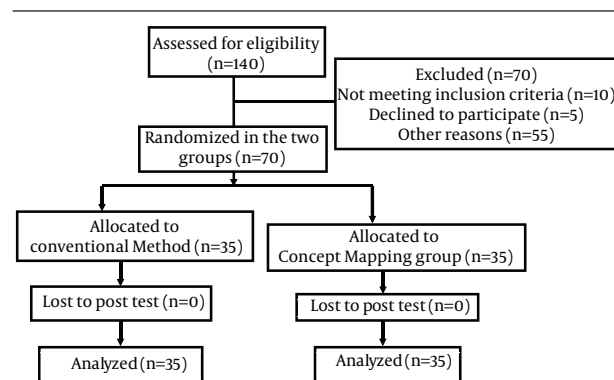


Figure 1. The Study Design

3.2. Instruments

A two-part instrument was used to collect data in this study including a demographic data form and a checklist for assessing the students' skills in selected procedures. The demographic data form consisted of questions regarding students' age, gender, grade point average (GPA), living location, marital status and the group in which the student was assigned to.

The checklist used to observe student's skills in selected practical procedures consists of 9 items regarding having comprehensive knowledge of the indications and the relevant anatomy, obtaining patient's consent for the procedures, implementing all required preparations before the procedures, implementing the aseptic techniques, the technical ability to perform the procedure, implementing the required nursing care after the procedures, appropriate using of communication skills, using essential ethical and professional conduct and the observer's overall opinion on student's performance. All items scored on a 10-point Likert scale ranged from zero to 9, totaling a score of 0 to 81 for each skill. The checklist for DOPS has frequently been used previously (21, 22). Farsi version of this instrument was also validated by eleven faculty members in Zahedan nursing and midwifery college and presented appropriate content validity. Its reli-

ability was also checked through internal consistency method and the Cronbach's alpha was 0.94 (23).

3.3. Intervention

The intervention group was trained using concept mapping method followed by demonstrating relevant skills by instructors and students' practices. All maps were spider shaped so that the main concepts were in the middle of maps and sub-concepts were presented in the sides. In all maps, the teacher presented the material in a clockwise direction from the starting point. At the first session, the intervention group was informed that special software would be used to teach them in this course. Then, they were taught about using FreeMind software to draw concept maps. Then, the main course started in the second session onward. After each session, every student was required to design a concept map of the whole proposed lecture for the next session individually; then, at the beginning of the next session, a few concept maps prepared by the students were reviewed and feedback was given to them. All training sessions of the intervention group were held on Saturdays and Sundays, at the clinical skills center of nursing school of TUMS. In this study, the instructor (the second researcher drew concept maps using offline method in Free-mind (GNU General Public License, Java), based on the literature on websites and specialized instructions (23).

The control group was also trained in 14 sessions using conventional method (i.e. lecturing, demonstration and then students' practicing). The training sessions of this group were held on different days (Tuesdays and Wednesdays) to prevent exchanging the information about concept mapping between the two groups.

The curriculum of both groups was the same and the only difference was used teaching methods. The skills taught included intradermal injection, subcutaneous injection, intramuscular injection, intravenous cannulation, intravenous injection, intravenous fluids preparation, nasogastric catheterization, feeding through a nasogastric catheter (gavage), nasogastric lavage, oxygen therapy methods (through nasal cannula and face mask), measuring the blood pressure, airway suctioning, tracheostomy care and dressing change. The list of procedures was confirmed by the authorities in nursing school and the content validity of all concept maps were confirmed by 10 experienced nursing faculty members in the nursing school of TUMS.

Four weeks after the last training session, DOPS functional test was conducted without previously informing in the clinical skills center for all students in the both groups. Two lecturers of the "fundamentals of nursing" course in nursing and midwifery school at Tehran university of medical sciences (who were trained on DOPS and how to observe the students using special checklists, but did not know anything about

the project), conducted all testing procedures. Before starting the testing, all the students were gathered in a classroom and briefed about the DOPS and what should they do during the testing session.

Each student was required to select three procedures (i.e. cleaning, injection and sterilizing) among several procedures already taught to them. The name of procedure was written on pieces of paper and put in three boxes. Each student was asked to select randomly one procedure from each box. The students performed the selected procedures under direct observation of the aforementioned specialists who completed the DOPS checklists. Finally the mean of students' scores was calculated for each individual skill and recorded at the top of the checklist.

3.4. Ethical Considerations

The present study was approved by the institutional review board and the research ethics committee of TUMS. All students were aware that they are under investigation and signed an informed consent at the beginning of study. They also were assured about the confidentiality of their personal information.

3.5. Data Analysis

Statistical analysis was performed using SPSS-13 software (Spss Inc, Chicago, IL, USA). Kolmogorov-Smirnov test was performed and confirmed the normality of the DOPS scores. Independent samples T-test was used to compare the mean of procedural skills scores, the mean age and GPA of the two groups. Paired t-test was used to compare the mean scores on each group before and after the intervention. Chi-square test was used to compare gender differences and Fisher's exact test for marital status and residential area of the two groups. Statistical significance was considered at P value < 0.05.

