Concept Mapping - A Tool to Enchance Critical Thinking in B.Sc Nursing Students

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ABSTRACT	ARTICLE DETAILS

Background: Critical thinking in present times is a profoundly esteemed instructive outcome after an educational course or program particularly corresponding to higher level of professional training. The main aim of the study was to compare the method of instruction and to enhance critical thinking among nursing students.

Methodology: Quasi-experimental study was conducted to assess the effectiveness of concept mapping versus traditional method of instruction as a tool to enhance critical thinking among nursing students in medical surgical nursing (cardiovascular system). Pre-test and post-test control group design was used. B.Sc Nursing III year students were included as experimental group (n=97) and comparison group(n=94). The experimental group was initially given a session on concept mapping and its uses in nursing education. For both the groups instruction on cardiovascular conditions using concept mapping and traditional method was administered respectively. The experimental group and comparison group were assessed for the critical thinking ability using structured questionnaire. The concept maps were evaluated using McMurray's method scoring criteria.

Findings: The findings of the study suggest that the difference between pre-test and post-test mean knowledge scores in Concept mapping (variables- analysis, synthesis and evaluation) was found to be significantly higher than the traditional group at 0.05 level. There was significant improvement in construction of concept maps in criteria related to breadth, interconnectivity, and linkage. Majority of students coined the opinion which indicates high level of acceptance that ranges between 90 to 100%.

Conclusion: It was concluded that concept mapping is an innovative strategy for enhancing critical thinking ability in nursing students.

KEYWORDS: Concept mapping, critical thinking, traditional method of instruction, learning material.

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I.   INTRODUCTION

Learning is a dynamic, lifelong process. According to Fleming, individuals in the process of learning often create a state of mind behaviors that determine inclinations and desires within the way they learn. These popular ways are the learning styles. Individuals acquire and pass knowledge in a particular way.

Nursing knowledge is constructed based on the matrix of simple to complex. As we progress from the starting point and continue to graduation, demand is more in knowledge base construction than applied knowledge in caring for patients.

In the past decades, increasing emphasis has been on the importance of critical thinking. Rote memorization has been an accepted learning method in the past but not recommended because in-depth meaning is not elicited[1]. Finding techniques to encourage and assess critical thinking in nursing students is a problem for nurse educators. Concept maps are thought to be an effective metacognitive technique for facilitating information acquisition through meaningful learning.

According to National Training Laboratories of Maine, United States, an average student's knowledge retention rate may vary from 10% to 90%, and studies have found that student's learning preferences also have a substantial impact on their knowledge retention[2].
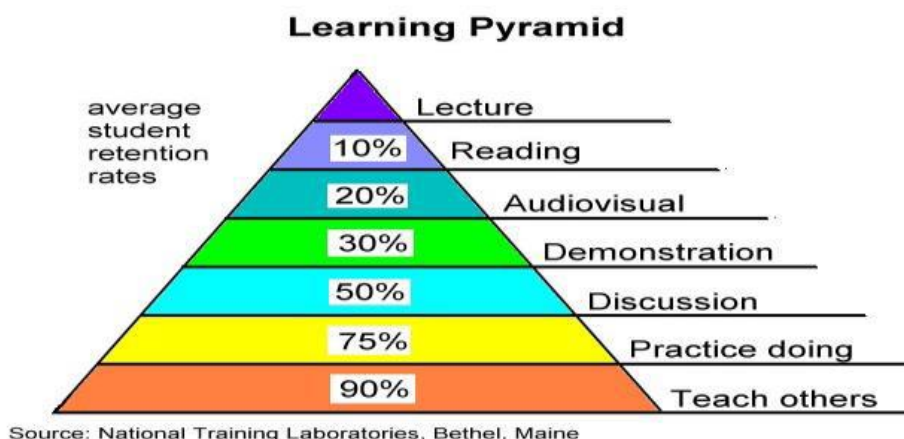
Figure 1. Percentage of Student Retention Rate (Source: National Training Laboratories, Bethel, Maine)

A core competence of baccalaureate nursing education is critical thinking. Concept mapping can be stated as an active teaching and learning that helps nursing teachers to inculcate critical thinking and problem-solving strategies in students.[3] It has been suggested as a learning strategy to encourage nursing students to think critically as it stimulates the use of thinking skills such as analysis, inference, and evaluation, thus encouraging the development of critical thinking.[4]

When addressing a learning activity, a learning style is formed based on perception, problem-solving and recalling a learned task. It is relatively consistent over time and throughout a wide range of learning contexts. The learning style notion assumes that the learner's style, instructional design and performance area all inextricably linked.

