Effectiveness of Using Mind Map to Improve Nurses Performance Regarding Infection Control at Obstetric and Gynecological Departments

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Abstract: **A mind map is drawing which can be used as a simplified content management system. It allows storing all data in a centralized location to stay organized. The aim of this study: to assess the effectiveness of using of mind map to improve nurses performance regarding infection control at Obstetric and Gynecological Departments. Design: a quasi-experimental study was used. Setting: the study conducted in obstetrics and gynecological departments, Menoufia university hospitals, Menoufia Governorate. Subjects & Methods: a total of 55 nursing staff in obstetrics and gynecology department in the period from April 2019 to august 2019 were recruited in the study. There were divided into subgroup about 5 to 7 nurses were attended that used the mind mapping as a study tool. Data were collected through questionnaire sheet, observational check list, pretest, posttest & follow up test and nurses' opinionnaire sheet. Results: revealed that there is statistically significant difference was found between the pretest and posttest regarding nurses' knowledge improvement and performance. Highly statistically significant difference was found between total knowledge regarding mind mapping & performance of the nurses. Conclusion & Recommendations: based on the results of the current study, it can be concluded that using of mind mapping strategy significantly improve nurses' knowledge & performance in obstetrics and gynecology departments. Based on the finding the study is recommend: Integrating mind mapping strategy as a method of training and teaching to nurses receiving training courses.**

Keywords: **Mind Mapping – nurses' performance.**

1. INTRODUCTION

Worldwide, the educational and training programs and teaching strategies in nursing and medical schools have witnessed changes aimed at increasing students and staff members' active participation and responsibility for own learning, with more tendency towards self-directed learning and training to ensure lifelong continuing education **(Buzan, 2016).**

These changes emerged from educators' concerns that students tend to memorize facts "rote learning" rather than understand and apply concepts "meaningful learning"**(Buzan and Buzan, 2014).** Problem-based learning incorporates techniques of brainstorming, organizing ideas, taking notes, learning collaboratively, presenting, and studying. Moreover, critical thinking is increasingly gaining importance in nursing education and training **(Spencer et al., 2016),** and various teaching strategies have been identified to apply it **(Julie et al., 2017)**.

Active learning methods, as problem-based learning, case-based teaching, didactic learning and web-based teaching are recognized strategies to stimulate student's critical thinking. These strategies aid students to learn and eventually integrate information. These learning strategies differ in efficiency and applicability, but they are in the same conceptual

framework which is the constructivist theory of learning. This learning theory states that learning with understanding, happens when learners integrate new information with their current knowledge. Constructivism underlies mind mapping and concept mapping as learning strategies which are promising approaches in the setting of medical education. **(Ghada AbHamid, 2017)**

Such innovative approaches would promote students' ability in developing care plans and health promotion activities, as well as synthesizing disease processes, and forming differential diagnoses **(Rendas et al., 2016, Rosciano, 2015)**. Nonetheless, this requires active teaching and learning strategies, which would constitute a new challenge to nurse educators. **(Arne Menn , 2020)**.

In recent years, understanding how to assist paramedical members in their learning journey via diverse teaching and learning strategies has gained popularity, and to that end, there has been an increase in the publication of learning strategies used in medical education that may help nurses learn and integrate information. **(Genevieve Pinto Zipp, et al., 2019)**

Nurse educators or trainer should create learning experiences that enable nurses to think and to be better learners. Mind mapping is a creative way for nurses to engage in a unique method of learning that can expand memory recall and help create a new environment for processing information. This strategy was created in the early 1980s **(Daley et al, 2016)**

To help nursing students to deal with the pregnant women efficiently based on scientific and organized knowledge, new educational strategies in nursing education as a concept map is used. The nurse as educator has several roles as trying to help pregnant women get the most accurate information, working to minimize the impact of health problems on her health, making sure that they are not inactive and isolated, but empowering them to be active agents in their health care plan. Nurse as educator has also the opportunity to meet the pregnant women in MCH centers, and discuss with each woman individually in order to provide her with information, knowledge or skills that she is in need to make her own appropriate choices and decisions for her health care plan.**(Pintrich PR, De Groot EV., 2015)**

Educational materials have recently emerged which aim to improve memory for medical information by representing facts in the form of "mind maps". Aim was to evaluate the effectiveness of using mind maps as a self-learning method As Mind maps are considered a powerful metacognitive tool that can facilitate the acquisition of knowledge through meaningful learning, and can thus be used to promote and evaluate critical thinking **(Edwards and Cooper, 2015)**.

By using mind maps, learners make a link between unknown and known information that leads to deeper understanding. It is an extremely effective method of taking notes, and it aids recalling of existing memories. This teaching-learning method does not teach students to think, but helps them to actively acquire information. **(Sarhangi et al, 2016)**.

In mind mapping, because the nurse creates the mind mapping without a template or flow chart to direct their thinking, the mapping ultimately represents the nurse's own interpretation and integration of ideas, resulting in meaningful learning. Meaningful illustration expounded by a richer and deeper integration information that can nurture both declarative (explicit) and implicit knowledge associated with critical thinking and long-term learning. **(D'Abundo et al., 2019)**

Significance of the study

Nurse trainers are under pressure to increase trainees' qualifications that are able to think critically, work hard, be more creative and solve problems in a variety of clinical practice settings to apply infection control principles. They require active teaching strategies to promote meaningful learning, instead of relying on traditional methods that promote recall and memorization. A review of the current state of the science with regard to mind mapping demonstrates that this teaching-learning method can assist nurse trainers to prepare trainees to think critically in the complex health care environment. **(Norman Williams, Keith Pearson,2016)**

Therefore, the researcher was motivated to examine the effectiveness of this technique in nurses' staff working in obstetrics and gynecological department. **(WHO, 2018)**

Aim of the study

This study aims to assess the effectiveness of mind map to improve nurses' performance regarding infection control at obstetric and gynecological departments through:

1. Assessing nursing staff base line knowledge regarding infection control and maternity care regarding mind mapping.

2. Integrating mind mapping in educating regarding infection control and maternity care for nursing staff.

3. Evaluate nursing staff performance after using mind mapping strategy.

4. Assess nursing staff acceptance to mind mapping studying.

Research hypothesis:

Using Mind mapping has a positive effect in improving nurses' performance regarding Infection Control at Obstetric and Gynecological Departments

2. SUBJECTS AND METHODS

This study aimed to assess the effectiveness of using mind map to improve nurses' performance regarding infection control at obstetric and gynecological departments.

Research hypothesis:

Using mind map has a positive effect in improving nurses' performance regarding infection control at obstetric and gynecological departments.

The subject & methods of the current study were discussed under the following:

I. Technical design

II. Operational design

III. Administrative design

IV. Statistical design

I. Technical design

The technical design for the study included research design, setting of the study, study subject and tools of data collection.

Research Design:

Quasi-experimental research design to the study group as (pre, post & follow up) was used to achieve the aim of the current study.

Research Setting:

The study was conducted at Menoufia University hospitals in shebin elkom city – Menoufia Governorate. It was implemented in:

- Lecture class in the inpatient of obstetrics and gynecology department.

- Nurses break room of the operating rooms (OR) of the department of Menoufia University hospitals.

A) Sample type:

This study was done through convenient sample technique.

B) Sample size:

All nurses working at obstetrics and gynecological departments in Menoufia University hospitals were included in the study (55) nurses

Data collection tools:

The data collection tools for the current study were composed of three tools, a questionnaire sheet, opinionnaire sheet, and an observational checklist.