4. Results

For gender distribution, 58.1% of the students in the control group and 56.9% of the intervention group were females. No significant difference was observed regarding demographic characteristics of the two groups (Table 1).

Table 2 presents students' mean scores in three skills of cleaning, injection and sterilizing before and after the education. Before education, no significant differences were observed between the two groups in the three skills of cleaning (P = 0.251), injection (P = 0.185), and sterilizing (P = 0.568) (Table 2). The students mean scores significantly increased after the education and the difference between pre and post intervention of the students mean scores were significant in the both groups at < 0.001. However, after education, in all three skills, the mean scores of the intervention group were significantly higher than the control group (P < 0.001; Table 2).

Table 1. Characteristics of Participants in the Concept Mapping and Control Group ^{a, b}

Variables	Control Group	Intervention Group	P Value
Gender			0.68
Male	15 (41.9)	15 (43.1)	
Female	20 (58.1)	20 (56.9)	
Marital status			0.93
Single	31 (88.6)	34 (97.1)	
Married	4 (11.4)	1 (2.9)	
Residential area			0.96
With parents	25 (71.4)	23 (65.7)	
Dormitory	10 (28.6)	12 (34.3)	
Age, y	19.45 ± 0.86	19.16 ± 0.86	0.33
GPA^b	17.51 ± 1.49	17.74 ± 1.38	0.51

^a Data are presented as mean ± SD or No. (%).

^b GPA: grade point average

Table 2. Comparison of the Mean Score of Practical Skills Between Two Groups Before and After Intervention ^a

Time	Control Group	Test Group	P Value ^b
Before Intervention			
Skill			
Cleaning	23.8 ± 2.26	24.5 ± 2.54	0.251
Injection	23.8 ± 2.47	24.6 ± 2.69	0.185
Sterilizing	23.5 ± 2.92	24.4 ± 2.56	0.568
After Intervention			
Skill			
Cleaning	63.7 ± 1.94	77.9 ± 2.62	0.001
Injection	56.9 ± 7.61	77.3 ± 2.77	0.001
Sterilizing	61.6 ± 3.18	77.5 ± 2.69	0.001
P value ^c	0.001	0.001	

^a Data are presented as mean ± SD.

^b Independent t-test.

^c Paired t-test.

5. Discussion

To the best of our knowledge, this was the first study comparing the effect of concept mapping and traditional methods of skill teaching on nursing students learning in practical skills. The study revealed that both methods could significantly increase the mean score of students at posttest. However, students' posttest mean scores were significantly higher in the group taught via concept mapping method. Our finding on positive effect of concept mapping on learning was in line with some previous studies such as Van Bon-Martens (24), Gul and Boman (25) and Magnussen (26), Harrison and Gibbons (27), and Gonzalez et al. (10). Though not on psychomotor domain, all of these studies confirmed that concept mapping is superior to conventional methods in enhancing students' learning in the cognitive domain. Although both teaching methods used in this study could enhance

students learning, nurse teachers are responsible to find, develop and implement more effective methods on students learning. This fact would be more important in the psychomotor domain that is more pertinent to patients' safety and the quality of nursing services. Therefore, it is suggested to integrate concept mapping as an effective method in our conventional methods of skill teaching. Inconsistent with our findings, Hsu and Hsieh reported that although concept mapping had some positive effects on learning, the effect was not statistically significant (14). However, our study and several previous investigations showed that concept mapping would be effective if appropriately implemented. Concept mapping shows concepts in a hierarchical format from general to detail, such as a pyramid structure of information in long-term memory. Therefore, concepts learned via this way can re-

main for a long-term and increase learning significantly (9). Concept mapping also allows students to understand the errors in their understanding of concepts and then would increase their motives to correct such errors (28). According to Tseng et al. concept mapping combines the problem-oriented learning, critical thinking, self-directing learning and enhances students' performance in the training group (29). Scahill et al. also reported that concept mapping improves students' learning and academic achievement with a positive effect on their attitudes (30).

When a concept map is drawn by the students, they integrate their new knowledge with what they have learned previously. This method may help students to easily classify their knowledge, make them coherent to make a deeper understanding. This would assist students reaching higher levels of cognitive learning rather than memorizing a series of concepts.

This study showed that concept mapping was superior to conventional skill teaching methods. Considering the results of this study, it is suggested to use concept mapping in teaching practical courses such as fundamentals of nursing. This method would perhaps be more effective if integrated with teachers' conventional teaching methods. To this end, nurse teachers should be trained to integrate concept mapping in their teaching and learning activities.

However, the nature of each course, instructor's mastery and types of learners can affect selecting teaching method. This study was implemented in a small sample and compared the concept mapping with conventional methods. Therefore, it is suggested to perform studies using concept mapping in other practical courses in nursing and to compare it with other active teaching methods.

In this study, the effect of intervention was assessed in the skill center not in the real clinical setting. Therefore, investigating the effect of concept mapping on students' competencies in real clinical setting is suggested.

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Authors' Contributions

Nasrin Rasoul Zadeh and Zohre Parsa Yekta designed the study and conducted data analysis, Hamidreza Sadeghi Gandomani gathered the data, interpreted it and Masoumeh Delaram wrote and revised the manuscript.

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No conflicts of interest, were declared by the authors.

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