One of the essential activities in nursing practice is the creation of a concept map. The idea map provides broad benefits in the field of nursing, such as encouraging patient understanding, making the nursing process more efficient, and improving the nursing professional's critical thinking skills. Concept maps help the learners to accurately acquire the information they need.[5] Preparation, production of statements, structuring of statements, representation of statements, interpretation of maps and utilization are all steps in the concept mapping process. Concept maps can be prepared in a variety of shapes. When creating a concept map, there are a few things to be keep in mind.[6]

Literature review on the development of concept maps indicated that the development of concept maps undergoes various stages. Firstly, was emergence, followed by consolidation. Transformation was the third stage. Research in nursing education progressed in a similar way but with some differences. Various visual organizer solutions were proposed and labeled as concept maps, but they lacked the intellectual features required. Finally, concept mapping research has progressed to an established stage, but there is still a need for a transformative stage.[7]
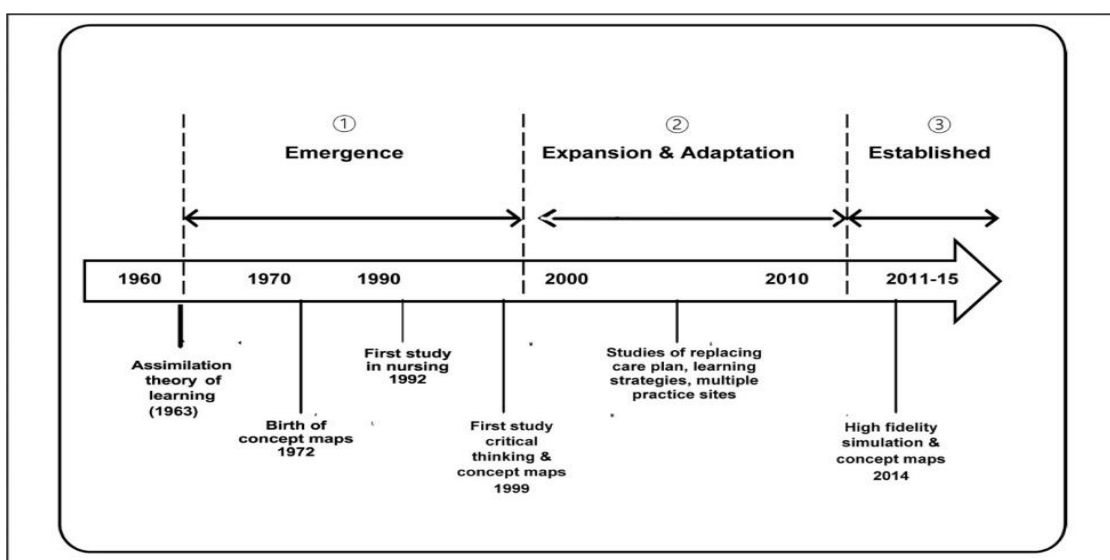

Figure 2. Chronological growth of concept mapping in nursing.

Therefore in is study, the main aim is to utilize concept mapping as a technique in nursing education to deliver comprehensive information and improve learning retention in cardiovascular nursing topics among third year B.Sc Nursing students.

To explore the critical thinking ability of millennial nursing students enrolled in a mental health nursing course, concept mapping was used as a teaching and learning tool. Fifth semester students were selected, and critical thinking was measured using HESI specialty exam. The study's findings revealed that students exceeded the national average in 23/30 (73%) in 30 categories of critical thinking and achieved acceptable or recommended levels in 5/5 areas of critical thinking in a HESI Critical Thinking exam.[8]

In a comparative study to assess the effectiveness of concept mapping and traditional linear teaching methodology was performed using Critical Thinking Skills Test in 2013. 60 bachelor students took part in pediatric clinical nursing courses at a selected University of Medical Sciences in Iran. The study findings suggested that concept mapping is an effective clinical teaching-learning activity to enhance promote critical thinking among nursing students.[9]