1- Structured Interview Questionnaire sheet:

It was developed by the researcher after reviewing the national and international related literature. This tool consisted of four main parts as the following: ¬

➕ **Part 1:** This part aimed to collect data about demographic characteristics of the study subjects as: nurses' name, age, gender, education and years of experience.

♦ **Part 2:** this part aimed to collect data about nurses' opinion regarding the use of the mind map in education, training program, attendance of infection control precautions training programs and using mind map before in their previous academic years and nurses' knowledge regarding using of mind map after lecturing them about mind map and how it can be applied in the training to control infection. It includes their opinion about the methods of teaching of infection control in the department.

Scoring system:

The part has a list of 5 items as:

• Nurse opinion about the way that used to explain infection control, scored as 1for excellent, 2 for very good, 3 for good, 4 for accepted, 5 for not accepted.

• Previous utilization of mind map, scored as 1 for yes and 2 for no.

• Preferring mind map in training, 1 for yes and 2 for no.

• If the answer yes for the previous question why? as open question.

• If the answer no, why? as open question.

Tool (II): nurses knowledge about infection control:

It aimed to assess knowledge of nurses regarding infection control precautions where consisted of hand washing, appropriate isolation precautions, antiseptic for skin, intravenous infusion, a safety box, cleaning of surgical instruments, safe disposal of medical waste, Gloves and Acupuncture through needles or other sharp objects to achieve the objectives of the study consisted of 15 questions related to the studied topics as MCQ. In addition, infection control to improve nurses' knowledge and performance related to infection control precaution using mind map strategy.

Scoring system of nurses' knowledge:

▪ Incorrect answer : scored one

▪ Correct answer : scored two

This part was guided by **(CDC, 2016)** and modified by the researcher to assess nurses' knowledge about infection control precautions in their practice in the obstetrics and gynecological departments, containing 15 questions and the total score is 30 score, the score from 18 to 30 is considered satisfactory and the score from 10 to 18 is considered accepted and the score less than 10 is unsatisfactory.

Tool (III): observational check list:

It aimed to assess nurses' performance which guided by **(APIC, 2017)** and modified by the researcher to evaluate nurses' performance about infection control precautions provided to maternity and newborn through different procedures. **It consists of:** Infection control precautions regarding hand hygiene, Putting on and remove Personal Protective Equipment (PPE), Follow infection control principals during different nursing activities as (perineal care, catheterization, wound dressing, emergency medications and iv infusion administration, cannulation, blood transfusion, handling oxygen equipment, vital signs assessment, handling and brushes surgical instruments, neonatal sepsis prevention through assessment, care and dressing, disposal of patient waste. The researcher perform the checklist for all nurses participated in the study at their working places as (Operating and delivery room, Labor first stage room & high-risk pregnancy unit, Medication room and handling of medical files)

Scoring system:

Each correct answer was scored 2 point and 1for wrong answer. The total score was 70 marks for performance. The total score for performance about infection control precaution was classified as satisfactory ≥ 60%, unsatisfactory < 60%.

The Educational Sessions was developed through four phases as following:

(I) Assessment phase:

The educational session was partially constructed for the assessment of nurse's performance. The assessment was performed before implementation of educational program by interviewing nurses to assess knowledge (pretest) by using tool 1& tool 3 after explaining the aim of the study and their approval to participate in the study. This phase started

immediately after having approval. After identifying the nurses, they were met in inpatient of obstetrics and gynecological departments, Operating room, labor first stage observation room and high risk room. Nurses fill out the questionnaire sheet in the morning shift. The time taken for filling out the questionnaire sheet varied between 10-15 minutes. Also, nurses' practices were observed**.**

(II) Planning phase

Based on the results obtained from interview sheet and observational checklist (from pilot study and assessment phase) as well as reviewing the related literature the educational sessions was developed by the researcher. Detected needs, requirements and deficiencies were translated into aim and objectives of the educational sessions. The contents were selected on the basis of identified needs. The used in the sessions were prepared as lectures by laptop, group discussion, demonstration, colored posters, a handout of the design mind map contents illustrated by pictures by the researcher that covered theoretical and practical information.

(III) Implementation phase:

The educational sessions of this study was implemented through five sessions in which nurses were divided into small groups involved 3 to 5 nurses to facilitate the learning process. The length of each session differed according to the content and nurses responses. It was ranged from 30-45minutes. The first session about mind map strategy, second and third sessions about Infection control precautions, fourth and fifth sessions about using mind map as teaching method and applying mind map in infection control teaching. Each session started with summary of the previous session and the objectives of the new one taking were explained in Arabic language and simple English terms that suit level of nurse's education. Motivation and reinforcement during session were used in order to enhance nurses learning.

(IV) Evaluation phase:

In this phase every nurse of the studied sample were interviewed individually immediately after implementation of educational health sessions to assess their knowledge (posttest) by using tool no. one and tool no. three.

Also after two months later the nurses of the studied sample reassessed for follow up distributed tool no. one and tool no. three.

Supportive materials:

The researcher used supportive materials as: CDC instructions, papers and colored pens, laptop, colored posters, Power Point, a handout of the design mind map to teach infection control.

Administrative and ethical considerations:

In the planning stage, a written approval was obtained from the dean of the faculty of nursing of Helwan University to the manager of Menoufia university hospitals and to the head of obstetrics and gynecological department. All nurses were informed about the study aim and procedures and about their rights to participate or not, as well as to withdraw without explanations. Oral informed consents were obtained from each nurse who agreed to participate in the study.

II- Operational Design:

The operational design for this study included three phases namely; preparatory phase, pilot study and field work.

Preparatory phase:

This phase stared with a review of the current, past local and international related literature about the various aspects of the subjects of the study, using textbooks, articles, journals and websites to be acquainted with magnitude of the study, guide and prepare the educational sessions and data collection tools.

Tool Validity:

The validity was tasted for content validity by jury of three experts in the field of maternal and newborn health nursing specialty to ascertain relevance and completeness; reviewed the questionnaire and the intervention for content and face validity. Their comments were reviewed and the necessary modifications were done as it in training. It was rephrasing some sentences.

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Tool Reliability:

Reliability was applied by the researcher for testing the internal consistency of the tool, by administration of the same tool to the same nurses under similar conditions two times using knowledge questionnaire sheet and observational checklist.

Pilot study:

A pilot study was carried out on 10% (5 nurses) from the total sample size which were included in the study. The aim of the pilot study was to find out the possible obstacles or problems that might be face the researcher and interfere with data collection. Nurses included in the pilot study were not excluded from the sample because no modification was done to the tools of data collection.

Field work:

Data collections were done in a period of four months from the beginning of March 2019 to the end of June 2019. The researcher collected data for 4 days per week from 11:00 am to 12:00 pm. The sample was divided into small subgroups of three to five nurses in the same break time during the shifts and when work pressure is little. Firstly the researcher was clarified the aim and the objectives of the study to nurses gain their oral acceptance of participant in the study.

Assessment phase:

- **First week (1st day):** the researcher explains the purpose of the study. The data was collected in a simplified Arabic language, Distributed structured interview questionnaire to nurses at their work place during the break time. After that the researcher recollected it and analyzed it to assess their needs and knowledge deficit.

By the end of first week all nurses was assessed.

Preparation phase:

- **Second week:** The researcher started to prepare break room and lecture room in obstetrics and gynecological department to implement the theoretical part of educational sessions.

