Impact of mind mapping on the critical thinking ability of clinical nursing students and teaching application

Hang-Zhou Wu¹ and Qiu-Ting Wu²

Abstract
Objective: We analyzed the impact of mind mapping on the critical thinking ability of clinical nursing students and its use as a teaching application. This study provides reference information for clinical teaching.

Methods: We selected 64 nursing students using convenience sampling. Participants received basic knowledge training of mind mapping in three sessions during the intervention. Questionnaires on critical thinking ability were designed by the researchers, adopting the Chinese version of the Critical Thinking Disposition Inventory. Data collected using the questionnaires included learning strategy function and clinical skill improvement with mind mapping, as well as students’ degree of adaptability to mind mapping. Participants’ critical thinking ability before and after the intervention was analyzed using a paired t-test.

Results: The critical thinking inclination of nursing students was significantly improved after intervention compared with that before the intervention (t = −0.74). The four dimensions of open-mindedness, inquisitiveness, cognitive maturity, and systematicity among nursing students after the intervention were also significantly improved compared with before the intervention.

Conclusion: Mind mapping is conducive to improving the critical thinking ability of clinical nursing students.

Keywords
Mind map, nursing students, critical thinking ability, clinical education, Critical Thinking Disposition Inventory, China

Date received: 24 May 2019; accepted: 15 November 2019
Background

The modern medical environment requires nurses to have abilities of independent judgment, independent decision-making, and independent execution in clinical practice. Hence, nursing staff must be equipped with critical thinking skills. Critical thinking pervades all human activities via the processes of thinking and reflection and is key in acquiring all of the abovementioned abilities. In recent years, an increasing number of educators have realized the disadvantages of traditional teaching methods. Nursing educators have therefore attempted to implement various teaching methods, to improve critical thinking skills in nursing students.

In recent years, mind mapping has been applied in the field of nursing as a novel thinking method that has been integrated with teaching and learning. Mind mapping, as a new learning memory tool, was proposed in the early 1960s by Tony Buzan, a psychologist and educational expert in Britain. Mind mapping uses a technique of combining drawings with words to build memory links between a topic keyword and image, color, or other link, thereby highlighting the key point and level of the memory contents, allowing learners to effectively store and extract information. It has been revealed that mind mapping, as a training tool in thinking, not only improves learning efficiency but also increases learning motivation and interest. However, there is a lack of evidence on whether mind mapping can be effectively applied to clinical practice education.

The aim of the present study was to analyze whether mind mapping can effectively improve the ability to think critically among clinical nursing students. We discuss the impact of mind mapping on critical thinking among nursing students in clinical practice and provide reference information for clinical teaching.

Participants and methods

Research participants

We selected nursing students at grade A tertiary hospitals in Fuzhou City using a convenience sampling method. All nursing students who were on duty in the medical and surgical wards from August 2016 to December 2016 were included in the study. The exclusion criteria were nursing students who did not wish to collaborate in the research process. In this study, all nursing students voluntarily participated in the research.

Research tools

The questionnaire included basic information such as sex, age, and school information. The Chinese version of the Critical Thinking Disposition Inventory (CTDI-CV) was applied. The content validity of the CTDI-CV is 0.89, as revised by Peng and other translators at Hong Kong Polytechnic University; the Cronbach’s alpha value of the CTDI-CV is 0.90. This scale consists of seven dimensions: analyticity, open-mindedness, self-confidence, inquisitiveness, cognitive maturity, systematicity, and truth-seeking; there are 10 entries per each dimension, for a total of 70 entries. The content of these entries are assessed using six ranking levels, from “strongly agree” to “strongly disagree”. In the questionnaire, scores from 6 to 1 were considered positive entries, with higher scores indicting stronger agreement; scores from 1 to 6 scores were considered negative entries, with higher scores indicting stronger disagreement. The total score of each dimension ranges from 10 to 60, in which a score ≥40 indicates a positive inclination toward critical thinking, a score <30 a negative inclination, and a score of 30 to 40 indicates neither positive nor negative inclination toward critical thinking. The total
score of the scale ranges from 70 to 420, with a score <210 indicating a negative inclination, a score of 210 to 280 a neutral inclination, a score >280 a positive inclination, and a score >350 indicating a strong inclination toward critical thinking. In the present study, the Cronbach’s alpha coefficient was 0.967.