The effect of concept mapping training was assessed by using quasi-experimental design on nursing students with pre and post assessment technique on 70 undergraduate nursing students. The researchers revealed that there was statistical significant correlation among total knowledge scores and problem solving abilities. Also, it specified that there was improvement application part of theoretical knowledge in the clinical settings.[10]

Problem Statement:

Quasi-experimental study to assess the effect of concept mapping versus traditional method of instruction as a tool to enhance critical thinking among nursing students in medical surgical (cardiovascular system) course in selected nursing colleges, India.

II.   MATERIALS AND METHODS

The research approach adopted for study was a quantitative (Quasi-experimental) research approach. In this type of approach, the investigator was able to evaluate the effectiveness of the method of instruction type which will enhance critical thinking among nursing students.

The study was conducted in 4 selected nursing colleges situated in four directions (east, west, north and south) geographically located in Bhopal, Madhya Pradesh, India and was selected through lottery method. Two colleges were simultaneously selected for Experimental group (Concept mapping) and Control Group (Traditional-lecture method) method of instruction. Initial assessment of knowledge for both the groups were done by 50 structured multiple-choice questions which were primarily higher order thinking questions. This was followed by two different methods of instruction for selected colleges on the topics: coronary artery disease, angina pectoris, myocardial infarction, congestive heart failure and hypertension. Two extra hours of coaching was given to the experimental group on development of concept maps prior to the selected method of instruction. This helped the nursing students to construct their own concept maps on the five cardiovascular topics which was further assessed using McMurray model. After ten days, post-test was conducted for both the groups. Furthermore, the experimental group also completed a structured opinionnaire which helped the investigator to determine the understandability on the concept of map construction, collaboration and creativity level.

The sample consisted of 200 B.Sc Nursing IIIrd year students, which were divided into two groups of 100 students in both the groups ie traditional method and concept mapping method of instruction.

The data collection tool was divided into three sections:

Section I- Demographic variables: This consisted of questions to elicit demographic data such as Age, Gender, Marital status, University grades of B.Sc Nursing II Year, Grades of Medical-Surgical Nursing –I in B.Sc Nursing II Year, and Interest in nursing profession.

Section II- Structured Knowledge Questionnaire: It was developed after an extensive review of research and non-research literature, seeking the opinion of experts and guide, formal and non-formal discussion with peer group and investigator's professional experience. The blueprint was prepared specifying the domains. Items were prepared specifying the domains of objectives (Knowledge, 5%, Comprehension, 5%, Application, 10%, Analysis, 20%, Synthesis, 30% and Evaluation, 30%).

Section III- Structured Opinionnaire: Consisted of 12 statements which were subdivided into three categories. First category is Preparation which consists of 5 statements, second category is Comprehension which consists of 5 statements and third category is Collaboration which has 2 statements. This was only distributed among the Experimental Group.

Content validity of the teaching material was done by seven nursing experts working in the field of medical-surgical nursing and nursing education. The reliability of structured questionnaire was calculated by using Kudar Richardson 20 and was found out to be 0.82 which is under acceptable range

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The knowledge score obtained by the nursing students were categorized as follows:

Range of scores	Percentage of score	Level of knowledge
41 - 50	81 and above	Very good
33 - 40	66 - 80	Good
25 - 32	50 - 65	Average
0 - 25	Less than 50	Below average

The scoring criteria of McMurray Model is as follows:

Scores of Map	Criteria	Category
19 - 24	Excellent	3
13 - 18	Good	2
< 13	Acceptable	1

Ethical approval was obtained from the Institutional Ethical Committee of all the four selected Colleges of Nursing, Bhopal. The study subjects signed a written informed consent form indicating their desire to participate in the investigation.

III.   RESULTS & FINDINGS

All the collected data was entered in Microsoft Excel software and coded for statistical analysis performed using SPSS version 26. The data was tabulated, analyzed and interpreted using descriptive and inferential statistics.

