

## Effectiveness of Mind Mapping Strategy Using among Community Undergraduate Nursing Students

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### Abstract

**Background:** Nursing students need to be equipped for self-directed, lifetime learning. One of these creative learning strategies is mind mapping. Utilizing innovative teaching techniques, like the mind mapping strategy, is essential for promoting learning since they ensure that knowledge is retained so that it may be recalled and stimulate critical thinking. **Aim:** To investigate the effectiveness of mind mapping strategy among community undergraduate nursing students. **Subjects and method:** **Design:** A quasi-experimental research design pre-post-test and control group was used to achieve the aim of the current study. **Setting:** the study was carried out in the Faculty of Nursing affiliated with Sohag University. **Subjects:** The study included 600 newly entry students in the fourth year at the B.Sc. level. Nursing students who were selected through a non-probability convenient sampling technique were divided equally into experimental and control groups each including 300 students from the above-mentioned study setting. **Tools:** Three tools were used for data collection: **Tool (I):** A close-ended self-administering questionnaire, administered to both groups pre-and post-intervention to assess part (1) Students' data and part (2) Students' opinions regarding the utilization of the mind mapping strategy. **Tool (II):** Undergraduate nursing students' perception of mind mapping strategy, **Tool (III):** Undergraduate nursing students' knowledge about community health nursing, it was also administered to the experimental groups pre/post the intervention. **Results:** In comparing the two groups, the control group performed better with ( $p < 0.001$ ), the experimental group had a very high perception of the mind-mapping strategy, and their scores were strongly correlated with the intervention ( $p < 0.01$ ). The results showed no statistically significant difference between the pass rates of the control group (44%) and the intervention group (50%) after the intervention. However, after the intervention, the experimental group's pass rate increased to 90% while the control group's was 52% with ( $p < 0.001$ ). **Conclusion:** As a result of resolving retention and memory problems, the study found that mind mapping is a more effective study technique than other study techniques now in use, helping students learn subjects more successfully. **Recommendations:** The study suggested that the mind mapping strategy should be implemented as an effective teaching technique for effective and acceptable teaching technique for nursing students' education.

**Keywords:** Mind mapping strategy, Community undergraduate nursing students

### Introduction:

Globally, nursing education programs and teaching strategies have changed to encourage students to take more ownership of their education and engage in active learning, with a greater tendency toward self-directed learning to ensure lifelong continuing education. These modifications resulted from educators' worries that pupils frequently memorize data through "rote learning" rather than comprehending and applying ideas from "meaningful learning" (Buzan and Buzan, 2010).

Based on the constructivist theory of learning,

mind mapping and concept mapping as learning strategies that, are promising approaches in the setting of medical education. Mind Mapping refers to a visual diagram used to record and organize information in a way similar to how our brain processes memories. It was invented by Tony Buzan in the 1970s. Mind mapping as a teaching tool has many benefits such as encouraging critical thinking by inspiring medical and nursing students to assimilate information, understand complex subjects, and recognize relations between the clinical and basic sciences. It is said to be a

useful graphic method for enhancing learning and cognitive clarity. Problem-based learning incorporates a variety of strategies, such as taking notes, brainstorming, evaluating students' organizational abilities, learning together, presenting, and conducting research. According to **Spencer et al. (2019)**, critical thinking is also becoming more and more important in nursing education.

Furthermore, mind mapping is a visual aid that displays complex relationships and information

in a nonlinear manner by combining words, pictures, colors, and branches that branch out from a main thought. The use of images and diagrams to improve memory and foster knowledge is emphasized. Improves the representation of connections and interactions between concepts, which facilitates the assimilation and retention of knowledge (**Rosciano et al., 2019**).



(Buzan and Buzan (2010): <http://www.mindmap example.com/samples.php>)

The following are the seven steps Buzan provides for creating a mind map: Begin in the middle of a blank page that has been turned sideways. 2) To illustrate the main point, use a picture or image. 3) Make consistent use of color. 4. Join the primary branches to the main image, and the branches of your second and third levels to the first and second levels. 5. Instead of having straight lines, curve the branches. 6. Use one important word for each line. 7) Make use of pictures all along. An easy way to represent knowledge visually rather than verbally is through mind mapping. In addition, mind mapping has lately become a widely accepted method for revealing truths in medical knowledge while creating instructional materials meant to improve memory. Therefore, the researchers wanted to determine the effect of using mind mapping on pediatric nurses' performance regarding infection control at Neonatal intensive care units (**Deka et al., 2019**).

Learning experiences should be created by nurse educators to support students' ability to think and learn more efficiently. Mind mapping is an innovative learning strategy that provides students with a new environment in which to process material and may help improve memory recall. A technique known as mental mapping was created in the early 1980s to assist students in organizing their thoughts by mentally mapping words or ideas to make them more clear (**Daley et al, 2016**).

According to **Ambrose et al. (2018)**, a mind map is a diagrammatic representation of words, concepts, tasks, or other aspects related to a research topic arranged around a main phrase or notion. The study's main topic is shown in the center, with keywords related to its subtopics extending outward in an irregular manner. A method of providing further information about the problem and progressively branching off smaller branches from the subtopics is employed. Not only are creative arrangements appropriate, but they are also essential to promote increased creativity and enjoyment during the learning process (**Jones et al., 2018**).

