Effect of Metacognitive Program on Nursing Students' Academic Achievement

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Abstract

Metacognitive program can help nursing students to develop the skills needed to think critically and reflect on their own learning processes. The aim of this study was to assess the effect of metacognitive program on nursing students' academic achievement. Methodology: An experimental design was used to conduct the present study, at the faculty of nursing, Zagazig University. The sample included 70 nursing students in the fourth academic year divided into two equal groups; study and control group. Two tools were used for data collection; 1) Metacognitive Awareness Inventory 2) Student transcripts. Results: After the program implementation the highest nursing students in the study group had a significantly higher level of metacognition compared to those in the control group (80% & 11.42% respectively). Before the program implementation, the highest percentage of nursing students in both the study and control groups had low level of critical thinking (91.7% & 90.4% respectively). The nursing students in the study group who received the metacognitive training program had a significantly higher level of academic achievement compared to the control group. Conclusion: There was a significant improvement in nursing students' metacognition and academic achievement in the study group compared to the control group after the program implementation. Recommendations: Providing training courses to faculty members on how to develop students' metacognitive skills and play a role in modeling and coaching these skills. Adopting active learning strategies (case studies, reflections, simulations, group projects, and problem-solving activities) that require students to apply metacognitive skills.
Key words: Metacognitive program, Nursing Students, Academic Achievement

Introduction:

Metacognition refers to the ability to think about one's own thinking processes. It involves the awareness and understanding of one's own cognitive processes, such as attention, perception, memory, and problem-solving. Metacognition allows individuals to reflect on their own thinking, monitor their own learning, and make adjustments to their strategies as needed. It is a critical component of learning and problemsolving, as it enables individuals to approach complex tasks systematically and make informed decisions **(Blankenberger, & Henning, 2021; Roussel, Thomas & Harris, 2020).**

Metacognition is a cognitive process that involves thinking about one's own thinking and becoming aware of one's own cognitive processes and abilities. It is the ability to observe and reflect on one's own thoughts, feelings, and behaviors, and to use that information to improve one's learning, problem-solving, and decision-making abilities. Metacognition can be defined as a cognitive process that involves thinking about one's own thinking. It is the ability to reflect on one's own cognitive processes, such as knowledge, reasoning, truth, and justification, and to use that understanding to regulate and control those processes **(Guo, & Zhang, 2021).**

Metacognition involves a set of skills and strategies that enable individuals to monitor, control, and regulate their own thinking processes. These skills and strategies include planning, monitoring, evaluating, and adjusting one's own thinking. By being aware of their own cognitive processes and biases, individuals can make more thoughtful and deliberate decisions, leading to better outcomes in various contexts **(Schraw & Bruning, 2022; Liu & Zhang, 2021; Wang, & Johnson, 2021).**

Metacognitive skills refer to the cognitive processes that enable individuals to think about their own thinking and learning. These skills involve the ability to monitor, evaluate, and regulate one's own cognitive processes, such as attention, memory, and problem-solving. Metacognitive skills also include the ability to plan, set goals, and reflect on one's own performance **(Tofade, & Elsner, 2021).**

In the context of education and learning, metacognitive skills are critical for effective learning, as they enable individuals to approach tasks systematically, monitor their own progress, and make adjustments to their strategies as needed. In the context of nursing practice, metacognitive skills are essential for providing effective patient care, as they enable nurses to think critically and reflectively about patient care issues, identify potential problems, and develop effective solutions based on the best available evidence **(Flavell, 2020).**

Nursing students who possess metacognitive skills are capable of consciously focusing their attention on important information, accurately judging their level of understanding, using their intellectual strengths to compensate for weaknesses, and using appropriate strategies to correct errors. It is important to note that not all nursing students have the same ability to apply metacognition effectively to problem-solving and decisionmaking. However, metacognition can be taught, and as a result, critical thinking, self-directed learning, problem-solving, and decision-

making skills can be improved **(Haghighi, Pakpour & Khankeh, 2021; Hsu, Chang & Lee, 2020).**

Nursing academic achievement refers to the successful completion of nursing coursework and the attainment of knowledge and skills necessary for professional nursing practice. Metacognition has been shown to play a critical role in nursing academic achievement. Metacognitive strategies such as self-reflection and self-evaluation can significantly improve nursing academic achievement, particularly in areas such as clinical decision-making and patient care **(Broussard, White & Phillips, 2020).**