For the study, in the traditional method there were 94 B.Sc Nursing III year students and 97 in Concept Mapping method. Out of total 191 students, 139 (72.22 %) were females and 84 (43.97%) were 21 years old.
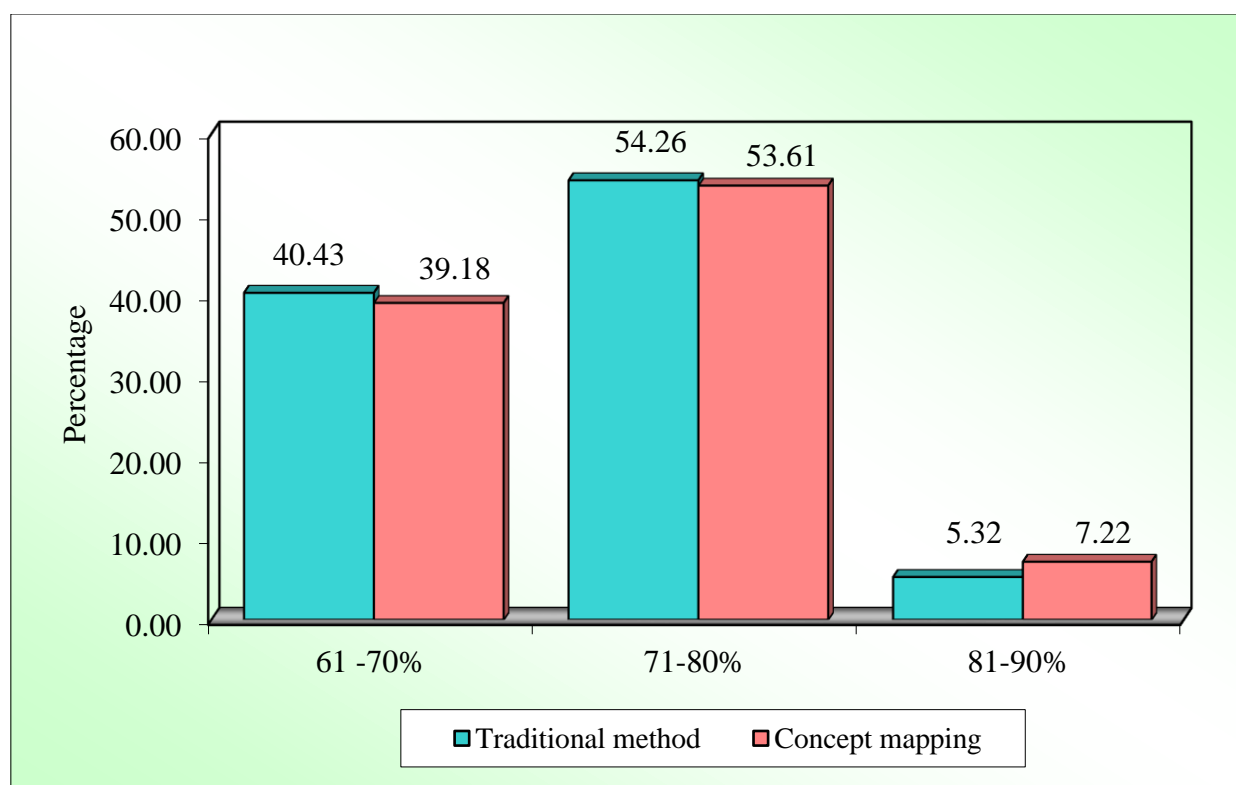

Figure 3. Comparison of University grades of B.Sc Nursing II Year.

Figure 3 shows that in the B.Sc Nursing II Year University examination majority (54.26%) of students scored in the range of 71-80% in the traditional method and 53.51% in the concept mapping method of instruction group. Data pertaining to their grades of Medical Surgical Nursing I in BSN II year, majority (45.5%) of them were in the range of 71-80% in both the groups.

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Table 1. Pre-test and Post-test knowledge scores (n=191)

Type of test	Range of Scores	Traditional method	Concept mapping
		Frequency and percentage	Frequency and percentage
Pre-test	Low level	14 (14.89%)	14 (14.43%)
	Average level	58 (61.70%)	65 (67.01%)
	High level	22 (23.40%)	18 (18.56%)
Post-test	Low level	0 (0%)	0 (0%)
	Average level	22 (23.40%)	7 (7.22%)
	High level	72 (76.60%)	90 (92.78%)

Table 1 depicts the pre-test and post-test knowledge scores of participants and there is an improvement in the scores. Association of pre-test levels of knowledge among the two study groups was also calculated and there was no association at 0.05 level of significance.

