

**Concept Mapping: as a Tool for Problem Based Learning on Students  
Problem Solving skills, Metacognitive Awareness, and Self-directed  
Learning**

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This study delves into the utilization of concept mapping as a strategic tool within problem-based learning (PBL) to enhance students' problem-solving skills, metacognitive awareness, and self-directed learning abilities. Concept mapping, a visual representation of knowledge structures, is explored as a means to cultivate and refine students' problem-solving capabilities, preparing them for challenges in various domains. Additionally, the research investigates how concept mapping within a PBL context promotes metacognitive awareness, helping students become more conscious of their learning strategies and enabling them to identify gaps in understanding. Moreover, the study explores the role of concept mapping in empowering self-directed learning, fostering autonomy and a deeper sense of ownership over students' educational journeys. The insights gained from this research not only inform instructional design practices, providing evidence-based strategies for enhancing problem-based learning through concept mapping but also contribute to the broader educational research discourse, offering valuable perspectives on effective teaching and learning strategies.

### **The aim of the study**

The present study aimed to evaluate the utility of concept mapping as a learning tool for problem solving. As well, examine the effect of using concept mapping as a tool for problem based learning on students' Metacognitive Awareness, problem solving skills, , and self -directed learning at Zagazig Faculty of Nursing.

### **Research hypotheses:**

1. There is a difference in students ' metacognitive awareness skills regarding using concept map as a tool before and after implementation of the educational program.
2. There is a difference in students ' problem solving skills regarding using concept map as a tool before and after implementation of the educational program.
3. There is a difference in students ' self -directed learning regarding using concept map as a tool before and after implementation of the educational program.
4. Relationship between scores of students ' metacognitive awareness skills, problem solving skills, and self -directed learning before and after participation in the educational program.
5. To estimate student perception regarding effectiveness of concept mapping as a learning tool after implementation of program.

### **Research design:**

A quasi-experimental design was used for this study.

### **Study setting:**

This study was conducted at Faculty of Nursing, Zagazig University, Egypt, which included seven scientific departments namely; Nursing Administration, Psychiatric and Mental Health Nursing, Pediatric Nursing, Community Health Nursing, Maternal and New Born Health Nursing, Medical Surgical Nursing, and Geriatric Nursing. These departments aimed to prepare highly qualified nursing students able to compete nationally and internationally and providing high quality of nursing care.

**Subjects:** The following subjects were included:

The subject of the study included fourth year nursing students who enrolled in second semester nursing administration course in the academic year 2023-2024 for experimental group. Group was chosen using simple random sample.

**Sample Size:**

The ideal sample size was estimated at confidence interval 95%, margin of errors 5.0%, the required sample size was 70 nursing students.

**Tools of data collection:**

A questionnaire sheet used to collect data for this study and composed of six parts:

**Part 1:** personal data such as gender, age, marital status, previous work experience.

**Part (2): Cases of Problem Solving (Scenarios)**

Scenarios (NO. 6) were developed by the researcher based on related literature and about actual or potential problems related to the managerial skills in the clinical setting.

**Part (3):** Metacognitive Awareness of Reading Strategies Inventory (MARSI): that was developed by Richard & Mokhtari [2002] (11) to measure students' metacognitive awareness of reading strategies in 3 scales; general reading strategies (13 items), problem-solving strategies (8 items) and strategies to support the study (9 items). All responses are based on a 5-item Likert scale. The reliability has determined 0.995 by Cronbach's alpha coefficient.

**Scoring system:**

The scores were categorized into satisfactory level (students who scored  $\geq 75\%$  on metacognitive awareness based questions) and poor unsatisfactory level (students who scored  $<75\%$  on metacognitive awareness based questions).

**Part (4):** The problem solving inventory: was developed by Heppner, 1988) is composed of 28 self-report items assessed on a 5-point Likert scale that are designed to

measure people's perceptions of their problem-solving abilities. Responses to the items range from 1 (strongly disagree) to 5 (strongly agree), and the total score ranges from 28 to 140

**Part (5):** Self-directed learning- Scale: Self-directed learning skills sheet was used to measure the skills of self-learning which developed by Sukseemuang (2009). It was used to measure the skills of self-learning. It consisted of 10 skill areas that involve the ability to manage learning tasks without having them directed by others. Scored by 4 likert type items as follow : DK: do not have or are not able to use the skill listed(1) ; LO have a low ability to use the listed skills(2); MD have a medium ability to use the listed skills(3); and HI developed experiences and activities to the listed skills(4).

#### **Scoring system:**

Scoring system represent self-directed learning skills of student ranging from poor <50%, average 50-75, and good >75% (Obied et al, 2013).

**Part (6):** This part was developed by researcher to measure perception of students regarding effectiveness of concept mapping activity after implementation of program on 4 Likert scale: (4) strongly agree, (3) agree, (2) neutral, and (1) disagree.