Metacognitive skills are positively correlated with nursing academic achievement, as they allow students to reflect on their own learning processes, identify their learning needs, and adjust their learning strategies accordingly. By developing strong metacognitive skills, nursing students can become more effective learners and problem-solvers, which can lead to improved academic outcomes and better preparation for professional nursing practice **(Kaddoura, 2020).**

Significance of the study:

Metacognitive skills can shift nursing education from a teacher-centered teaching to student-centered learning and promote nursing students self-directed learning readiness, critical thinking ability, autonomy, and professional identity. So, metacognitive skills help nursing students identify their strengths and weaknesses in problem-solving, critical thinking, self-directed learning leading to enhance their academic performance and prepare them for labor market.

Aim of the study

Assess the effect of metacognitive program on nursing students' academic achievement.

1. Identify nursing students' metacognition level before and after the training program implementation.
2. Determine nursing students' academic achievement level after the program implementation.

Research hypothesis:

1. Nursing students' metacognition level in the study group will be improved after the training program implementation.
2. Nursing students' academic achievement level in the study group will be significantly better than those in the control group.

Subject & Methods:

Research Design: An experimental design

Setting: Faculty of Nursing, Zgazig University

Subjects: A representative sample of the fourth-year nursing students; the required sample size was consisted of 70 nursing students. They were divided into two equal groups; 35 study group and 35 control group.

Tools of data collection:

Tool I: Metacognitive Awareness Inventory (MAI):

It was developed by **Schraw and Dennison in (1994),** to assess an individual's metacognitive awareness. It consists of two parts:

Part I: Personal characteristics data sheet for nursing students to collect data about their code no, age, gender, marital status and residence.

Part II: Consists of 52 statements representing two dimensions of metacognition. First dimension is "knowledge of cognition", includes three sub-dimensions: declarative knowledge (knowledge about self and strategies) 8 items, procedural knowledge (knowledge about how to use strategies) 4 items and conditional knowledge (knowledge about when and why to use strategies) 5 items. Th second dimension is "regulation of cognition", includes five sub-dimensions: planning (goal setting) 7 items, information management strategies (organizing) 10 items, comprehension monitoring (assessment of one's learning and strategy) 7 items, debugging strategies (strategies used to correct errors) 5 items and evaluation (analysis of performance and strategy effectiveness after a learning episode) 6 items.

Scoring system:

The responses of the items were measured by using 5–point Likert scale as follows: strongly agree (5), agree (4), neutral (3), disagree (2), and strongly disagree (1). Scores were ranging between 52 and 260. The total score was calculated and converted into percent score by dividing students total score by the maximum possible score then multiply by 100. In this study, metacognition level was considered;

- Low, if the score less than 55%.
- Moderate, if the score ranges from 55% to 82%.
- High, if the score more than 82%.

Tool II: Student transcripts:

Are official documents that provide a comprehensive record of a student's academic achievements over a period of time, typically a semester, academic year, or the entire duration of their program of study, are typically issued by educational institutions such as schools, colleges, and universities, and are used to document a student's educational progress and achievements. In this study, students' achievement in the exam scored according to the scoring system at the faculty of Nursing, Zagazig University as follows:

- Less than 60% is poor degree.

- The range from 60% to less than 65% is pass degree.

- The range from 65% to less than 75% is good degree.

- The range from 75% to less than 85% is very good degree.

- The range from 85% to 100% is excellent degree

Validity & Reliability:

The tools of data collection were tested for their content and face validity by a jury of three experts at the faculty of nursing, Zgazig University. The reliability of tools was tested by the author using Cronbach's alpha: Metacognitive Awareness Inventory = 0.923.

Pilot study:

A pilot study was carried out on 10% of nursing students (7) to test the tools feasibility, understandability and to estimate the time consumed for filling in the forms.

Administrative Design:

Official permissions were obtained from the dean of the faculty of nursing, Zagazig University to conduct the study.

Ethical Considerations:

The study was approved by the Ethics Research Committee at the Faculty of Nursing; Zagazig University. Oral and written consent were taken from subjects and reassured them about the confidentiality and anonymity of the study. They were informed about their right to refuse or withdraw from the study at any time.