**Questionnaire on the application of mind mapping in teaching activities.** We used a questionnaire addressing application of mind mapping to teaching activities. The survey was self-designed by the investigators to collect the students’ attitudes and evaluations of mind mapping as a teaching method. The content validity of this questionnaire was revised by three clinical experts with senior professional titles in nursing and more than 5 years of clinical teaching experience. The content of the questionnaire included learning strategy function and clinical skill improvement for mind mapping, as well as the degree of adaptability of students to mind mapping, among other aspects. A 5-point Likert ranking scale was adopted, with response options of strongly disagree, disagree, uncertain, agree, and strongly agree. These were each given a score from one to five; a score >4 indicated a positive attitude, a score of 3 a neutral attitude, and a score <3 indicated a negative attitude. Open-ended questions were included to assess the thoughts of nursing students regarding the application of mind mapping to teaching.

This questionnaire was validated by seven experts in two-round Delphi surveys. The panelists included (1) medical or surgery nurse educators with at least 2 years’ teaching experience, (2) at least 5 years’ working experience, and (3) a bachelor’s degree or above. Panelists evaluated the appropriateness and relevance of each item independently and provided their comments. The content validity index was calculated as the percentage of items identified as “relevant” or “very relevant”; this was 92% in the first round. Based on the experts’ comments, three questions were modified. The content validity index in the second round, conducted 2 weeks later, was 100%.

The Cronbach’s alpha of the questionnaire was 0.82. The internal consistency of the questions was 0.80, indicating an acceptable internal consistency.

**Intervention method**

During the internship period, basic knowledge training in mind mapping was provided by a full-time educator with a PhD and many years’ experience in the application of mind mapping for nursing students. The training was conducted for a total of three sessions of 2 hours each. The main contents included the definition, development process, and role of mind mapping, as well as an introduction to the drawing software and drawing method. The researchers conducted three demonstrations of mind mapping using a clinical case diagram, to improve nursing students’ understanding and comprehension of clinical mind mapping and to enhance their interest in learning the techniques. Each demonstration lasted about 40 minutes.

Each internship group, consisting of 4 to 6 members, learned and discussed the role and drawing method of mind mapping for a total of 3 to 5 sessions per group, for 30 to 40 minutes per session. Each group was allowed to independently select a topic for the mind mapping session, according to the educational contents of the Internship Department. Each group drew a mind map according to disease entities included in ward round teaching of the Internship Department. The investigators and clinical educators collected and summarized the data.

**Data collection and statistical methods**

The investigators personally administered the questionnaires to nursing students
before and after the intervention, and collected all completed questionnaires. Data before the intervention were collected just prior to nursing students beginning their clinical training in the medical and surgical wards. Data after the intervention were collected after students finished their training in the wards, about 2 months later.

Data input and statistical analysis were conducted using SPSS 17.0 (SPSS Inc., Chicago, IL, USA). Comparative analysis was performed to assess the critical thinking ability of nursing students before and after the intervention using a paired t-test. The results of the analysis are reported using mean and standard deviation.

**Ethical considerations**

This study was conducted in accordance with the Declaration of Helsinki. The study was conducted with the approval of the Ethics Committee of The First Affiliated Hospital of Fujian Medical University. Written informed consent was obtained from all participants.

**Results**

**Demographic variables of participants**

Sixty-four nursing students from grade A tertiary hospitals in Fuzhou City were recruited using a convenience sampling method. The age range of the included students was 21 to 23 years. Among participants, 62 (96.87%) were women and two (3.13%) were men; 34 (52.35%) students were undergraduate university students and 30 (46.2%) were junior college students. There were 14 student groups, with an average of 4 to 6 students per group.