Revise and redesign the prepared educational sessions and adding the missed items that well met nurse's needs & knowledge deficit. Inform the nurse's by predesign schedule including time, place and number of nurses who will participate in implementing the sessions.

Implementation phase:

The researcher gave the first session about the methods of teaching and mind map as a new strategy of training (what does it mean, materials needed to apply mind map, How can be applied in training on infection control applications, the benefits of its application). This session lasted three quadrant hours (11.00am: 11.45pm) with break time for 5 minutes.

The second session: about applying mind map on infection control elements in obstetrics and gynecological department as (hand wash, waste management, instruments cleaning and general principles of infection control). This session lasted during one hour.

- **Second week(1st day):** from 11.00 am: 12.00 pm in lecture room in obstetrics and gynecological department started by take feedback about what was given through the previous sessions and the objectives of the new topic (applying mind map), taking into consideration using simple and clear language to be suitable for every level of nurses. the researcher demonstrate the mind map strategy by using paper, colored pens and printed samples to mind maps. During half hour (11.00am: 11.30am), then break 10 min. after that half hour (11.30:12.00pm) the nurses demonstrated mind map by using paper and colored pens

- **Second week(2nd day):** from (11.00am: 11.30am) started by take feedback about what was given through the previous sessions and the objectives of the new topic (infection control topics), the researcher conducted in nurses break room using paper and colored pens and power point presentation on laptop. Break 10 min .then; from 11.30:12.30 pm the nurses re-demonstrated mind map application in infection control principles by using paper and colored pens. (Posttest), immediately every session: the researcher provides a theoretical & practical posttest. The same procedure was repeated in the third and fourth week to cover all sample subjects.

- **Third week (1ˢᵗ day)** perform the application of mind map in infection control topics in obstetrics and gynecological department.

- **Third week (2ⁿᵈ day)** the researcher perform the application of mind map in infection control topics for each group of the sample until the end of the week.

- **Fourth week (1ˢᵗ up to 4ᵗʰ day)** the researcher apply mind map in infection control topics using paper and colored pens for each group of the nurses and answer their questions about infection control precautions and how to apply principles side by side with shortage of equipment, facilitators, increasing of patient flow and inappropriate number of nursing staff which can increase the time of sessions.

Evaluation phase:

In this phase the researcher evaluate the effect of using mind map to improve nurses' knowledge regarding infection control at obstetric and gynecological departments by the posttest immediately after educational sessions implementation.

After two months, the researcher implemented the study assessment tools as follow up evaluation to all nurses through observational check list without informing the nurses and during their work including all practices and procedures and their applying of infection control precautions as in the following map:

* Mind map in the field of work of the study.

All sessions included:

▪ **Theoretical parts:**

• What does mind map mean?, materials needed to apply mind map, How can be applied in training on infection control applications?, the benefits of its application. (it takes one session)

• Infection control precautions in obstetrics and gynecological department as (hand wash, waste management, instruments cleaning and general principles of infection control). (it takes one session)

▪ **Practical parts:**

• Applying mind map to explaining infection control principles. (It takes two sessions).

• Revision and exam all content by using pretest questionnaire.(it take one session)

III- Administrative Design:

An official letter requesting permission to conduct the study was directed from the manager of Menoufia University hospitals to obtain their approval to carry out this study. This letter included the aim the study and photocopy from data collection tools in order to get their permission and help for collection of data.

IV- Statistical Design:

The collected data were coded and entered into the statistical package for the social science (SPSS V.23.00). Quality control was done at the stages of coding and data entry. Data were presented using descriptive statistics in the form of frequencies and percentages for categorical variables and means and standard deviations for continuous quantitative variables. Qualitative categorical variables were compared using Chi-square ($X2$) test; the hypothesis that the row and column variables are independent, without indicating strength or direction of the relationship. Qualitative variables were compared using chi-square test, T test and F test. Statistical significance was considered when P-value < 0.05 and highly significant difference obtained at $p<0.001$.

Limitation of the study:

- Four nurses were withdrawal because of maternity leave.

- The shortage of nursing staff prolonged the time of data collection from the study.

3. RESULTS

This study was aimed to assess the effectiveness of Using Mind Map to Improve Nurses Performance Regarding Infection Control at Obstetric and Gynecological Departments. Through the results were presented in the following sequence:-

1. Assessing nursing staff base line knowledge regarding infection control and maternity care regarding mind map.

2. Integrating mind map in educating regarding infection control and maternity care for nursing staff.

3. Evaluate nursing staff performance after using mind map strategy.

4. Assess nursing staff acceptance to mind map studying.

The results of this study were classified in (4) parts:

Part I: Distribution of the studied nurses at Obstetrics/Gynecology department, Menoufia University Hospitals (MUHs), according to their socio-demographic characteristics, and having training courses about mind map. (Table 1-2 and figures 1- 2).

Part II: Distribution of the studied nurses according to their knowledge about infection control policies (tables, 3 – 5, and figure 3 - 4).

Part III: Relation between variables of the study (tables, 6 – 7, and Figure 5).

Part IV:– Distribution of the studied Nurses' practice of infection control precautions throughout observational check (tables 8 to 12)

Part I: Distribution of the studied nurses according to their socio-demographic characteristics, and having training courses about mind map. (Table 1-2 and figures 1- 2).

Table (1): Distribution of the studied nurses according to the Socio – demographic characteristics (N = 55)

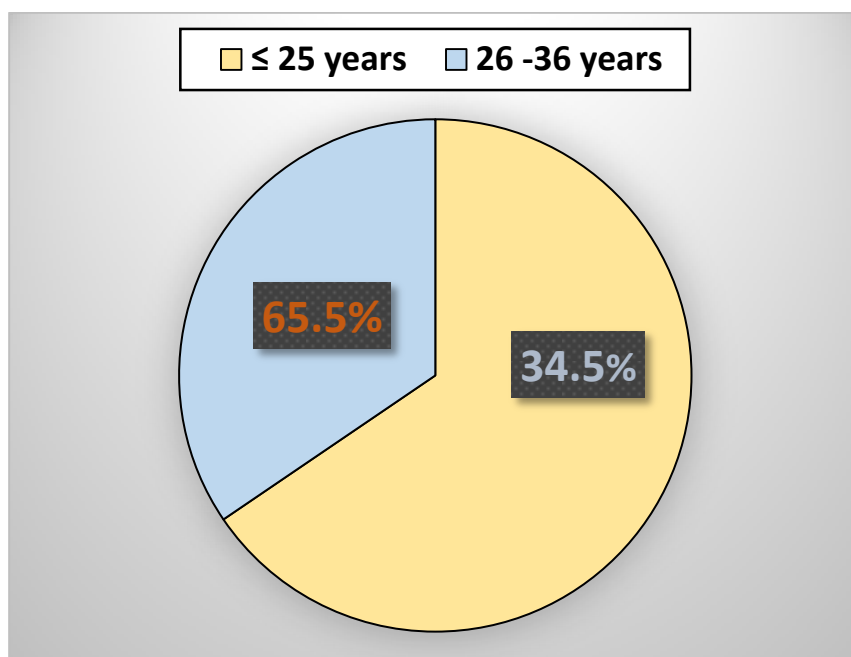| Socio demographic characteristics	N0.	%
Age (Years)		
≤ 25 years	36	65.5
26 -36 years	19	34.5
Mean ± SD	**23.6 ± 4.5**	
Experience groups:		
≤ 5 years	20	36.4
6 – 14 years	22	40
15 - 25 years	13	23.6
Qualifications:		
Technical	35	63.6
High qualified nurse	20	36.4
Mean ± SD	**9.1 ± 3.2**	
Total	**55**	**100**