Statistical Design

Data entry and statistical analysis were performed using computer software, the (SPSS), version 20. Suitable descriptive statistics were used. Paired test was used to compare between paired variable of normally distributed. The Chi-square test was used to detect the relation between the quantitative variables, correlation coefficient (r) test was used to estimate the close association between variables. P-values which were less than 0.05, 0.001 were considered as statistically significant and highly significant respectively.

Result:

Table (1) shows personal characteristics of nursing students in the study and control groups. It is clear from the table that the highest percentage of nursing students in the study and control groups were in the age group less and equal twenty-one years, female, single and residence in urban areas (68.6%, 62.5%, 74.3%, 77.1%, 91.4%, 85.7%, 80%, and 82.9%, respectively).

Table (2) shows metacognition levels of nursing students in the study and control groups throughout the program phases. It's clear from the table that the highest nursing students in both the study and control groups had low level of metacognition before the metacognitive skills training program implementation (82.9% & 85.71% respectively). However, after the metacognitive skills training program was implemented, the highest nursing students in the study group had a significantly higher level of metacognition compared to those in the control group (80% & 11.42% respectively).

Figure (1) displays nursing students' knowledge of cognition in the study and control groups throughout the program phases. It indicates that there was a significant improvement in the level of knowledge of cognition in the study group compared to those in the control group throughout the program phases. As, it is clear from the figure that the highest percentage of nursing students had low level of knowledge of cognition before program implementation in both the study and control groups (84% & 80%, respectively). Conversely, after the program implementation, the majority of nursing students in the study group (88%) had high level of knowledge of cognition compared to (6%) of nursing students in the control group.

Figure (2) displays levels of nursing students' regulation of cognition in the study and control groups throughout the program phases. It indicates that there was a significant improvement in the level of regulation of cognition in the study group compared to those in the control group throughout the program phases. As, it is clear from the figure that the highest percentage of nursing students had low level of knowledge of cognition before program implementation in both the study and control groups (84% & 83%, respectively). Conversely, after the program implementation, the majority of nursing students in the study group (79%) had high level of knowledge of cognition compared to (9%) of those in the control group.

Table (3) demonstrates nursing students' achievement level in the nursing administration course in the study and control groups. As shown from this table the majority of nursing students in the study group (97.1%) had excellent academic achievement level in the administration course, compared to slightly less than half of nursing students in the control group (45.7%), with a highly statistically significant difference between the study and control groups (P = < 0.001).

Table (4) shows relation between nursing students' metacognition in the study group and their personal characteristics throughout the program phases. It is clear from the table that there was no statistically significant relation between nursing students' metacognition in the study group and their personal characteristics throughout the program phases, where p value > 0.05.

Table (5) shows relation between nursing students' academic achievement level in the study group and their personal characteristics after the program implementation. It is clear from the table that there was no statistically significant relation between nursing students' academic achievement level in the study group and their personal characteristics after the training program implementation, where p value > 0.05.

Table 1: Personal characteristics of nursing students in the study and control groups (n=70).

Personal Characteristics	Study group (n=35)		Control group (n=35)		χ^2	p-value
	No	%	No	%		
Age (per years)						
≤21	24	68.6	23	62.5	0.00	1
>21	11	31.4	12	37.5		
Mean +SD	21.3±0.52		21.3±0.54			
Gender						
Male	9	25.7	8	22.9	0.078	0.78
Female	26	74.3	27	77.1		
Marital status						
Single	32	91.4	30	85.7	0.00	1
Married	3	8.6	5	14.3		
Residence						
Rural	7	20	6	17.1	0.00	1
Urban	28	80	29	82.9		

Table 2: Metacognition levels of nursing students in the study and control groups throughout the program phases (n=70).

Metacognition levels	Before the program				After the program			
	Control group (n=35)		Study group (n=35)		Control group (n=35)		Study group (n=35)	
	No	%	No	%	No	%	No	%
Low < 55%	30	85.71	29	82.9	25	71.42	2	8.6
Moderate 55%:82%	5	14.28	6	17.1	6	17.1	5	14.28
High > 82%	0	0	0	0	4	11.42	28	80

Table 3: Nursing students' academic achievement level in the nursing administration course in the study and control groups after the program implementation (n=70)