Table 2. Comparison of pre-test and post-test scores of knowledge and its components in traditional method of instruction by Wilcoxon matched pairs test

Variables	Time points	Mean	SD	Mean Diff.	SD Diff.	% of change	Z-value	p-value
Total Knowledge	Pretest	25.40	5.29	-9.35	4.45	-36.81	8.3290	0.0001*
	Posttest	34.76	5.02					
Total Comprehension	Pretest	4.72	0.71	-0.22	0.57	-4.73	3.2958	0.0010*
	Posttest	4.95	0.27					
Total Application	Pretest	3.30	1.63	-1.02	1.29	-30.97	6.0308	0.0001*
	Posttest	4.32	1.00					
Total Analysis	Pretest	5.64	2.25	-1.89	1.48	-33.58	7.4748	0.0001*
	Posttest	7.53	1.60					
Total Synthesis	Pretest	7.02	2.64	-3.00	1.93	-42.73	8.1008	0.0001*
	Posttest	10.02	2.29					
Total Evaluation	Pretest	4.72	3.75	-3.21	2.81	-68.02	7.6728	0.0001*
	Posttest	7.94	3.43					

Since p values in all of the variables was less than 0.05 level of significance, it can be inferred that there was significant difference between pre-test and post-test mean scores as measured by Wilcoxon matched pairs test.

Table 3. Comparison of pre-test and post-test scores of knowledge and its components in concept mapping method of instruction by Wilcoxon matched pair test

Variables	Time points	Mean	SD	Mean Diff.	SD Diff.	% of change	Z-value	p-value
Total Knowledge	Pretest	25.20	5.03	-14.15	6.38	-56.18	8.3290	0.0001*
	Posttest	39.35	5.41					
Total Recall and Comprehension	Pretest	4.73	0.70	-0.24	0.67	-5.01	3.0594	0.0022*
	Posttest	4.97	0.23					
Total Application	Pretest	3.31	1.62	-1.41	1.74	-42.68	6.5667	0.0001*
	Posttest	4.72	1.17					
Total Analysis	Pretest	5.63	2.22	-2.53	1.98	-44.87	7.4748	0.0001*
	Posttest	8.15	1.63					
Total Synthesis	Pretest	6.98	2.57	-4.70	2.63	-67.36	8.1470	0.0001*
	Posttest	11.68	2.21					
Total Evaluation	Pretest	4.55	3.54	-5.28	3.54	-116.10	7.8659	0.0001*
	Posttest	9.82	3.21					

Table 3 shows comparison of pre-test and post-test scores of knowledge and its components in concept mapping method of instruction by Wilcoxon matched pairs test. In case of total Knowledge, the post-test rank scores were statistically significantly higher than pre-test rank scores ($z = 8.32$, $p < 0.05$). In Recall and comprehension, the post-test rank scores were statistically significantly higher than pre-test rank scores ($z = 3.05$, $p < 0.05$). Pertaining to application, the post-test rank scores were statistically significantly higher than pre-test rank scores ($z = 6.56$, $p < 0.05$). For Analysis, the post-test rank scores were statistically significantly higher than pre-test rank scores ($z = 7.47$, $p < 0.05$). In case of synthesis, the post-test rank scores were statistically significantly higher than pre-test rank scores ($z = 8.14$, $p < 0.05$) and for evaluation, the post-test rank scores were statistically significantly higher than pre-test rank scores ($z = 7.86$, $p < 0.05$). Since p values in all of the variables was less than 0.05 level of significance, it can be inferred that there was significant difference between pre-test and post-test mean scores as measured by Wilcoxon matched pairs test.