Fig. 1: Frequency of age groups of studied nurses (N=55)
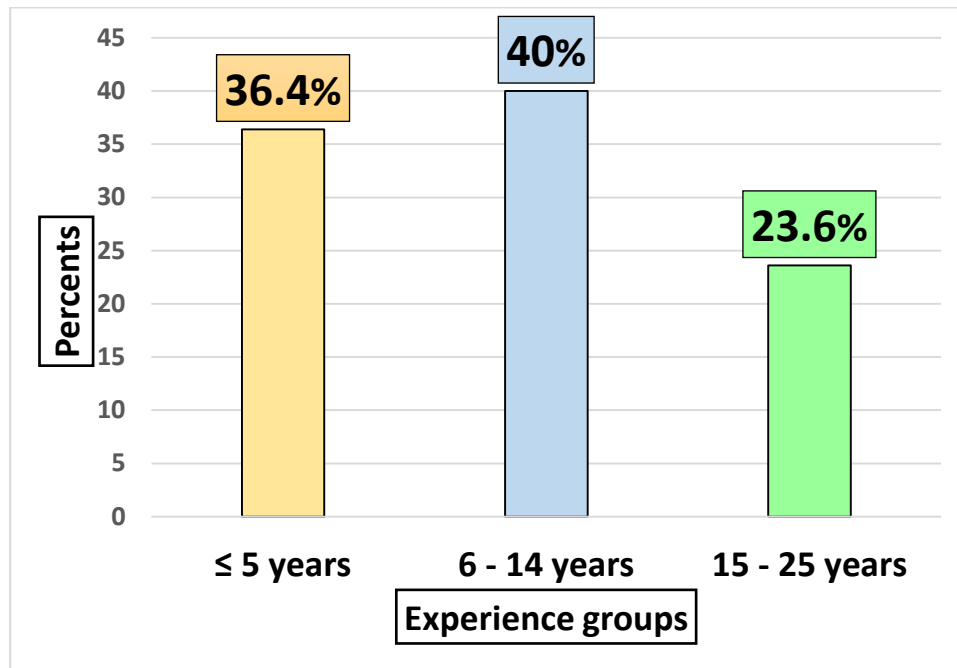
Fig. 2: Frequency of Experience groups of studied nurses (N=55)

Table (1) & Figure 1 and 2 shows that nearly two thirds (65.5%) of the studied nurses aged (less than or equal 25 years) as they are in the young age group with mean of (23.6 ± 4.5 years). As regards experience groups, (40%) of them had experience (6 – 14 years), and (36.4%) had experience less than or equal 5 years, with mean of (9.1 ± 3.2 years of experience. Qualifications of the studied nurses was about two third of them (63.6%) technical nurse and (36.4) as high qualified nurse

Table 2: Distribution of the studied nurses according to mind mapping experience opionannire among studied nurses (N=55)

Mind mapping experience	N0.	%
Nurses' explanation of infection control policies within Obs./Gyn. Department :		
▪ Excellent	1	1.8
▪ Very Good	13	23.6
▪ Good	21	38.2
▪ Acceptable	20	36.4
Previous using of Mind Mapping in their studies:		
▪ Yes	7	12.7
▪ No	48	87.3
Preferring using this training after explanation?		
▪ Yes	43	78.2
▪ No	12	21.8
If yes, why (N=43):		
▪ Save time	21	48.8
▪ Faster delivery of information	22	51.2
If <u>no</u>, why (N=12):		
▪ Prefer traditional explanation	6	50
▪ Easy follow up of patients	3	25
▪ Give nursing courses to follow Infection control policy	3	25
Total	**55**	**100**

▪ **Table (2)** shows distribution of mind mapping experience among studied nurses revealed that majority of studied nurses explained infection control policies within their Obstetrics and Gynecological Departments as good (38.2%) , while (36.4%) of them explained it as acceptable. Also, majority of them (87.3%) did not use mind mapping in their studies. Approximately about three quarter of studied nurses prefer using mind mapping after explanation, as it is Save time and Faster delivery of information.

Part (II): Distribution of the studied nurses according to their knowledge about infection control policies (Tables 3-5)

Table (3): Distribution of the studied nurses according to their knowledge about the Infection Control policies before intervention. (N = 55)

The nurses ' knowledge about the Infection Control policies before intervention	Wrong answer& I don't know		Incomplete correct answer		Complete correct answer	
	No	**%**	**No**	**%**	**No**	**%**
. The most cost effective means of Infection Control	5	9.1	50	90.9	0	0
. The most common methods of infection in health facilities	39	70.9	16	29.1	0	0
. The appropriate isolation precautions for the prevention of	24	43.6	31	56.4	0	0
. It is an antiseptic for skin and living tissues as well as an	31	56.4	24	43.6	0	0
. All of the following shall be deemed to be true for the non	29	52.7	26	47.3	0	0
. A tight intravenous infusion requires all of the following	21	38.2	34	61.8	0	0
. All of the following statements regarding disinfection	38	69.1	17	30.9	0	0
. One of the following is not a safety box	21	38.2	34	61.8	0	0
. All of the following is true for the cleaning of instrument	24	43.6	31	56.4	0	0
. All of the following recommendations for the prevention	33	60	22	40	0	0
. All of the following recommendations for safe disposal of medical waste are valid, <u>except</u>	8	14.5	47	85.5	0	0
. Choose the correct phrase from the following statements	16	29.1	39	70.9	0	0
. Gloves must be changed in the following cases except	22	40	33	60	0	0
. Acupuncture through needles or other sharp objects is the main cause of exposure of staff in health facilities to blood-borne diseases	8	14.5	47	85.5	0	0
. Using clean gloves in this cases except	45	81.8	10	18.2	0	0
Mean total knowledge score	**8.4 ±2.3**					

Table (3) showed that the majority of the studied nurses as more than three quarters of them demonstrated wrong answer or were didn't know infection control policies before intervention. (70.9%), (60%) , and (81.8%) were don't know or showed wrong answer regarding the most common methods of infection in health facilities , recommendations for the prevention, and Using clean gloves in this cases except respectively. In addition, no one of studied nurses answer any knowledge question with complete and correct answer (29.1%). The mean total score of studied nurses' knowledge about Infection Control policies before intervention was **(8.4 ±2.3).**

Table 4: Pre, post, and follow up interventions studied nurses responses to total knowledge assessment questionnaire (N=55).

Knowledge total score groups	Interventions			P value
	Pre N0. %	Post N0. %	Follow up N0. %	X^2=30.7, P=0.000 HS
Poor knowledge (0-10)	46 83.6	15 30.6	24 49	
Fair knowledge (11-20)	9 16.4	34 69.4	25 51	
Total	55 100	49 100	49 100	

Table 4 highlight the efficacy of using mind map to improve nurses' knowledge and consequently performance regarding infection control at obstetrics and gynecological departments In Menoufia university hospitals. Post and follow up interventions revealed a highly significant improvement as (69.4%) in the post test and about (49%) in the follow up test, (F=30.9, p<0.000) in the mean total score of knowledge from (8.4±2.3) pre intervention to (11.4± 1.8) in post intervention, and (10.4±1.8) in follow up intervention.

Table 5: Distribution of the studied nurses according to Pre, post, and follow up mean total knowledge score among studied nurses responses to total knowledge assessment questionnaire (N=55).