Academic achievement levels	Study group (n=35)		Control group (n=35)		χ^2	p-value
	No	%	No	%		
Excellent (85%:100%)	34	97.1	16	45.7	22.7	<0.001(HS)
Very good (75%: < 85%)	1	2.9	15	42.9	15.9	<0.001(HS)
Good (65%: < 75%)	0	0.0	4	11.4	F	0.11

χ^2 Chi square test   HS=Highly significant

Table 4: Relation between nursing students' metacognition in the study group and their personal characteristics throughout the program phases (n=35)

| Variables | Metacognition | | | | | |
| | Before the program | | | After the program | | |
	Mean ±SD	T	p-value	Mean ±SD	T	p-value
Age (years):						
≤21	8.6±2.5	0.303	0.587	23.6±2.4	0.563	0.406
>21	7.66±2.5	0.025	0.894	22.3±1.8	1.257	0.724
Gender:						
-Male	7.1±2.3	1.607	0.062	21.6±1.8	1.307	0.151
-Female	9.6±2.6	0.257	0.071	23.2±1.6	0.636	0.461
Marital status:						
Single	8.7±2.5	0.247	0.508	23.4±1.9	0.808	0.36
Married	7.5±2.1	1.607	0.062	21.6±1.8	1.307	0.151
Residence:						
- Rural	8.6±2.5	0.303	0.587	23.6±2.4	0.563	0.406
- Urban	7.66±2.5	0.025	0.894	23.2±1.6	0.636	0.461

Table 5: Relation between nursing students' academic achievement level in the study group and their personal characteristics after the program implementation (n=35).

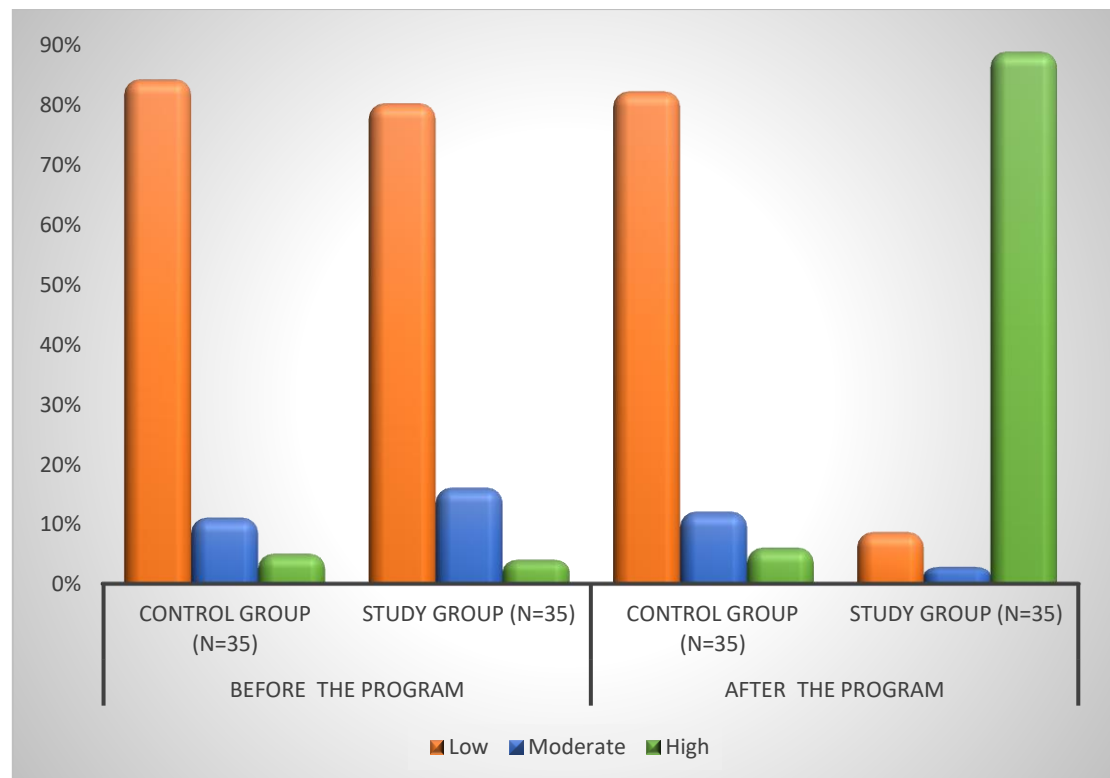| Personal characteristics | Academic achievement level | | No. | p-value |
	Excellent No (%)	Very good No (%)		
Age (years):				
≤21	24 (70.58)	1 (100)	25	0.397
>21	10 (29.41)	0	10	0.524
Gender:				
Male	12 (35.29)	0	12	0.572
Female	22 (64.70)	1 (100)	23	0.431
Marital status:				
Single	32 (94.11)	1 (100)	33	0.285
Married	2 (5.88)	0	2	0.319
Residence:				
Rural	16 (47.05)	0	16	0.592
Urban	18 (52.94)	1 (100)	19	0.274