The nursing sector is growing quickly and offers a wide range of courses. Nursing students have a lot of material to learn throughout their courses. Consequently, instead of honing their critical thinking abilities, students could learn by rote. Reforms in nursing education today demonstrate how

critical it is to equip students for autonomous, lifelong learning (**Ambrose et al., 2018**).

According to **Eshwar et al. (2016)**, mind mapping is one active learning strategy that encourages students to make use of their innate cognitive abilities and memory recall. A simple method known as mind mapping involves representing knowledge using visuals rather than textual language. The mind-mapping approach helps students arrange the content by putting the primary theme in the center and the associated sub-themes around it (**Atia et al., 2017**).

Mind maps help encourage and evaluate critical thinking since they are thought to be powerful metacognitive tools that can support people in learning in meaningful ways (**Edwards and Cooper, 2020**). Using mind maps, students connect the dots between known and unknown material to gain a greater understanding of the various courses (**Kyoko and Hiroko, 2019**). It helps with the recall of memories and is a very effective method of taking notes. With the help of this teaching-learning strategy, students can actively acquire knowledge rather than being taught how to think. It helps children make connections between stories using patterns, phrases, or symbols (**Mento et al., 2019**).

Additionally, as mind mapping combines concepts, encourages reflection and inquiry, facilitates gaining a conceptual understanding of a significant amount of material, and bridges the gap between theoretical and clinical competence, it can be used for self-learning. It is also compatible with problem-based learning. According to **Wilson et al. (2019)**, it has been utilized in biomedical research and systematic review procedures (**Pombo et al., 2017**) together with associated software.

#### **Significance of the study:**

Nurse educators are under pressure to create graduates who are capable of critical thought and problem-solving in a variety of clinical practice scenarios. Active teaching strategies that promote meaningful learning are necessary for them to replace traditional teaching methods that focus on memorization and recall. One teaching-learning technique that could be used by nurse educators to assist students become critically thinking members of the complex healthcare environment is concept mapping.

In several scientific domains, mind mapping has been widely acknowledged as an effective learning technique for analyzing, distilling, retaining, and recalling information. However, the nursing literature reveals a paucity of evidence about the application of mind mapping as a learning approach in nursing education. The principal objective of the study was to ascertain the effects of mind-mapping learning methodologies among undergraduate nursing students.

#### Aim of the study:

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The study aimed to investigate the effectiveness of mind mapping strategy among community undergraduate nursing students.

#### Research hypothesis:

Application of mind mapping technique expected to improve learning process among undergraduate nursing students with better success rates.

#### Subjects and method:

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#### Research design:

A quasi-experimental research design pre-post-test with a control group was used to achieve the aim of the current study

#### Settings:

The study was carried out in the Faculty of Nursing affiliated with Sohag University.

#### Sample:

600 newly enrolled B.Sc. students in their fourth year were included in the study. The 300 students in each of the experimental and control groups were drawn equally from the aforementioned research setting and were nursing students chosen using a non-probability convenient sampling technique.

#### Tools for data collection:

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**Tools:** Three tools were used for data collection:

**Tool (I):** A close-ended self-administering questionnaire was administered to both groups pre- and intervention. It was developed by the researchers after reviewing the related national and international literature (**Oluwatosin and**

**Mento et al., 2019; Adodo, 2019**), this tool consisted of three parts as the following:

**Part 1:** This part included information about the personal data of undergraduate nursing students as age and gender.

**Part II:** students' opinion regarding the utilization of the mind mapping strategy. **Part 2:** This part aimed to assess community undergraduate nursing students opinion after using the mind mapping strategy being lectured on mind mapping as a new teaching method, previous applications of mind mapping in education, and preferred applications of mind mapping (Buzan, 2012 and A Abdel Hamid, 2017)

#### Scoring system:

- A nurse's assessment following the use of mind mapping was given a score of one for excellent, two for very good, three for good, four for accepted, and five for rejected.
- Using mind maps in training previously; one point is awarded for each affirmative response and zero for no response.
- Preferring to use one for yes and zero for no in mind mapping throughout training.

**Part III:** This section contained a written test with 20 multiple-choice questions covering the material presented in class. The test was administered to both groups twice: once prior to and once following the intervention. For the correct response, a mark of two was awarded, and for the incorrect response, a mark of zero. There was a community health nurse (40). Students were considered passed when their score was more than 80% and failed when it was lower.

**Tool (II):** Undergraduate nursing students' perception of mind mapping strategy: **To** assess perceptions of the intervention group's undergraduate nursing students towards the pre-and post-intervention mind mapping learning approach. The researchers created it after studying relevant national and international literature (**Oluwatosin, 2018; Adodo, 2019**). With the help of this instrument, intervention students' perceptions of mind maps as a learning tool were to be evaluated. Ten statements—five positive and five negative—were included. The replies were given on a 5-point Likert scale, with "strongly agree" being the most common

response. Accordingly, these received scores ranging from five to one. For negative assertions, the scoring was inverted so that a higher score denotes greater agreement with the statement. To calculate a mean score with a maximum of five, the 10 items' scores were added up and divided by the number of statements.

**Tool (III):** Undergraduate nursing students' knowledge about community health nursing, also administered to the experimental group's pre/post the intervention (**pre/post**): It was developed by the researcher after reviewing the national and international related literature (Deka et al., 2019, Phenwan & Tawanwongsri, 2018), It covered questions related to students' knowledge about community health nursing such as introduction to concepts of community health nursing, historical development of community health nursing, a nursing process in the community, principles of good counseling, rearrange these steps of counseling, scopes of community health nursing, components of community health practices, the role of community health nurse, home visiting and home health service. As regards mind mapping, it included questions related to the definition of a mind map, materials required when using mind mapping, and how mind mapping be used, as well as the advantages of using a mind mapping strategy (Davies, 2020).