Mean Knowledge total score	Interventions			P value
	Pre	Post	Follow up	
X± SD	8.4±2.3	11.4±1.8	10.4±1.8	F=30.9, P=0.000 HS
N	55	49	49	

Table 5: The post program' Fair knowledge responses increased from (16.4%) pre intervention to (69.4%) post intervention. The follow up intervention program' Fair knowledge responses increased from (16.4%) pre intervention to (51%)follow up intervention.

Part III: - Relation between variables of the study (tables, 6 - 7).

Table 6: Relation between nurses socio-demographic characteristics and their level of post intervention knowledge about Infection control policies (n= 55)

Total knowledge / Socio-demographic characteristics		Post intervention knowledge groups					
		Poor knowledge		Fair knowledge		Chi-square	
		N	%	N	%	X^2	P-value
Age (years)	≤ 25 years	7	46.7	24	70.6	2.5	0.11 NS
	26 – 36 years	8	53.3	10	29.4		
Experience groups	≤ 5 years	4	26.7	13	38.2	0.78	0.67 NS
	6 -14 years	6	40	13	38.2		
	15 - 25 years	5	33.3	8	23.6		
Using Mind Map in their studies	Yes	4	26.7	3	8.8	Fisher	0.17 NS
	No	11	73.3	31	91.2		
Total		15	30.6	34	69.4		

NS= No statistical significance (P > 0.05)

Table (6) showed that there were no statistical significant differences between the studied nurses' socio-demographic characteristics and the total score of post intervention knowledge about infection control policies (p >0.05 for each) .More than half of the studied nurses who had poor knowledge score , were of older age group 26 – 36 years old (53.3%) (P >0.05). less than half of the studied nurses (40%) who had poor knowledge score, were had experience 6 -14 years (P > 0.05). In relation to their using Mind Map in their studies, there was no statistical significant difference between those who use this method and those who were not use it regarding their total score of knowledge(P>0.05).

Table (7): Relation between nurses socio-demographic characteristics and their level of follow up intervention knowledge about Infection control policies (n= 55)

Total knowledge / Socio-demographic characteristics		Follow up intervention knowledge groups					
		Poor knowledge		Fair knowledge		Chi-square	
		N	%	N	%	X^2	P-value
Age (years)	≤ 25 years	15	62.5	16	64	0.01	0.91 NS
	26 – 36 years	9	37.5	9	36		
Experience groups	≤ 5 years	8	33.3	9	36	0.17	0.72 NS
	6 -14 years	9	37.5	10	40		
	15 - 25 years	7	29.2	6	24		
Using Mind Map in their studies	Yes	6	25	1	4	Fisher	0.04 Sig.
	No	18	75	24	96		
Total		24	49	25	51		

NS= No statistical significance (P > 0.05), S = Significant

Table 7 revealed that there were no statistical significant differences between the studied nurses' socio-demographic characteristics and the total score of follow up intervention knowledge about infection control policies (p >0.05 for each of age as well as experience groups) .Three quarters of the studied nurses who had poor knowledge score , were not use Mind Map in their studies (75%), while a quarter of them were used this method compared to only 4% among those who have fair knowledge, and this difference was significant statistically (P < 0.05)

The results showed that nurses had unsatisfactory knowledge about infection control before implementation of educational program. Nurses' knowledge and practice had been improved significantly after implementation of educational program either immediately or 2 months later.

Part IV: Distribution of the studied Nurses' practice of infection control precautions throughout observational checklist it contains 5 tables :

Table (8): Distribution of the studied Nurses' practice of infection control precautions throughout observational check list for Hand hygiene. (n=55)

	Pre				Post				Follow up				X^2	p.value
	Done		Not done		Done		Not done		Done		Not done			
	No	%	No	%	No	%	No	%	No	%	No	%		
Hand hygiene														
Using the right steps for hand washing	14	25.45%	41	74.5%	45	80.4%	11	19.6%	33	58.9%	22	40%	13.62	0.001
when going from a dirty to a clean area	2	3.6%	53	96.36%	37	66.1%	18	32.7%	40	76.9%	15	27.3 %	89.005	<0.001
when hands are soiled	8	14.3%	48	85.7%	44	84.6%	8	15.4%	51	91.1%	5	8.9%	97.552	<0.001
before and after coming in contact with patient, their equipment or belongings	26	46.4%	30	53.6%	45	81.8%	10	18.3%	25	48.1%	27	51.9%	16.225	<0.001
Before cleaning or disinfection is carried out	2	3.6%	54	96.4%	44	80%	11	20%	27	51.9%	25	48.1%	37.463	<0.001
After the risk of exposure to body fluids	20	35.7%	35	63.6%	32	58.2%	23	41.8%	23	41.8%	32	58.2%	1.785	0.410
after handling soiled linen	8	14.3%	47	85.45%	44	84.6%	7	12.7%	45	80.4%	11	19.6%	70.407	<0.001
before handling clean linen	13	23.6%	42	80.8%	31	55.4%	24	43.6%	26	46.4%	29	52.7%	15.004	0.001
All jewelry on Hands are removed and washed	28	50.9%	27	49.1%	30	54.5%	25	45.45%	29	52.6%	26	47.27%	1.051	0.591
Bottle of liquid soap is kept in a clean container and labeled daily	20	35.7%	35	63.6%	45	80.4%	11	19.6%	24	42.9%	31	57.1%	42.234	<0.001
use of non-touch techniques and skin preparation	18	32.1%	37	67.27%	47	83.9%	8	14.5%	33	60%	22	40%	39.279	<0.001

Table (8): The third part of the results was concerned with the highly statistically significance of practice level regarding prepare, handling and applying infection control precautions for obstetrics and gynecological precedes when comparing with pre and post of implementation of intervention As in Hand hygiene and using the right steps for hand washing (80.4%)(p≤0.001)

Table (9): Distribution of the studied Nurses' practice of infection control precautions throughout observational check list for Putting on and take Remove Personal Protective Equipment (PPE) (n=55):

	Pre				Post				Follow up				X^2	p.value
	Done		Not done		Done		Not done		Done		Not done			
	No	%	No	%	No	%	No	%	No	%	No	%		
Putting on Personal Protective Equipment (PPE)														
Gown: Put on gown, with opening in the back taking care to cover the entire front and back of uniform. Tie gown securely at back of gown (tie neck first and then waist).	31	56.4%	24	44.6%	48	87.3%	7	12.7%	43	78.2%	12	21.8%	37.025	<0.001
Mask: Put on mask, with blue facing outward and wire on top. Secure it over the nose, mouth and chin. If mask has ties - tie head first then at neck. If elastic, pull around ears. Press wire around nose.	40	71.4%	16	28.6%	49	89.09%	6	10.9%	32	58.2%	23	41.8%	1.338	0.512
Goggles: Put on goggles or face shield when appropriate.	38	69.09%	17	30.9%	43	78.2%	12	21.8%	50	90.9%	5	9.09%	41.113	<0.001
Gloves: Pull cuffs of gown down over part of hands prior to applying gloves. Apply gloves, making sure extending gloves to cover the cuff of the gown sleeve. No exposed skin!	22	40%	33	60%	32	58.2%	23	41.8%	15	27.27%	40	72.72%	2.818	0.244
Remove PPE.														
Remove gloves	12	21.8%	43	78.2%	40	71.4%	16	28.6%	14	25.45%	41	78.8%	14.661	0.001
Remove goggles/face shield (only if appropriate)	41	74.5%	14	25.45%	42	76.4%	13	23.6%	44	80%	11	20%	1.665	0.435
Remove gown	25	45.5%	30	54.5%	45	81.8%	10	18.2%	14	26.9%	38	73.1%	8.647	0.013
Remove mask	1	1.8%	54	98.2%	42	75.0%	13	23.6%	12	21.8%	43	82.7%	83.953	<0.001
Perform hand hygiene immediately after removing PPE.	8	14.3%	47	85.7%	32	58.2%	23	41.8%	34	65.4%	18	34.6%	65.662	<0.001
Alcohol based hand rubs (ABHR) near point of use	17	30.4%	38	69.6%	48	87.3%	7	12.7%	23	41.8%	33	58.2%	14.150	0.001