Figure 1: Levels of nursing students' knowledge of cognition in the study and control groups throughout the program phases (n=70).
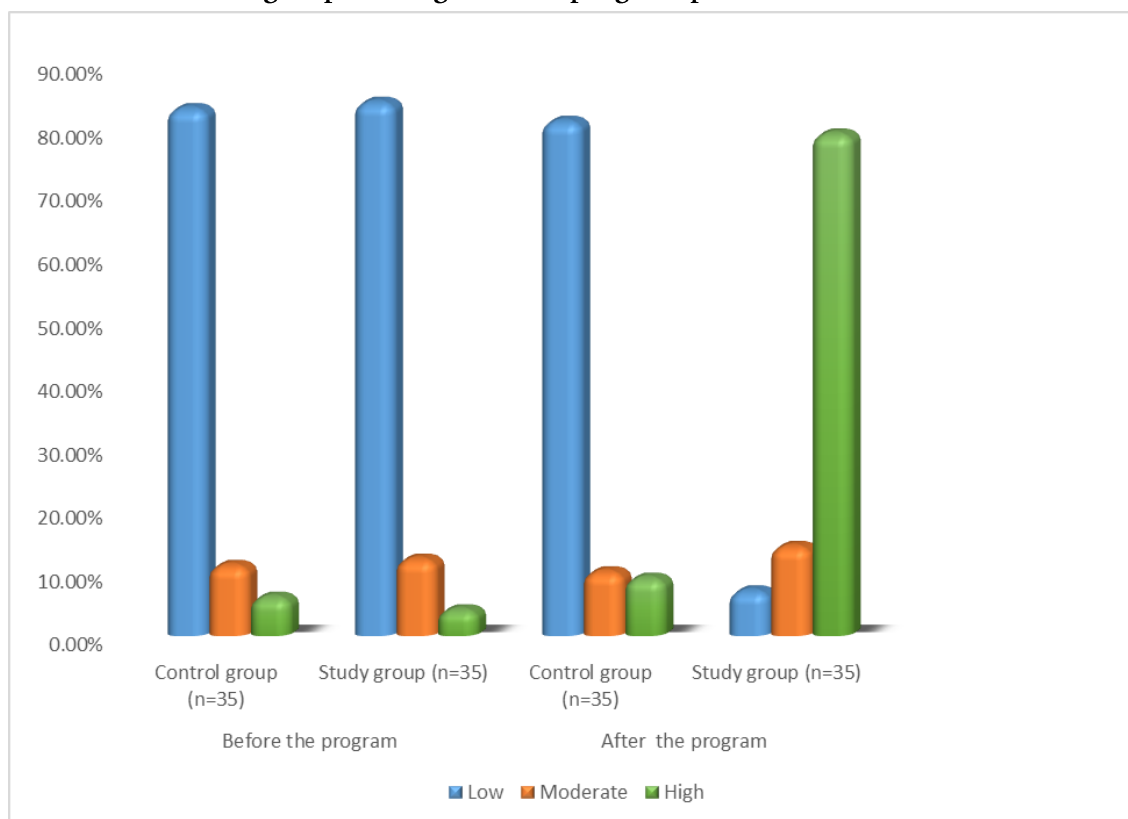

Figure 2: Levels of nursing students' regulation of cognition in the study and control groups throughout the program phases (n=70).

Discussion:

Regarding to personal characteristics of the nursing students in the study and control groups, the findings of the present study showed that the highest percentage of nursing students were female. This may be due to that entering of male to nursing faculties is recent in Egypt in general and Zagazig University particularly. In addition, the community vision of nursing career as a female impression make restriction on male students to enter the faculty of nursing. Nursing has historically been a female-dominated profession, and women continue to make up the majority of nursing students. Also, there are several factors that contribute to the gender imbalance in nursing. One factor is societal expectations and gender roles, which have traditionally placed a greater emphasis on caregiving and nurturing roles for women. Additionally, nursing has often been portrayed as a "feminine" profession, which may discourage men from pursuing careers in nursing.