Table 4. Scores of Myocardial Infarction Concept Map Based on McMurray's Model

SN	Criteria	Excellent		Good		Acceptable	
		Freq.	%	Freq.	%	Freq.	%
1	Breadth	51	52.7	29	29.9	17	17.5
2	Interconnectivity	57	58.8	32	33	8	8.2
3	Use of Descriptive links	53	54.6	31	32	13	13.4
4	Efficiency of links	49	50.5	39	40.2	9	9.3
5	Layout	54	55.7	27	27.8	16	16.5
6	Development over time	51	52.7	26	26.7	20	20.6

Similarly, concept maps developed by the participants on angina pectoris, coronary artery disease, congestive heart failure and hypertension were tabulated. After reviewing the concept maps constructed by the nursing students, it can be said that with the advancement of constructing maps from 1 to 5, the students developed the skill in drawing maps. This helped them to utilize their own creativity and linking the themes/nodes with each other. This also conveys a positive message to the faculty/nursing teachers that using concept maps in teaching especially medical surgical nursing conditions will be very fruitful. The sessions will become more interactive which will enhance deep rooted learning in the students.

Table 5. Student's Opinion on Concept Mapping Method of Instruction (n=97)

SN	Dimensions	Statements	Strongly Agree or Agree	
			Frequency	Percentage
1	**Preparation**	Concept map assignments prepare me well for class sessions.	87	90
2		Concept map construction is enjoyable.	90	93
3		Concept maps encouraged me for self-study and review.	90	93
4		Concept map assignments reduce the anxiety about learning.	88	91
5		It is a time-consuming activity.	89	92
6	**Comprehension**	I understood how to construct concept maps.	94	97
7		I felt comfortable preparing the maps.	95	98
8		I will use concept maps when revising other medical-surgical topics.	97	100
9		Visualization concretizes concepts in a tangible manner.	97	100
10		It facilitates interconnections among concepts	97	100
11	**Collaboration**	Sharing maps with friends helps me to address my flaws.	95	98
12		Sharing maps helps me identify linkage among the concepts.	95	98

The data also represents that students could rightly sense the impact of a variant teaching learning activity which helps them to reason logically, critically analyze, synthesize and evaluate the concepts of medical-surgical nursing.

IV. DISCUSSION

It was found from the present study that concept map is an innovative educational strategy for enhancing critical thinking ability in student nurses. Concept maps allow students to associate and link relationships between concepts and disparate bits of information and assist in establishing meaningful learning by connecting former knowledge with ongoing knowledge acquisition. [11]

Providing teaching to students is so pivotal by the teachers and the result of instruction is improvement in the cognitive, psychomotor and affective aspect of the learner. The improvement in learner is a relevant indicator of teacher's effective instruction. Adequacy in teaching by an instructor and student's learning capability can be improved through proper methodology adopted in a learning circumstance. However, in recent times, the nursing education sector is highlighting on expanding attention to the significance of student centeredness in the teaching–learning system. This issue has gained a ton of consideration in relation to how students comprehend the concepts, retention of concepts and utilization of it in an effective manner.[12]

Nursing students are exposed to a vast amount of information through the extensive published material that is available in all nursing libraries that very specific, scientific and technical for the students. Unless the teaching faculty provides a conducive and motivating learning environment to students, which will promote better interaction and comprehension in learners. The nursing students might have gained some information in their short-term memory through memorization; nevertheless, such learning cannot be retained for a long-term. Nursing students must be skillful in organizing and linking the learned facts, concepts and principles with current knowledge in order to make sound decision-making in nursing practice. The efforts put in developing concept maps will assist nursing students to learn more credibly that will lead to the development of metacognitive protocol to enhance relevant and consequential learning.[13]

The investigator would like to emphasize another study which was conducted to determine the use of concept mapping in a problem-based learning curriculum. The role of concept map was to activate and elaborate on prior knowledge, support problem solving, promote conceptual thinking and understanding, organizing and memorizing knowledge.[14] The current study also supported and inferred on better comprehension, linkage and long-term retention of knowledge.

Meaningful learning is most likely to occur when information presented in a sequential and systematic way. There are three key factors which are associated with meaningful learning. To begin with, meaningful learning entails assimilating new concepts and propositions into an existing cognitive framework. The Second factor talks about knowledge that is organized hierarchically in cognitive structure, and most new learning involves placing new concepts and proposition into existing hierarchies. The third factor is related to the idea that knowledge acquired through rote learning will never be assimilated.