Table (9): the results was concerned with the highly statistically significance of practice level regarding Putting on Personal Protective Equipment (PPE) (87.3%), Remove (PPE)(71.4%)(p≤0.001)

Table (10): Distribution of the studied Nurses' practice of infection control precautions throughout observational check list for infection control principals during nursing activities and Disposal of patient wastes. (n=55)

	Pre				Post				Follow up				X^2	p.value
	Done		Not done		Done		Not done		Done		Not done			
	No	%	No	%	No	%	No	%	No	%	No	%		
Follow infection control principals during :														
perineal care	16	29.1%	39	70.9%	35	63.6%	20	36.4%	21	38.2%	34	61.8%	10.304	0.006
catheter procedures	13	23.6%	42	76.4	37	67.3%	18	32.7%	29	52.7%	26	47.3%	3.191	0.203
dressing changes	40	72.7%	15	27.3%	23	41.8%	32	58.2%	20	36.4%	35	63.6%	13.846	0.001
emergency medications iv infusion administration	33	60%	22	40%	32	58.2%	23	41.8%	30	54.5%	25	45.5%	22.238	<0.001
Cannulation	35	63.6%	20	36.4%	31	56.4%	24	43.6%	30	54.5%	25	45.5%	6.589	0.037
blood transmutation	12	21.8%	43	78.2%	33	60%	22	40%	25	45.5%	30	54.5%	8.739	0.013
Handling oxygen equipment	15	27.3%	40	72.7%	20	36.4%	35	63.6%	15	27.3%	40	72.7%	60.681	<0.001
Vital signs assessment	35	63.6%	20	36.4%	41	74.5%	14	25.5%	40	72.7%	15	27.3%	65.079	<0.001
Handling and brushes surgical instruments	24	43.6%	31	56.4%	29	52.7%	26	47.3%	16	29.1%	39	70.9%	9.473	0.009
Neonatal Sepsis prevention by assessment, care and dressing	21	38.2%	34	61.8%	30	54.5%	25	45.5%	24	43.6%	31	56.4%	62.598	<0.001
Total		44.35%				56.5%								
Disposal of patient wastes														
A red plastic bag marked with the universal warning sign or the word "biohazard" · Impervious to moisture	43	78.2%	12	21.8%	43	78.2%	12	21.8%	39	70.9%	16	29.1%	40.080	<0.001
Of a strength sufficient to resist ripping, tearing, or bursting under normal conditions of use and handling (all except sharps)	31	56.4%	24	43.6%	40	72.7%	15	27.3%	23	41.8%	32	58.2%	25.575	<0.001
Located away from pedestrian traffic and be vermin and insect free	15	27.3%	40	72.7%	16	29.1%	39	70.9%	32	58.2%	23	41.8%	2.645	0.266
Store human tissue as placenta, blood and output of abortion & gynecological procedures in closed area and sent quickly to the mincer for medical waste	12	21.8%	43	78.2%	29	52.7%	26	47.3%	16	29.1%	39	70.9%	4.665	0.097
Soiled laundry to be done outside facility is stored in closed, plastic-lined container	33	60%	22	40%	29	52.7%	26	47.3%	33	60%	22	40%	1.093	0.579
Beds and table is clean, unchipped and covered with clean linen and changed from patient to other	10	18.2	45	81.8%	33	60%	22	40%	23	41.8%	32	58.2%	9.408	0.009

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Table (10): the results was concerned with the highly statistically significance of practice level regarding follow infection control principals during specific maternity procedures (56.5%), (perineal care, catheter procedures(63.6%), dressing changes(67.3%), emergency medications iv infusion administration(41.8%), Cannulation(58.2%), blood transmutation(56.4%), Handling oxygen equipment(60%), Vital signs assessment(36.4%), Handling and brushes surgical instruments(74.5%), Neonatal Sepsis prevention by assessment(52.7%), care and dressing(54.5%)(p≤0.001)

Table (11): Distribution of the studied Nurses' practice of infection control precautions throughout observational check list for infection control in Operating and delivery room. (n=55)

	Pre				Post				Follow up				X^2	p.value
	Done		Not done		Done		Not done		Done		Not done			
	No	%	No	%	No	%	No	%	No	%	No	%		
Operating and delivery room														
Dry clean, Well ventilated, Containers are washable and cleanable, Items are stored properly, Sterile items within the expiry date and Solutions & multidose vials discarded as recommended	16	29.1%	39	70.9%	40	72.7%	15	27.3%	33	60%	22	40%	1.037	0.595
Scrub facilities are available & well located	23	41.8%	32	58.2%	33	60%	22	40%	30	54.5%	25	45.5%	1.537	0.464
Dirty instruments and waste are properly handled and transported	19	34.5%	36	65.5%	45	81.8%	10	18.2	38	69.1%	17	30.9%	53.910	<0.001
Single use items are not reused	30	54.5%	25	45.5%	49	89.1%	6	10.9%	22	40 %	28	50.9%	19.017	<0.001
Surgical instruments are not washed manually in the theatre	37	67.3%	18	32.7%	42	76.4%	13	23.6%	38	69.1%	17	30.9%	64.697	<0.001
Pre-operative skin antisepsis is achieved by the use of the proper antiseptic and being left over the skin for spontaneous drying.	38	69.1%	17	30.9%	39	70.9%	16	29.1%	27	49.1%	28	50.9%	8.785	0.012
Sharps wastes and needles are placed in a sharps container and Discard the used sharps object as soon as possible into the sharps container.	29	52.7%	26	47.3%	50	90.9%	5	9.1%	50	90.9%	5	9.1%	19.421	<0.001
HLD (high-level disinfected), surgical and disposable gloves of good quality	23	41.8%	32	58.2%	42	76.4%	13	23.6%	40	72.7%	44	80%	43.934	<0.001
Total		48.9				77.3%								

Table (11): the results was concerned with the highly statistically significance of practice level regarding Operating and delivery room (77.3%) (p≤0.001)

Table (12): Distribution of the studied Nurses' practice of infection control precautions throughout observational check list for infection control in Labor first stage room & high-risk pregnancy unit and Medication room and med. Charts (n=55)