#### **Scoring system of undergraduate nursing students' knowledge:**

Each correct answer received one point, while incorrect answers received zero. The knowledge received a total of 30 points. The total score knowledge was divided into two categories: satisfactory level of knowledge ( $\geq 60\%$ ) and unsatisfactory level of knowledge ( $< 60\%$ ).

#### **Fieldwork:**

The researchers began meeting with undergraduate nursing students to explain the purpose of the study, and its protocols, and invite them to participate after receiving official approvals to carry out the study. Those who gave their assent were split into two equally sized, gender- and age-matched groups, one for the experimental group and

the other for the control group.

The experimental group was divided into small subgroups of 60 students each. The educational guidelines were presented in theoretical and practical sessions. Each subgroup got four sessions, two theoretical and three practical. The theoretical session time was (45-60 minutes each) including lectures using data show and group discussions covering the basic concepts, methodology, advantages, and applications of the mind-mapping learning methods. They were also informed about the principles of how to use mind mapping by drawing the topic in the center with keywords branching out in a divergent pattern; the keywords corresponding to subtopics. Then, smaller branches project from the subtopics with further details regarding the subject. The practical part was conducted in two sessions, one hour each using demonstration-re-demonstration. They involved hands-on training in producing mind maps for selected topics. topic was selected as study materials, namely unity health nursing such as introduction to concepts of community health nursing, historical development of community health nursing, nursing process in the community, principles of good counseling, rearranging these steps of counseling, scopes of community health nursing, components of community health practices, the role of community health nurse, home visiting and home health service. Questions about the approach and its implementation could be asked by participants during the session. The researchers encouraged students to call them if they needed any assistance.

The same study period and selected topics were provided to the student control group utilizing the conventional teaching approach. Following the course, undergraduate nursing students in both groups were evaluated using the same instrument and methodology. There was a written exam for this with 20 multiple-choice questions. The exam took one hour to finish. The questions demonstrated a variety of cognitive capacities according to Bloom's taxonomy. The test results for undergraduate nursing students in the two groups were compared. The intervention group also learned how undergraduate nursing students felt about the novel mind map technique by using the pre-designed measure. The project took two months to complete.

**Phases of the study:** The study was

conducted through the following four phases:

### I-Assessment Phase

- Every student was interviewed before conducting the application to collect the students' data using a tool (I) part (1).
- Students' knowledge, opinions, and perceptions regarding using mind mapping strategy were assessed by utilizing tool (I) part (2), tool II, and tool III).

### Validity of the tools

The content validity of the research tools was evaluated for clarity, comprehensiveness, appropriateness, and relevance by a board of five professional professors with more than ten years of experience in administration and community health nursing. The board verified the legitimacy of the tools' appearance and content.

### Reliability of the tools

Reliability was assessed by using Cronbach's alpha reliability test. The reliability of the first tool was 0.89, the second tool was 0.92, and the third tool was assessed by testing its internal consistency. It showed reliability with a Cronbach alpha coefficient of 0.86, i.e. higher than the acceptable level of  $\geq 0.70$  according to (*Kirk and Miller, 1986*).

### Administrative and ethical considerations:

Official approval to conduct the study was received by the Sohag University research ethical committee and through a letter issued by the Dean of the Faculty of Nursing, Sohag University. The researcher explained to the students that participation in the study is optional and that they have the freedom to discontinue at any moment, without providing a reason, before starting data collecting. Nursing students at the undergraduate level provided their verbal consent. Additionally, they were informed that their data would be kept private and only used for study.

### A pilot study

After the tool was created, a pilot study involving 10% of the sample was conducted (60 undergraduate nursing students). It was done to look for tool ambiguity, confirm item transparency, and determine how long it

would take to collect the data. The final form of the tools was developed using the findings from the pilot study, which also clarified and tested the feasibility of the research methodology. The pilot research's undergraduate nursing participants were also included in the study.

### II. Planning phase:

The objectives, priorities, and predictable outcomes were articulated depending on the findings of the previous phase, to meet the students' practical needs and knowledge deficits.

In this phase, five sessions (three theoretical and two practical) were planned by the researchers for the studied students to provide them with knowledge.

### III. Implementation phase:

The implementation of the mind mapping strategy was aimed to improve students' knowledge and practice through five sessions; three theoretical and two practical sessions (around 30-45 minutes for each).

At the beginning of each session, the researchers started by taking feedback about the previous session, and at the end of each session, the researchers gave a summary.

The researchers were available in the study setting 2 days per week from 8 a.m. to 12 p.m. Each student was individually interviewed using the previously mentioned study tools.

The simplified booklet was used as supportive material and given to students in the Arabic language to cover all items regarding the knowledge regarding community health nursing such as introduction to concepts of community health nursing, the historical development of community health nursing, a nursing process in the community, principles of good counseling, rearrange these steps of counseling, scopes of community health nursing, components of community health practices, the role of community health nurse, home visiting and home health service. As regards mind mapping, it included questions related to the definition of a mind map, materials required when using a mind mapping, and how mind mapping be used, as well as the advantages of using mind mapping strategy <sup>(21)</sup> after reviewing the related literature based on the assessment of the actual needs of the studied nurses.