**Critical thinking inclination before and after intervention**

The results of the assessment of participants’ inclination toward critical thinking before and after intervention are shown in Table 1. The total score for critical thinking inclination among nursing students before the intervention was 263.95 ± 46.09, indicating a neutral inclination. The total score for students’ critical thinking inclination after the intervention was 281.68 ± 46.14, indicating a positive inclination toward critical thinking. On comparing the critical thinking inclination before and after intervention, the inclination toward critical thinking of nursing students after the intervention was significantly improved compared with that before intervention (\( t = -0.74, P = 0.045 \)).

**Table 1. Results for participants’ inclination toward critical thinking, before and after the intervention (n = 64).**

| Dimension            | Scores before intervention (x ± s) | Scores after intervention (x ± s) | t      | P      |
|----------------------|-----------------------------------|----------------------------------|--------|--------|
| Analyticity          | 40.20 ± 5.85                      | 41.52 ± 4.92                    | -0.30  | 0.76   |
| Open-mindedness      | 35.25 ± 5.83                      | 39.02 ± 5.62                    | -4.13  | 0.00*  |
| Self-confidence      | 39.81 ± 6.51                      | 40.95 ± 6.50                    | -0.12  | 0.91   |
| Inquisitiveness      | 37.80 ± 6.10                      | 42.38 ± 6.39                    | -3.90  | 0.00*  |
| Cognitive maturity   | 36.59 ± 7.56                      | 38.86 ± 6.85                    | -0.24  | 0.04*  |
| Systematicity        | 37.88 ± 6.61                      | 40.92 ± 7.71                    | -1.74  | 0.047* |
| Truth-seeking        | 36.42 ± 7.63                      | 38.03 ± 8.15                    | -1.35  | 0.18   |
| Total score          | 263.95 ± 46.09                    | 281.68 ± 46.14                  | -0.74  | 0.045* |

*P < 0.05.
Critical thinking ability before and after intervention according to scores on each dimension

The four dimensions of open-mindedness, inquisitiveness, cognitive maturity, and systematicity among nursing students were also significantly improved after the intervention, as compared with those before intervention (Table 1) \( (P < 0.05) \). The four dimensions of analyticity, self-confidence, inquisitiveness, and systematicity after intervention showed a positive inclination toward critical thinking (Table 1).

Survey results regarding mind mapping application in teaching

Results of the survey on the application of mind mapping to teaching activities are shown in Table 2. The survey revealed that in the overall evaluation (average score 4.13 ± 0.73) of the mind mapping teaching method, nursing students had a positive attitude toward knowledge memory enhancement, cultivation of analytical abilities, the ability to systematically organize information, and the ability to combine theory with practice, among other aspects, all with scores of more than 4. Most nursing students reported that they enjoyed learning mind mapping and were willing to use the method in their work, with scores of more than 4 (Table 2).

In response to the open-ended questions, nursing students stated that the combination of mind mapping and professional knowledge can improve learning efficiency, contribute to learning memory, and cultivate analytical abilities. The main difficulties reported by participants in drawing mind maps (Figure 1) were that the process is time-consuming, being unfamiliar with application software, and being unskilled in drawing, among others.

Discussion

Improvement in critical thinking ability using mind mapping in nursing education

The research results revealed that the critical thinking ability of nursing students obviously improved after training in mind mapping (Table 2). The survey results indicated that nursing students had a positive attitude toward knowledge memory enhancement, cultivation of analytical abilities, the ability to systematically organize information, and the ability to combine theory with practice, among other aspects, all with scores of more than 4. Most nursing students reported that they enjoyed learning mind mapping and were willing to use the method in their work, with scores of more than 4 (Table 2). In response to the open-ended questions, nursing students stated that the combination of mind mapping and professional knowledge can improve learning efficiency, contribute to learning memory, and cultivate analytical abilities. The main difficulties reported by participants in drawing mind maps (Figure 1) were that the process is time-consuming, being unfamiliar with application software, and being unskilled in drawing, among others.