	Pre				Post				Follow up				X^2	p.value
	Done		Not done		Done		Not done		Done		Not done			
	No	%	No	%	No	%	No	%	No	%	No	%		
Labor first stage room & high-risk pregnancy unit														
Sterile solutions are dated when opened and disposed of within 24 hours	41	74.5%	14	25.5%	36	65.5%	19	34.5%	33	60%	22	40%	42.950	<0.001
waste bag covered , labeled waste bin and	40	72.7%	15	27.3%	41	74.5%	14	25.5%	25	45.5%	30	54.5%	23.153	<0.001
red bags for medical waste	34	65.4%	18	34.6%	38	69.1%	17	30.9%	34	65.4%	18	34.6%	37.731	<0.001
enough antiseptic solutions to follow the IP protocol (Enzymatic decontamination detergent/ solution, liquid detergent for cleaning, and chloride solution for surface cleaning	23	41.8%	32	58.2%	37	67.3%	18	32.7%	29	52.7%	26	47.3%	.624	0.732
liquid soap or any kind of hand washing disinfectant solution	22	40%	33	60%	44	80%	11	20%	36	65.5%	19	34.5%	26.573	<0.001
Total		58.9%				71.3%								
Medication room and med. Charts														
Syringes/sharps are disposed of in-impervious container	25	45.5%	30	54.5%	33	60%	22	40%	21	38.2%	34	61.8%	3.201	0.202
Internal and external medications are stored separately and properly	22	40%	33	60%	30	54.5%	25	45.5%	28	50.9%	27	49.1%	2.307	0.316
Medication room and charts are clean	38	69.1%	17	30.9%	32	58.2%	23	41.8%	40	72.7%	15	27.3%	57.024	<0.001
Refrigerator is clean	30	54.5%	25	45.5%	43	78.2%	12	21.8%	27	49.1%	28	50.9%	35.232	<0.001
Supplies and equipment are stored above floor level	41	74.5%	14	25.5%	49	89.1%	6	10.9%	42	76.4%	13	23.6%	76.776	<0.001
Sterile solutions are dated when opened and disposed of within 24 hours	49	89.1%	6	10.9%	51	92.7%	4	7.3%	42	76.4%	13	23.6%	95.738	<0.001
Total		62.1%				72.1%								

Table (12): the results was concerned with the highly statistically significance of practice level regarding

Labor first stage room & high-risk pregnancy unit (71.3%) and Medication room and med. Charts (72.1%) (p≤0.001)

4. DISCUSSION

As noted by **fleming et al, (2016)**, nursing knowledge is continually increasing in amount and complexity which leads to exposed of nursing trainees to vast amount of reading and study. The result is that they do not know how to study effectively and resort to the traditional study method which based on rote memorization rather than meaningful learning and from that, the trainees considers the different concepts as isolated elements of knowledge. This lack of integration may be the main reason for difficulties in concept formation and application of acquired knowledge.

Also **Nian-Shing et al., (2018),** focus on the point that clear as the traditional method might lead to temporary reward; most information is forgotten with 4-6 weeks and is often accompanied by negative feelings. Thus, using of mind mapping as a study tool to build explicit links and relations between concepts can help trainees to teach more meaningfully.

The current study aim to assess the effectiveness of mind map to improve nurses' performance regarding infection control at obstetric and gynecological departments

Regarding the distribution of the studied nurses socio-demographic characteristics, nearly the majority of studied nurses were in young age group (≤ 25 years), As regards experience groups, about half of them had experience (6 – 14 years), and more than quarter of studied nurses had experience less than or equal 5 years, nearly half of them had level of education (secondary school or a technical diploma) and the majority of them were married.

This finding was agreement **with Rasha G. M. , Olfat Abd E. Sh. & Moggeda M. (2019)**The present studies observed that the majority of studied nurses were at the age group from 20 to 30 years old, females, technical nursing institute, and most of them had years of experience less than five years.

This result was in the same line with **Considine et al., (2016)** it means when the nurses' experience and qualification increase or if the nurses had training course on their favorable knowledge also improves.

The results of the exciting study detected that total score of nurses' knowledge about infection control application was poor before implementation of the teaching sessions, in researcher point of view this may be due to nurses didn't receive previous training program about infection control as no pre-employment orientation program, insufficient number of nurses and lack of instructions. Also may be due to lack of updating information, and this might be due to the fact that basic education was not incorporated into either diploma or degree curricula. On the other hand, Egyptian nurses, particularly those works in bedside care are overworked because of the nursing shortage in the nursing staff. Therefore, they have limited time to enhance their knowledge about critical care.

More over all studied nurses were satisfactory level of knowledge after implementation of teaching sessions, in researcher opinion for significant improvement in nursing staff knowledge after application of teaching sessions about infection control application.

According to **Kanki, (2019)** reported that each organization and profession must set standards and objectives to guide individuals and practitioners in performing safe and effective care. Also not only must standards exist, but leader and managers also must see that subordinates know and understand the standards and employee must be aware that their performance will be measured in terms of their ability to meet the established standards.

In this respect, **Nehls et al., (2016)** mentioned that nurses must be able to expand their knowledge in this area through ongoing education, journal, and seminars. Consequently, teaching programs for nursing staff constitute an important part.

As well **Skees, (2015)** stated that; intended for professional nurses, continuing education is essential to safe and effective nursing care. The amount of knowledge required to take care of critically ill patients cannot be obtained simply through experience on the unit or at the bedside. In this respect **Zhao et al., (2016)** indicated that to improve retention theoretical knowledge is needed and to achieve better outcomes frequent theoretical and practical training are needed and give a chance to repeat the difficult parts of the sessions.

The WHO (2020) document on transforming and scaling up health professionals' education and training further reiterated the inadequacies of the current health workforce, both in terms of numbers and in their educational preparation.

The results of the exciting study detected that total score of nurses' practices about infection control about all studied nurses was poor before implementation of the teaching sessions; more over all studied nurses had satisfactory level of practices after implementation of teaching program regarding hand washing, limit infection in obstetrics' operating room and waste management . This in the same line with **Fathimath et al., (2016)** who mentioned that; regarding practices result of pretest indicates that the level of practices significantly increase with the level of education but effects of an educational program make the correlation not significant in posttest. In the light of the study of **Vargas et al., (2015)** the nurses lack the efficiency of updating their practice after being and settled in the clinical environment for a longer time and possible explanation for this finding is that the workload.

In this respect **Slater et al., (2018)** who reported that teaching sessions for nursing staff play an important role in assist in staff nurses in developing and enhancing their skills needed to provide high standards of care to their patients. This agreed with the present study as nurse's knowledge and practice improved after implementation of the nursing educational program. This in the same line with **Koo et al., (2016)** their study revealed that an improvement in nurses' practice after the attendance at continuing nursing education sessions. Research findings indicated that continued nursing education programs increase knowledge, practice and can also improve attitudes. In this respect **Mahmoud et al., (2016)** reported that teaching programs for nursing staff constitutes an important part. These programs are urgently designed to assist staff nurses in developing and enhancing their skills needed to provide high standards of care to their patients. This agreed with the present study as nurse's knowledge and practice improved after implementation of the nursing intervention.

This was not supported by **Blanton et al., (2018)** who mentioned that; knowledge and practice of health care providers were nearly not in the same level, **Gijare, (2021)** who reported opposite results regarding correlation between knowledge and practice, there was no correlation between knowledge and practice. As well **Askarian, McLaws, & Meylan, (2017)**had research titled as**" Knowledge, attitude and practices related to standard precautions of surgeons and physicians in university- affiliated hospitals of shiraz, Iran"** who found that there was no correlation between knowledge and practice. Generally the present study concluded that; the nurses' knowledge and practice need an improvement as the sample was different, so the study aim was achieved this in the same line with **Phillips et al., (2019)** who reported that; there is a no need to improve nurses' knowledge and practices related to infection control.

The previous finding was supported by **Cunningham, (2015)** conducted a user study in which 80% of the trainees thought "mind mapping helped them understand concepts and ideas in science".