- Different teaching methods such as lectures,

small group discussions, pictures, brainstorming, demonstration, re-demonstration using the necessary equipment and were available to apply for mind mapping strategy. Several teaching media were used, such as handouts, PowerPoint, figures, flipcharts, and illustrated videos were used about infection control.

**The theoretical and practical sessions** were carried out as the following

**First session (Theoretical):** At the beginning of this session, the researchers introduced themselves, welcomed the nurses, showed gratitude for their sharing in the study, and explained the objectives of these educational sessions. The 1<sup>st</sup> session covered the following items; community health nursing such as an introduction to concepts of community health nursing, the historical development of community health nursing, nursing process in the community.

**Second session (Theoretical):** These sessions covered the items related to the principles of good counseling, rearrange these steps of counseling, scopes of community health nursing, components of community health practices, and home visiting and home health service.

**Third session (Theoretical):** These sessions covered the items related to the role of community health nurse, the definition of a mind map, materials required when using a mind mapping, and how mind mapping be used, as well as the advantages of using mind mapping strategy <sup>(21)</sup>

**Fourth session (practical):**

These sessions included clinical demonstration and re-demonstration of studied students on the mind map. These Explaining sessions were done via mind mapping.

**Fifth session (practical):** Started by taking feedback about the previous sessions, and answering any questions, the researcher then thanked all the participants' students for their sharing in the study.

#### IV-Evaluation phase:

In this phase, the researchers investigated the effectiveness of the mind mapping strategy among community undergraduate nursing students by the posttest after the session's implementation using the same pretest tools.

#### Statistical Design:

After being coded, the gathered data were added to a social science statistical program (SPSS Version 23.00). At the coding and data entry stages, quality control was performed. For categorical variables, descriptive statistics were used in the form of frequencies and percentages, whereas for continuous quantitative variables, means and standard deviations were used. The Chi-square (X<sup>2</sup>) test was used to compare qualitative category data, with the hypothesis that the row and column variables are independent, but without revealing the degree or direction of the link. The chi-square test, T-test, and F-test were used to compare qualitative variables. When the P-value was less than 0.05 and the difference was p0.001, statistical significance was evaluated.

#### Results:

**Table 1** shows that 62% of the undergraduate nursing students in the experimental group were female compared to 58% in the control group. The two groups had comparable median ages of 20.13 years.

**Figure (1)** portrays that, after applying mind maps, approximately half (44%) of the undergraduate nursing students who were studied had excellent opinions, while just 4% thought it was unacceptable.

**Figure 2** makes clear that, according to all of the studied undergraduate nursing students, 100% of them had never used a mind map in their prior training.

According to **Figure (3)**, the majority of the undergraduate nursing students who studied (88%) preferred the use of mind maps in the classroom.

**Table (2)** demonstrates that previous to the intervention, there was no statistically significant difference between the pass rates of the experimental and control groups (44% vs. 50%). The success (pass) rates for the experimental group (90%) and the control group (52%) in the post-intervention phase differed statistically significantly (p<0.001).

Table 3 shows extremely high agreement for all affirmative statements on the intervention group's perceptions of the mind-mapping learning approach among the undergraduate nursing students who served as the study participant. For issue comprehension and memory improvement, the range was 78% to 92%. That being said, the table indicated that a very small percentage of respondents (4%) agreed with the negative phrases "Not my way of learning" and "I don't think it helped with retention of material."

About community health nursing pre and post-application ( $P < 0.001$ ), **Table (3)** shows that there was a highly statistically significant difference between the mean score knowledge and improvement of undergraduate nursing students in the post-test ( $p < 0.000$ ).

Table (4) indicates a significantly significant ( $P < 0.001$ ) difference in nurses' pre- and post-application knowledge of the mind mapping approach. Additionally, a highly significant improvement in the mean total knowledge score ( $p < 0.000$ ) was shown in the same table for the post-test.

**Figure (4)** demonstrates that 96% of the experimental group's undergraduate nursing students had unsatisfactory knowledge on the pretest, whereas 94% of them had satisfactory knowledge after using mind mapping.

**Table 6** displays statistically significant positive correlations between the undergraduate nursing students' post-pre-intervention scores (which reflect progress) and their agreement ratings regarding certain advantageous aspects of the mind-mapping technique. More people agreed with the statement that studying concepts helped with negative associations than with the statement that suggested it improved fact recall. In contrast, statistically significant weak to strong negative correlations between the agreement scores on the two negative assertions are displayed in the table. A total positive association was found between the students' total post-pre-intervention scores and their total agreement scores with a number of the mind-mapping approach's positive features.