#### **Field Work:**

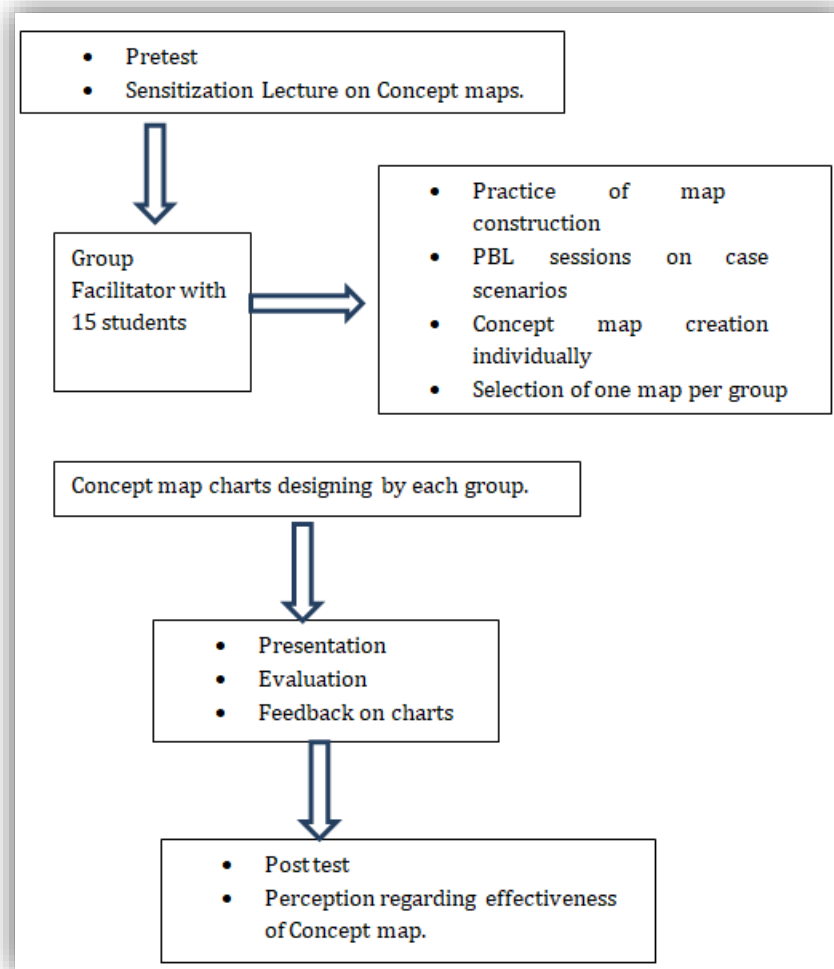
This study was executed in 3 months from beginning of February, 2023 till beginning of May, 2023. Students were classified into two groups' experimental group and control group. Each group was assigned a set of topics covered during lectures. This was followed by a multiple choice question (MCQ) based pretest. Questions for pretest were analytical and reasoning based. With the aid of group facilitator, students practiced map construction to acquaint themselves with this technique for a period of three weeks. The facilitator guided them on structural organization and integration of concepts.

Four PBL sessions for two hours per week were conducted, where in each group was handed over a scenario accompanied by questions based on specific learning objectives outlined by senior faculty members. Students of each group reviewed the scenario and searched for answers using multiple resources .Concept maps based on these scenarios were constructed individually by each student on paper, analyzed by multiple group discussions which took place twice to three a week. The facilitator coordinated all activities.

At the end of four weeks, one map was finalized by each group and students then designed charts based on these maps. Concept maps Charts had been designed on case scenarios. Evaluation of the charts was done by senior faculty members, taking into consideration eleven items. The structured grading rubric was adapted from the one advocated by Novak and Gowin (1984) (9). Feedback on the quality, structural organization and integration of concepts was given immediately after the presentation. Perception of students regarding effectiveness of Concept maps was taken through a pre

validated questionnaire consisting of open ended questions and close ended questions. A post test for all the respective groups was taken at the end of this activity.

### Study design sequence:



### Pilot Study:

A pilot study was carried out on 7 students (10% of the study sample) to check the clarity of the tools and to estimate the time needed to fill in the questionnaire sheets by each participant. Required modifications were done and the subjects who participated in the pilot study were excluded from the main study sample.

### Content Validity:

Data were collected using a self-administered questionnaire, after the translation of the instrument to Arabic. The content and face validity were established by a jury of experts (7 professors & assistant professors) from academic nursing staff, Zagazig, El-Fayoum

and Ain-Shams Universities. According to their opinions, all necessary modifications were done.

### **Administrative and Ethical Consideration:**

Approval to conduct the study was obtained from the dean of Faculty of Nursing and ethical committee after explaining the aim of the study. The students were informed that their participation in the study is completely voluntary and the cover letter introducing the study addressed the confidentiality of the participants. Consent was established with the completion of the questionnaires.

### **Statistical Analysis:**

Data entry and statistical analysis were done using the Statistical Package for Social Science (SPSS), version 20.0. The cleaning of data was done to be sure that there was no missing or abnormal data. Data were presented using descriptive statistics in the form of frequencies and percentages for categorical variables, and means and standard deviations for continuous variables. Pearson correlation analysis was used for assessment of the interrelationships between total scale scores. Multiple Linear inner regression analysis was used to assess the mediation effect.

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