Table 2. Survey results regarding application of mind mapping in teaching activities \( (n = 64) \).

| Content                                                                 | Attitude score \( (x ± s) \) |
|------------------------------------------------------------------------|-------------------------------|
| 1. Helps increase the degree of knowledge memory                        | 4.31 ± 0.61                   |
| 2. Helps develop analytical skills                                     | 4.24 ± 0.55                   |
| 3. Helps cultivate the ability to systematically organize various kinds of information | 4.58 ± 0.65                   |
| 4. Helps with comprehensively and integrally grasping patients’ information | 3.84 ± 0.74                   |
| 5. Helps link theoretical knowledge with clinical practice             | 4.20 ± 0.68                   |
| 6. Improves problem solving skills                                     | 3.92 ± 0.74                   |
| 7. I can adapt to clinical education that integrates mind mapping     | 4.12 ± 0.85                   |
| 8. I will draw mind maps while studying and working                    | 3.81 ± 0.94                   |
| 9. I like teaching using mind mapping very much                        | 4.06 ± 0.87                   |
| 10. I will use mind mapping often in my future work                    | 4.17 ± 0.85                   |
| 11. Applying mind mapping makes teaching more effective. I hope that educators will continue to use this method | 4.21 ± 0.69                   |
| Average                                                               | 4.13 ± 0.73                   |
mapping, with neutral inclinations toward critical thinking before the intervention improving to positive inclinations post intervention. After the intervention, the four dimensions of analyticity, self-confidence, inquisitiveness, and cognitive maturity in critical thinking showed positive inclinations, indicating an enhanced desire for acquiring knowledge among nursing students and improved attitudes regarding independent investigation and initiative. These findings were consistent with research results reported by Chen and Zhang\textsuperscript{13} and Chen and Zhao.\textsuperscript{14} Therefore, our findings confirm that the application of mind mapping in teaching can improve the critical thinking ability of nursing students.\textsuperscript{15,16} Mind mapping can be used to effectively integrate and optimize learning resources, helping to build a complete knowledge system. This approach will contribute to improving students’ abilities of comprehensive analysis, resulting in a more scientifically rigorous and effective learning process.\textsuperscript{17}

At the intervention stage, clinical educators guide nursing students in acquiring comprehensive and systematic knowledge and skills. These students can in turn provide patients with integrated professional health services including basic nursing, condition observation, rehabilitation guidance, and health education.\textsuperscript{18} At the internship stage, on-duty nursing students are full of intellectual curiosity and eager to apply their professional knowledge. Hence, this is a stage during which nursing students can attain a sense of accomplishment and responsibility. In our study, training in mind mapping helped nursing students adapt to new internship environments.\textsuperscript{9,19} The training possessed a good guidance function in professional knowledge mastery for students during their short internship period.\textsuperscript{20} Thus, the dimensions of open-mindedness, inquisitiveness, cognitive

![Figure 1. Examples of nursing student's mind map.](image-url)
maturity, and systematicity were obviously improved in our participants. However, the dimensions of analyticity, self-confidence, and truth-seeking did not show improvement. This may be because the clinical educators in this study were unfamiliar with mind mapping and thus, could not provide adequate guidance for students in these dimensions.

**Positive attitude toward the application of mind mapping in teaching nursing students**

In this study, we surveyed and interviewed participants and found that applying mind mapping in teaching has become a popular learning method among nursing students at the research hospitals in this study. Students reported that mind mapping helped to enhance their memory, to better acquire knowledge and analytical abilities and to systematically organize information. Students reported that they can adapt to mind mapping in clinical education that combines theory with practice, to acquire and improve their critical thinking abilities. In the present study, nursing students freely designed mind maps rather than being provided with a pre-drawn example. In this way, students’ initiative for learning can best be mobilized.\(^{21,22}\)

Despite our positive findings, we revealed that mind mapping was ineffective in improving participants’ problem-solving abilities. This is possibly related to the stronger emphasis on memory and learning efficiency of mind maps, with less emphasis on solving practical problems. In our study, nursing students reported that they might have less initiative to draw mind maps while learning because the process is time-consuming.

In conclusion, teaching using mind mapping can cultivate the critical thinking ability of nursing students. Furthermore, clinical educators can apply mind mapping during the training of these students in the internship process. This approach will help nursing students to acquire comprehensive skills and improve their initiative to learn.