**Table 1: The studied undergraduate nursing students' distribution in both experimental and control groups regarding their data**

	Group				X <sup>2</sup> test	p-value
	Experimental (n=300)		Control (n=300)			
	No.	%	No.	%		
<b>Gender:</b>					0.00	1.00
Male	114	38.0	84	42.0		
Female	186	62.0	174	58.0		
<b>Age: Mean±SD</b>	20.13±0.9		20.14±0.8		1.77	0.33

(U) Mann-Whitney test

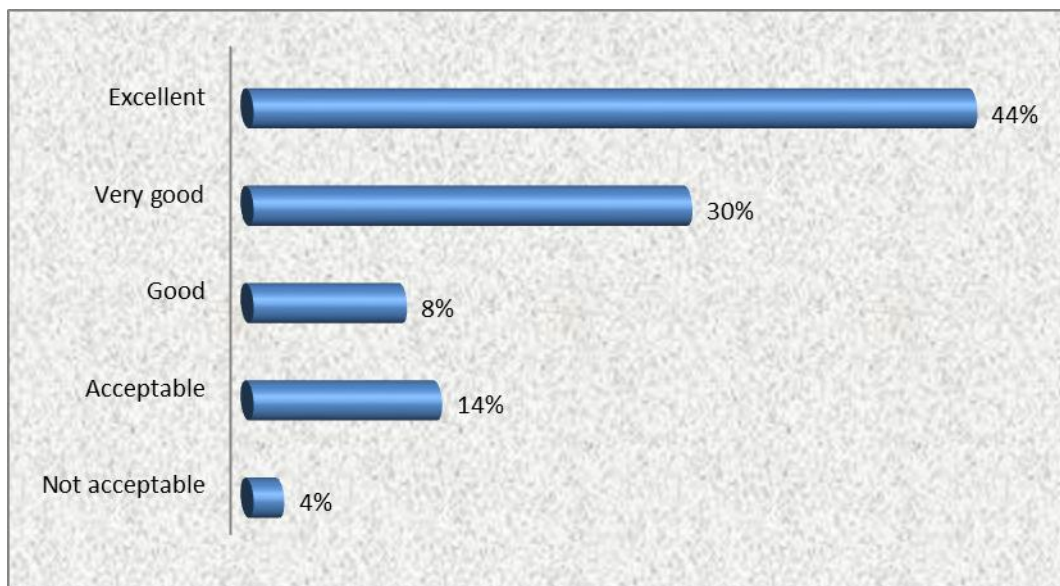
**Table 2: Written test scores among the studied undergraduate nursing students in both the experimental and control groups**

	Group				X <sup>2</sup> test	p-value
	Experimental (n=300)		Control (n=300)			
	No.	%	No.	%		
<b>Pre-score:</b>					1.66	0.54
Pass (80+)	162	54.0	156	52.0		
Fail (<80)	138	46.0	144	48.0		
<b>Mean±SD</b>	68.2±8.1		65.6±8.2		3.22	0.07
<b>Post-score:</b>					27.22	<0.001*
Pass (80+)	270	90.0	156	52.0		
Fail (<80)	30	10.0	144	48.0		
<b>Mean±SD</b>	89.2±7.6		72.6±5.8		89.33	<0.001*

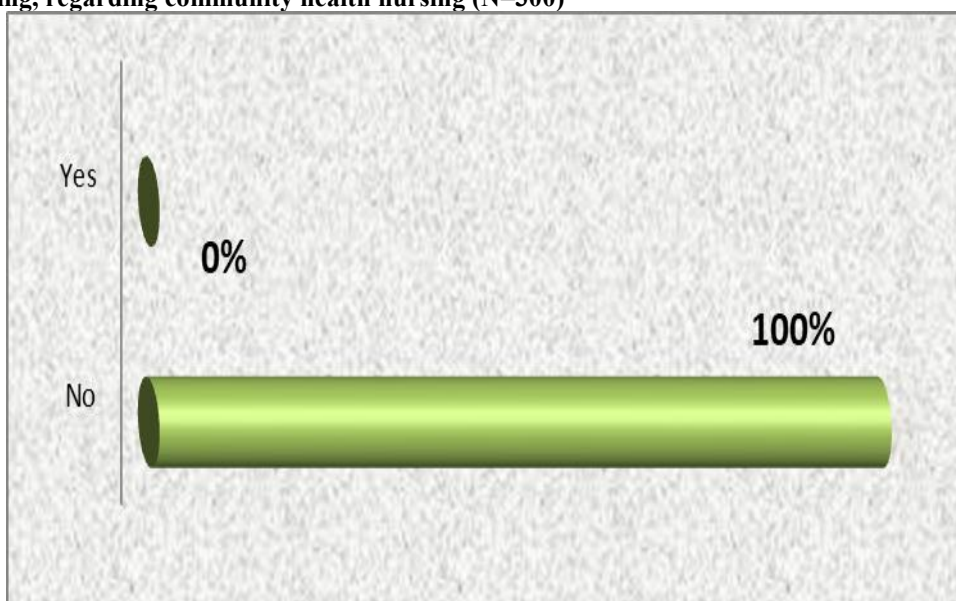
(\* ) Statistically significant at  $p < 0.05$

(U) Mann-Whitney test





**Figure 1: Undergraduate nursing students' opinion after the application of mind maps in training, regarding community health nursing (N=300)**



**Figure 2: Undergraduate nursing students' opinion regarding the previous application of mind maps in education (N=300)**