According to Otor, Concept mapping (CM) is a new teaching and learning strategy that establishes a bridge between how people learn in a sensible learning. Students need to have sufficient knowledge base, critical thinking viewpoint and the relations between different concepts. Concept mapping has the potential to improve meaningful learning and conceptual understanding in pupils. The authors of this study have highlighted the significance of hierarchical structures within the conceptual maps. The most general concepts are shown in the upper half of the map, while the specific concepts or nodes, which are less generic, are represented in the lower section of the map. One of the reasons that CM is seen to be effective in facilitating meaningful learning is that it acts as a kind of template, format, or scaffold to assist organize and arrange knowledge. Although the structure is built up joining small units of interacting concept and propositional frameworks.[14]

The findings of this study are consistent with the results of study conducted by Youssef and Mansour to determine whether concept mapping improved students' learning achievement in an advanced nursing course within the nursing baccalaureate program. Also, to identify students' attitudes towards concept mapping as a learning instrument for facilitating effective learning. The findings revealed that, as compared to standard teaching methods, implementing a concept mapping strategy can significantly improve students' learning achievement. Secondly, majority of the students were satisfied with use of concept mapping in advanced nursing courses. Further study is recommended to study the inevitable relationship between learning style preference and concept mapping as a teaching strategy.[15]

Due to the rapid changes in teaching science, scientific or concentrated learning skills are becoming more vital for nursing students as they are the future nurses who need to keep themselves abreast of these changes as they need to link and connect it to the practice of nursing. Thus, to remain professionally competent, today's nursing students must be motivated to become life-long relevant and significant learners. In a variety of ways, concept mapping aids meaningful learning. It is an activity that dispenses the student with an opportunity to organize, summarize, analyze, evaluate and creative in handling varied concepts and ideas.

Thus, it promotes the development of critical thinking skills, which will contribute in developing decision making and problem-solving skills.[16]

Furthermore, to support the outcome of the present study, Mohammed, Garas and Elsawl conducted quasi-experimental control study which propagates concept mapping as a tool for critical thinking in baccalaureate nursing students. The study findings suggest that, students who were involved with concept mapping showed an increase in their CT scores, then those in the control group and thus, supported the research hypotheses.[17]

The present study findings are also consistent with the findings of Wheeler and Collins, who conducted a quasi-experimental pretest and posttest design study that used a control group to evaluate the effectiveness of concept mapping in developing critical thinking in baccalaureate nursing students'.[18]

The findings are also consistent with the findings of Aein and Aliakbari, who conducted an experimental design study on 60 baccalaureate students who participated in pediatric clinical nursing course. 't-test' calculation demonstrated improvement in student's critical thinking skills in the experimental group was significantly greater than in the control group after the program. The findings of the study suggested that concept mapping is a clinical teaching-learning activity which promotes critical thinking in nursing students.[13]

The findings of the present study were found similar to the results of the investigation done by Nirmala and Shakuntala in which comparison of pretest and posttest scores of experimental group showed a highly significant difference of 0.04 levels and the study was able to show a significant improvement in critical thinking skills of student nurses after exposure to concept maps. The association of posttest critical thinking scores of experimental group with selected sample characteristics of student nurses showed that their mean posttest critical thinking score is independent of their age, religion, marks scored in 12th class and hours spent daily for study.[19]

Group participation and activity in the classroom is found to be increased with the use of concept maps in the classroom. Students also contributed to the development of concept maps through sharing their thoughts and ideas. Furthermore, the researcher found that the concept maps are inexpensive for which students need only paper and pencil to scribble the linkages between conceptual ideas. Concept maps have been found to be useful in applying the nursing process through careful planning in the study conducted by All and Heavens.[20]

V: CONCLUSION

Concept mapping is an innovative educational strategy and can be used to improve the critical thinking among students. When expressing critical thinking, it means building higher order of thinking and cognitive skills. According to Taxonomy of Educational Objectives, known as Bloom's taxonomy, cognitive domain is one of the learning domains which focus on development of intellectual skills such as critical thinking, problem solving and creating a knowledge base. This contains facts, procedural patterns, and concepts that aid in the development of intellectual abilities and skills. There are six major categories of cognitive process starting from the simplest to the most complex ie recall, comprehension, application, analysis, synthesis and evaluation, respectively.

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