It enables students and staff members to link stories through patterns, keywords, or symbols. Moreover, mind mapping can be used in self-learning; it facilitates the performance of a conceptual understanding of a huge amount of information, integrating concepts together, as well as promoting inquiry and reflection**,** and helps bridging the gap between theory and clinical competence. It can be integrated in problem-based learning **(Thomas et al., 2016).** It was even recently used in the conduction of systematic reviews and in biomedical research as well with related software programs. **(Pombo et al., 2017), (Jiang et al., 2016)** and **(Mammen, 2016; Wilson et al., 2016)**

Farrand et al., (2020) found that spider diagrams (similar to mind maps) had limited, but significant, impact on memory recall in undergraduate students as compared to preferred study methods. This improvement was only robust after a week for those in the diagram group and there was a significant decrease in motivation compared to the subjects' preferred methods of note taking. A metastudy about mind mapping concluded that mind mapping is more effective than "reading text passages, attending lectures, and participating in class discussions".

The same study by **https://en.wikipedia.org, (2020)** also concluded that mind mapping is slightly more effective "than other constructive activities such as writing summaries and outlines". However, results were inconsistent, with the authors noting "significant heterogeneity was found in most subsets". In addition, they concluded that low-ability students may benefit more from mind mapping than high-ability students.

Abdel Hamid.A.G,(2017) document that, in medical education, mind maps enable the student to better integrate information so that it is better organized. This results in the better recall of information.

As home care agencies look for new ways to achieve patient outcomes and staff competencies in a cost-effective manner, Mind Map is a method that can be used to quickly organize patient and staff education while evaluating the learner's comprehension of critical information. **Lippincott Williams & Wilkins, (2020)**

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Supporting the previous results by **Bawaneh, A. (2019)** the recommendation of the study was regarding using of mind mapping as the majority recommend to integrate mind map during their training and using it in workshops, also to be part in the clinical work, while a little number of the sample recommend the using of an exciting teaching methods to have information.

Buzan and Buzan (1996) identified that mind mapping promotes the use of radiant or central thinking to enhance the multiplicity of the brain. Mind mapping helped to explore the concept and its key associations in an organized, colorful, vibrant, and logical manner. While developing the mind maps, it found that its exploring the concept of critical thinking by reflecting how it makes patient care decisions in the clinical setting. Similarly, **Picton (2019)** found that using reflection enhanced the students' ability to describe their critical thinking process and demonstrate the concept in a graphic format. **Picton (2019)** also noted that mind mapping can be used to illustrate pathways that encourage reflection on patient care.

Mind maps also organize the relationships, and link between ideas and information. This makes it easier for studied sample to remember information and ideas for both immediate achievement and retention **Al-Otaibi, (2016); Hariyadi, Corebima, and Ibrohim, (2018).** In the same context, mind maps allow students to see the whole picture of the subject and increase the chance to remember ideas and information **Awajan,(2016); Balım, (2015)**. In addition, these maps are very rich in images, drawings, and shapes with different and attractive colors. Thus a mind map produces the best ways to transfer and remember knowledge and information. 90% of the inputs of the brain originate from the sense of visual sources, where the brain has an automatic response to the symbols and images that have a significant influence on recalling ideas and information.

These results are consistent with the results of some other studies as **Akinoglu, and Yasar (2017)** a study titled **"The Random-Map Technique: Enhancing Mind-Mapping with a Conceptual Combination Technique to Foster Creative Potential" and Balım (2016)** emphasized the importance of mind maps in improving studied sample' achievement and understanding concepts.

The study of **Harkirat (2015)** emphasized the importance of using mind mapping in teaching and enhancing studied sample' perceptions as well as their ability to translate information and ideas in an organized, coherent and comprehensive manner. This was confirmed by **Ackerman and his colleagues (2016)** who demonstrated the role of mind mapping in studied sample' assimilation, information, application of dispensed concepts and long-life learning retention. Nevertheless, **Wickramasinghe (2017)** a study titled "**Effectiveness of Mind Maps As A Learning Tool for Medical students** " did not find significant statistical differences between the use of mind mapping and the conventional method for medical students at the University of Colombo in Sri Lanka even though who studied mind mapping suggested that it was a useful way to summarize and remember information as the sample was different. This result was somewhat consistent with the results of **Farrand, Hussain, and Hennessy (2016)** Their findings was that the studied sample who studied under mind mapping, did not prefer it at all, against the present study as the results have high significance of satisfaction, were more reluctant to adopt it. This was evidenced by their diminished motivation for learning compared with who studied in the traditional way. In the same context, the result was not consistent with that of the **Trevino (2015)** aimed at investigating the effect of the use of mind maps. The results indicated that there were no statistically significant differences between the mind maps strategy and the traditional method. While mind mapping was its flexibility. The researchers' observations indicated that it can be used to help an individual trainee, group of nurses and nursing supervisors to improve work activity such as topics of the current study (infection control which is very broad topic). It can be used in any type of activity or any stage of work; thus, maps can be narrow or broad in scope, depending on the time of work or topic of the activity. When needed staff nurse can construct the maps in a very short period of time (an average of 15 to 20 min.), with little instruction and they can receive feedback, either from the head nurse or other staff members, on the spot very quickly.

Regarding the relation between gender and nurses' performance using traditional and mind mapping method, the current study didn't revealed results as all sample was females as the maternity nurses were all females. So, the significant interaction between mind mapping and gender can be interpreted in light of the cognitive style theory that categorizes females into same learning style.

The current study showed that there is a high statistical significance between staff nurses' performance and their previous level of education, as the nurse' performance of previous bachelor degree of nursing who work as high qualified nurse or nursing supervisor using mind mapping method exceeded those of previous nursing technical institute of nursing education and work as bedside nurse who exposed to the same training strategy.

According to findings of the current study showed that there is a statistical significance between the using of mind mapping and nurses' performance, the results agreement with **Martin Davies (2020)** who concerning the relation between knowledge regarding mind mapping and staff nurses performance, that the performance of the study sample that has theoretical knowledge about the mind mapping was highly statistical significance. It could be explained by that well understanding of mind mapping strategy provides opportunity for active involvement of nurses in their training process.

This result was agreement with the study done by **Ilkay Culha (2019)** conducted a study entitled " Active learning methods used in nursing education " the study mentioned that active learning methods and models are frequently used in educational sciences. Although the use of these methods in nursing education has increased recently, the number of studies is insufficient. Study results in this review indicate that using active learning methods in nursing education provides positive cognitive, affective and psychomotor outcomes for nursing students. Therefore academician and nursing students should be supported for the use of these methods. Also, more studies are needed in theoretical and clinical practices.

Finally, the findings of the present study supported the implementation of educational sessions about infection control application using mind map success in improvement nurses' knowledge and performance about infection control.

5. CONCLUSION

Based on the findings of the present study results were supported research hypothesis which was:

Using mind map has a positive effect in improving nurses' performance regarding infection control at obstetric and gynecological departments and the results supported the research hypothesis.

6. RECOMMENDATIONS

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

- Integrating mind mapping strategy as a method of teaching to nurses applying infection control in their field of work.

- It is important to offer an initial workshop for infection control committee members from doctors and nursing supervisors regarding the theoretical and technical aspect of mind mapping and it is essential to provide ongoing formative and summative feedback.

- Educational program for working nurses need a different simple teaching strategies which respect and put into consideration their different age, duties and responsibilities.

- Asking University hospitals, MOHP and all health facility must set of 2 week/year for nursing training for every nurse in atmosphere free from duties in order to enhance nurses level of knowledge and performance.

Future Recommendations:

- Further researches are still needed to explore the barriers that confront implementation of mind mapping in infection control application.

- Topics such as infection control which have many sub-topics need simple teaching methods as mind map.

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