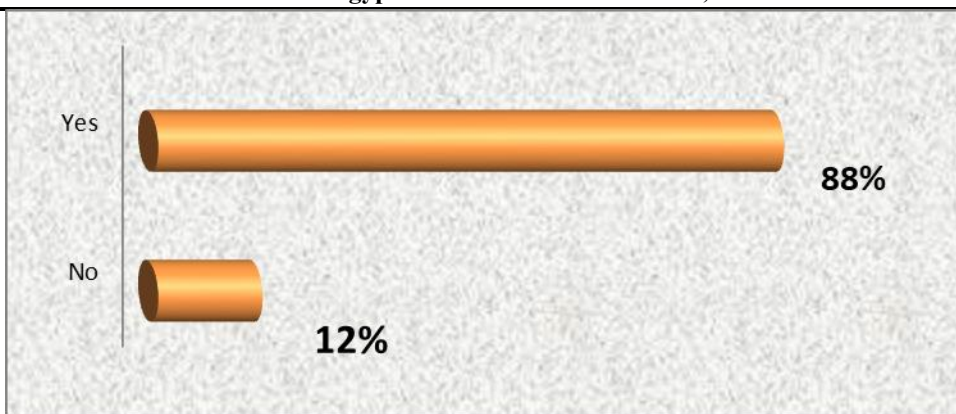


Figure 3: Undergraduate nursing students' opinion regarding preferring application of mind maps in education (N=300)

Table 3: Undergraduate nursing students' perception among the experimental group regarding mind mapping strategy

Items	Perception (%)		
	Strong agree/ Agree	Uncertain	Strong disagree/ disagree
Valuable when learning Concepts	88.0	12.0	0.0
Improving understanding of Topics	86.0	13.0	1.0
Helpful in recalling information	80.0	19.0	1.0
Helpful in organizing Information	84.0	8.0	10.0
Encouraged us to read & outline the chapters	83.0	7.0	10.0
Helped to clear my concepts	80.0	10.0	10.0
Good self-study tool	81.0	11.0	8.0
Helpful for rapid revision	84.0	11.0	5.0
Enjoyed learning nursing with this method	80.0	13.0	7.0
Not my style of learning	3.0	13.0	84.0
I don't think it helped with retention of material	2.0	18.0	80.0
Total perception	90.0	4.0	6.0

Table (4): Mean scores distribution among the studied students in the experimental group regarding their knowledge about community health nursing pre and post-application (N = 300)

Students' knowledge	Experimental Group (n=300)				X2	P-value
	Pre-mind mapping application		Post-mind mapping application			
	No	%	No	%		
Mean Knowledge total score	9.2±3.2		13.5±1.7		F=34.6	P=0.000

Table (5): Mean scores distribution among the studied students in the experimental group regarding their knowledge about mind mapping strategy pre and post-application (N = 300)

Students' knowledge of mind mapping	Pre-mind mapping application		Post-mind mapping application		t-test	P-value
	No	%	No	%		
Mean Knowledge total score	7.2±1.3		11.6±1.9		F=34.7 P=0.000 HS	

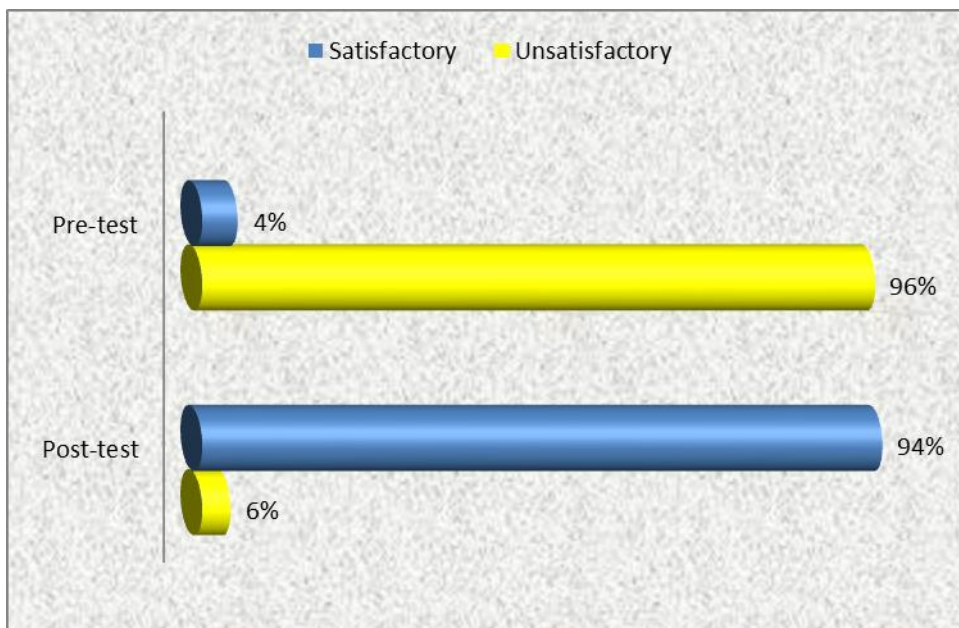


Figure (4): Total knowledge level pre and post-mind mapping application among students in the experimental group (N = 300)

Table 6: Correlation between the intervention group's perception regarding mind mapping strategy and the differences between their pre-posttest scores

Items	Post-pre-intervention scores	
	Spearman's rank correlation coefficient	p-value
Valuable when learning concepts	0.346	0.001**
Improving understanding of topics	0.375	<0.001**
Helpful in recalling information	0.633	<0.001**
Helpful in organizing information	0.466	<0.001**
Encouraged us to read & outline the chapters	0.579	<0.001**
Helped to clear my concepts	0.588	<0.001**
Good self-study tool	0.564	<0.001**
Helpful for rapid revision	0.573	<0.001**
Enjoyed learning nursing with this method	0.553	<0.001**
Not my style of learning	-0.442	<0.001**
I don't think it helped with the retention of material	-0.336	0.001**
<b>Total perception</b>	<b>0.619</b>	<b>&lt;0.001**</b>

(\*\*) Statistically significant at  $p < 0.01$

**Discussion:**

By creating mind maps, students can create connections between previously learned and new information, which increases comprehension. It is a very efficient method of taking notes and helps bring back memories from the past. Rather than providing instruction on critical thinking, this method of teaching and learning encourages pupils to actively acquire knowledge. Since the nurse's thinking isn't guided by a template or flow chart, mind mapping illustrates how the nurse interprets and integrates information, resulting in meaningful learning (**Mohammed et al., 2022**).