**Declaration of conflicting interest**

The authors declare that there is no conflict of interest.

**Funding**

This study was supported by the Projects of Educational and Teaching Reform of Universities in Fujian Province (No. J15035).

**ORCID iD**

Hang-Zhou Wu https://orcid.org/0000-0003-1354-0527

**References**

1. Chan ZC. A systematic review of critical thinking in nursing education. *Nurse Educ Today* 2013; 33: 236–240.
2. Ingram B, Jesse M, Fleagle S, et al. Transform, interact, learn, engage (TILE): creating learning spaces that transform undergraduate education. In: Carpenter RG (ed.) *Cases on higher education spaces: innovation, collaboration, and technology*. 2013, pp.165–185.
3. Naber J and Wyatt TH. The effect of reflective writing interventions on the critical thinking skills and dispositions of baccalaureate nursing students. *Nurse Educ Today* 2014; 34: 67–72.
4. Jeong HS. Critical thinking disposition, problem solving process, and empathy among Nursing Students. *Adv Sci Technol Lett* 2015; 103: 44–48.
5. Zhang ZG, Hou YY, Zhang J, et al. The influence of seven different teaching methods in the critical thinking ability of nursing student: a network meta-analysis. *Chin J Nurs* 2016; 51: 960–966.
6. Yoon J. A study on the critical thinking disposition of nursing students–focusing on a school applying integrated nursing curriculum-. *J Korean Acad Nurs Admin* 2008; 14: 159–166.
7. Kim SH, Nam HA and Kim MO. Critical thinking disposition, problem solving process, and simulation based assessment of clinical competence of nursing students in pediatric nursing. *Child Health Nurs Res* 2013; 20: 294–303.

8. Booker SQ and Peterson N. Use of the knowledge tree as a mind map in a gerontological course for undergraduate nursing students. *J Nurs Educ* 2016; 55: 182–184.

9. Spencer JR, Anderson KM and Ellis KK. Radiant thinking and the use of the mind map in nurse practitioner education. *J Nurs Educ* 2013; 52: 291–293.

10. Buzan T. *Mind map.* Beijing: CITIC Press, 2009, p.30.

11. Kotcherlakota S, Zimmerman L and Berger AM. Developing scholarly thinking using mind maps in graduate nursing education. *Nurse Educ* 2013; 38: 252–255.

12. Peng MC, Wang GC, Chen JL, et al. Validity and reliability of the Chinese critical thinking disposition inventory. *Chin J Nurs* 2004; 39: 644–647.

13. Chen HJ and Zhang YM. Research progress on application of mind mapping in nursing education and clinical practice. *Chin Nurs Res* 2014; 20: 2438–2440.

14. Chen YH and Zhao L. The practice and exploration of mindmapping in stomatology teaching. *China Med Educ Technol* 2006; 3: 220–222.

15. Oermann MH. Professional nursing education in the future: changes and challenges. *J Obstet Gynecol Neonatal Nurs* 1994; 5: 153–159.

16. Oermann MH and Gaberson KB. *Evaluation and testing in nursing education.* New York: Springer, 1998.

17. Shuttle A. Mind maps may enable more nurse research. *Nurs Times* 2011; 107: 11–16.

18. Li MM and Li H. Post evaluation of change nurses in different wards. *J Nurs Sci* 2014; 29: 49–52.

19. Wu XY, Huang M and Li J. Application of mind map to entrance guidance for nursing students practicing in emergency department. *J Nurs Sci* 2012; 27: 64–65.

20. Shin H, Sok S, Hyun KS, et al. Competency and an active learning program in undergraduate nursing education. *J Adv Nurs* 2015; 71: 591–598.

21. Mueller A, Johnston M and Bligh D. Joining mind mapping and care planning to enhance student critical thinking and achieve holistic nursing care. *Nurs Diagn* 2002; 13: 24–27.

22. Shi YS and Pan HY. Application of mind map in clinical teaching of closed thoracic drainage with suction for nursing students. *Chin J Nurs Educ* 2016; 13: 679–682.