According to the study's findings, the median age of the two groups was about the same from the researchers' perspective, and there was no statistically significant difference between them. For a fair comparison of the control group and the experimental group, this group similarity was crucial.

The current study's findings revealed that about half of the studied undergraduate nursing students reported excellent opinions after the application of mind maps compared to only 4% of them considered it as not acceptable. From the researcher's point of view, it reflected the positive effects of the application of mind mapping.

The current study's findings revealed that all of the studied undergraduate nursing students reported did not use mind maps in their previous training. According to the researchers, this validated the need for using mind mapping in nursing education.

The present study found that the majority of the studied undergraduate nursing students preferred the application of mind maps in education. **Wu H and Wu Q (2020)** were in the same line with the current finding in a study that aimed to determine the impact of mind mapping on the critical thinking ability of clinical nursing students and its use as a teaching application, as they revealed that most nursing students reported that they enjoyed learning mind mapping and were willing to use it in their work. Furthermore, **Atia G (2017)** was consistent with the present finding as she reported that, there is a high level of students' satisfaction and positive perception of mind mapping as a

method of teaching in a study titled 'Effectiveness of Mind Maps as an Aid for Nursing Students' Education. The significance of the study and the benefit of employing a mind-mapping technique in this research are highlighted, in the opinion of the researchers. Since mind maps are especially full of pictures, sketches, and forms in a variety of eye-catching colors, they are believed to be the finest tool for helping people transfer and recall knowledge and information. The brain receives 90% of its information visually, and concept memory is greatly impacted by the brain's innate sensitivity to symbols and images.

The current study's findings showed that there was no statistically significant difference in the pass rates of the control and experimental groups before the intervention. In the post-intervention phase, there was a statistically significant difference between the success (pass) rates for the experimental group and the control group. This, in the opinion of the researchers, demonstrated the advantages of utilizing the mind-mapping method in nursing education. The results of the current study thus supported the use of mind mapping in teaching.

The outcomes of this investigation also align with those of **D'Antoni, et al. (2019)**, who found that mind mapping is a useful technique for aiding medical students in remembering new knowledge and retrieving short-term memory. These findings are in line with a study conducted in North Carolina by **Kaddoura et al., (2019)** under the title "Impact of a concept map teaching approach on nursing students' critical thinking skills," which found that first-year nursing students in the Bachelor of Nursing program who were taught by a mind mapping group performed significantly better on posttests than their counterparts who were taught using traditional methods.

Similarly, in a quasi-experimental study conducted in Iran, **Jaafarpour et al. (2019)** evaluated the effectiveness of concept mapping as a teaching method for nursing students. Their results showed that the group that used mind mapping had significantly higher post-test scores than the group that used conventional methods. Moreover, their scores improved throughout the eight sessions of the intervention.

According to **Rooda's (2019)** research, mind mapping can be an effective learning strategy

for baccalaureate-level students enrolled in an introductory nursing research course. The findings of this study are consistent with that finding. The results showed that students who used mind-mapping strategies did better on tests than those who did not. According to the study's findings, pupils who employed mind mapping were able to access and remember a significant amount of complex information.

**Zadeh et al. (2020)** also observed no differences between the pretests of the two groups in their quasi-experimental study comparing the efficacy of mind mapping to traditional approaches among Iranian nursing students. On the posttest, however, students in the mind mapping group outperformed those in the control group. However, a study by **Bixler et al. (2018)** in the United States titled "Collaborative concept mapping and critical thinking in fourth-year medical students" clarified the evidence supporting the usefulness of mind mapping in advancing students' critical thinking abilities and disposition in addition to improving their knowledge and practice.

The undergraduate nursing students who participated in the study had a very high agreement for all affirmative statements regarding how the intervention group saw the mind-mapping learning approach, according to the study's findings. Additionally, the results of the post-test scores demonstrated how strongly the undergraduate nursing students agreed with all positive comments regarding the mind-mapping learning technique and the development in the student's level of knowledge. The outcomes show that mind-mapping techniques have a positive effect on learning at all cognitive levels.

This result is congruent with a study conducted in Ireland by **Duffy et al., (2019)** under the working title "Experiences of utilizing Prezi in psychiatry education." The study's findings revealed that the majority of mind-mapping users thought the method was entertaining, stimulating, and beneficial.

In a similar vein, **Grice (2016)** noted that nursing students who employed mind mapping as a teaching tool appreciated and found value in the process of making these maps. Grice's study, which was carried out in the US, was centered on "Concept Mapping as a Learning Tool in Occupational Therapy Education".

The current study discovered that there was a highly statistically significant

difference between **undergraduate nursing students'** mean score knowledge and improvement in the post-test ( $p < 0.000$ ) regarding community health nursing pre and post-**application**. This is reflected in the positive effects of using mind mapping in nursing education and training about infection control. So, the current study findings supported the integration of mind maps in infection control continuing education to improve nurse's knowledge and practice. **Elasrag and Elsabagh (2020)** were consistent with the present study findings as demonstrated a highly statistically significant difference between the mean score of student's total knowledge before and after the application of mind mapping. Also, **Wenjun L et al., (2020)** congruent with these results concluded that mind mapping not only improves medical students' awareness and operational skills of nosocomial infection prevention and control knowledge but also improves their hand hygiene compliance and satisfaction in their study about 'The application of mind mapping in the knowledge and skill training of nosocomial infection prevention and control of medical students'.

Similarly, **Abdel Hamid (2017)** did a study on "Mind maps as a novel teaching approach for medical students" and reported that, in medical education, mind maps allow students to better absorb information and organize it. As a result, information is more easily remembered. The researchers view this because of using different pictures and colors in mind mapping, both of which facilitate the conversion of information from short- to long-term memory also, it improves the recall of information, allows faster access to the information, and ultimately increases creativity (**Antoni 2009**). Supporting previous findings by **Chin Y. (2017)**, who studied "Developing a mind map-based life review program to improve psychological well-being of cancer patients" and concluded that mind map helped cancer patients to easier organize past experiences through combining images and words to classify and organize information visually. **Bahm (2019)** was against the current finding in a study about "Use of technology-assisted techniques of mind mapping and concept mapping in science education: a constructivist study" concluded that students who used technology-assisted technique of

concept mapping reported positive opinions and stated that learning through concept maps was more useful and engaging than learning through using technology-assisted technique of mind mapping.

**The present study showed that** there was a highly statistically significant difference between nurses' knowledge regarding mind mapping strategy pre and post-application. Also, the same table illustrated a highly significant improvement in the post-test in the mean total score of knowledge. From the researcher's point of view, it reflected the success of using mind mapping in education.

The current study showed that almost all of the studied **undergraduate nursing students** in the experimental group had an unsatisfactory level of knowledge in the pretest while in post- mind mapping application, most of them had a satisfactory level of knowledge. **Bayumi et al., (2022)** were in harmony with the present study finding as they found that 36% of the studied nurses had an unsatisfactory level of knowledge about infection control precautions in the operating room using mind mapping in the pretest but post-intervention, all of them (100%) had a satisfactory knowledge level. According to the researchers, this could be due to a lack of updated knowledge about infection control precautions and a nursing shortage.

Regarding correlations between the post-pre-intervention scores of the studied undergraduate nursing students and their scores of agreement with various positive aspects of the mind mapping strategy, the current study's findings revealed that there were statistically significant positive correlations between the post-pre-intervention scores of the studied undergraduate nursing students and those scores. According to the researcher, it shows improvement in the undergraduate nursing students' mind-mapping strategy after the intervention. These results are consistent with a study by **Jones et al., (2018)** titled "The impact of mind mapping activities on students' motivation," which highlighted the ability of students to comprehend information with an improvement in grade values.

According to the current study's findings, undergraduate nursing students who used the mind mapping approach had higher success

rates and significantly higher post-pre score deference in numbers. Thus, it seems that mind maps are a more effective teaching tool than conventional techniques. Its innate qualities, which highlight the topic's key components with codes and images in a range of colors and dimensions, stimulate the brain's synergistic activity, which in turn enhances recall capacity (**Spencer et al., 2019**).

These results are consistent with those of **Atia et al. (2017)**, who investigated the "Effectiveness of Mind Maps as a Learning Tool for Nursing Students" and found that, because it is well-liked by students, mind mapping is a useful and effective educational technique that could aid nursing students in learning nursing lessons. To increase students' capacity for learning, nursing schools should implement this straightforward method, which only requires a brief training in its application. Due to this, nursing educators may need to receive training on how to use Mind Maps as a Learning Tool with nursing students. The results of the study show that using mind mapping as a learning tool can assist undergraduate nursing students retain information more efficiently and creatively as a teaching-learning strategy to help the students to attain and recall a large volume of information during their course of study (**Sikha et al., 2018**).

Mind maps also help to arrange linkages and connections between ideas and information. This makes it easier for the study's sample to recall knowledge and ideas for both immediate achievement and long-term retention. So mind maps help those who have weak memory to remember details of visual pictures. In addition, it is an innovative and effective method for remembering things better than the routine way of reading texts as concluded by **Kalyanasundaram et al., (2017)**. In the same context, **Spoorthi et al., (2019)** mentioned that mind maps, assist students in integrating information, and consequently, help them to organize and retain it in a study entitled 'Mind Mapping- an Effective Learning Adjunct to Acquire a Tsunami of Information'. Furthermore, mind maps are excellent learning tools to enhance students' abilities to formulate concepts, analyze data, as well as connect ideas, and understand the

relationships between them. It involves visual knowledge reconstruction and is easier to follow and engage with than verbal and written scripts as mentioned by **Alsuraihi (2022)**.

### Conclusion:

Based on the findings of the present study, the current study concluded that the mind-mapping strategy had a positive effect on improving students' knowledge and the mind-mapping strategy is superior to the other currently used study methods and that successfully helps students in learning subjects by overcoming issues with retention and recall.

### Recommendations:

**In the light of the findings of the study, the following recommendations are suggested:**

- The study suggested that the mind mapping strategy should be implemented as an effective teaching technique for effective and acceptable teaching technique for nursing students' education.
- Further studies and replication of the present study with a larger sample of students in different settings are required for results.

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