This finding agreed with **El-Guindy et al., (2022),** who carried out a study to determine metacognition and mindfulness and its relation to decision making abilities and found that the highest percentage of participants were females. In the same line, **Chan, Yen, & Ting (2021),** who assessed generic capabilities and metacognitive awareness of first-year nursing students and found that the majority of nursing students were female.

Also, **Jin and Ji (2020),** who conducted a study to examine the correlation of metacognitive ability, self-directed learning ability and critical thinking in nursing students and reported that most of nursing students were female. Likewise, **Hind, Awatef, Hanan (2019),** carried out a study in Egypt to assess nursing students' perspective of metacognition competency, self-regulation, and problem-based learning strategy and found that most of nursing students were females.

Metacognition level of nursing students in both the study and control groups throughout the program phases

The findings of the present study revealed that the nursing students in both the study and control groups had a low level of metacognition before the training program implementation. However, after the metacognitive training program was implemented, the nursing students in the study group had a significantly higher level of metacognition compared to those in the control group. This was likely due to the fact that the program provided actual practice and instruction on metacognitive strategies and skills, which helped the nursing students in the study group to better understand their own knowledge and improve their problem-solving, self-assessment, and self-correction capabilities.

Also, this may be due to before the implementation of the program the nursing students did not have any idea regarding metacognition. While, the metacognitive skills training program implementation enrich the knowledge of nursing students in the study group regarding

metacognition than those in control group. The finding that the highest percentage of nursing students in the study group had a high level of metacognition after the program implementation is consistent with the goal of metacognitive training program, which is to help students develop their metacognitive skills and the fact that the control group did not show the same improvement suggests that the program was effective in promoting metacognitive development among nursing students.

The current study findings were consistent with a study carried out by **Li et al., (2022)**, to examine the effect of a nursing comprehensive skill training course on nursing students' metacognitive awareness and concluded that the training program had a significant positive effect on the nursing students' metacognitive awareness. Also, these findings in the same line with a study carried out by **Li & Yuan (2022),** to assess the effectiveness of a metacognitive intervention on enhancing students' metacognitive development and reported that the metacognitive intervention had a significant positive effect on the students' metacognitive development and the students reported higher levels of metacognitive skills and use of metacognitive strategies after the intervention.

Similarly, these findings agreed with **Yıldırım (2021),** who carried out a study to investigate the effect of metacognitive training on the metacognitive awareness of nursing students and found that the nursing students in the study group had a significantly higher level of metacognitive awareness compared to the control group after the intervention. Also, **Karabacak & Karadağ (2021),** conducted a study to examine the effect of metacognitive training on nursing students' metacognitive awareness and found that the nursing students in the study group had a significantly higher level of metacognitive awareness compared to the control group after the intervention.

Nursing students' knowledge of cognition domain of metacognition throughout the program phases in the study group.

As regarding knowledge of cognition domain of metacognition, the current study findings showed that the nursing students in the study group demonstrated a significant improvement in their knowledge of cognition after the metacognitive training program compared to those in the control group. These findings were in agreement with **Mok and Li (2021)**, who conducted a study to examine the effects of metacognitive training on metacognitive knowledge and found that the metacognitive training had a significant positive effect on the students' metacognitive knowledge and the students of the study group showed greater improvement in their metacognitive knowledge than the control group.

Also, **Chen, Zhang & Zhang (2021)**, who conducted a study to examine the effects of metacognitive training on self-regulated learning and metacognitive knowledge of nursing

students and the results of the study showed that the metacognitive training had a significant positive effect on the students' metacognitive knowledge. Likewise, **Wu et al. (2021),** who conducted a study to investigate the effects of metacognitive strategy training on metacognitive knowledge and self-regulated learning strategies among nursing students and concluded that a metacognitive training program improved nursing students' metacognitive knowledge.

Regarding nursing students' regulation of cognition in the study and control groups throughout the program phases

The study findings showed that there was a significant improvement in the level of regulation of cognition in the study group compared to those in the control group throughout the program phases. As, the highest percentage of nursing students had low level of metacognitive regulation before program implementation in both study and control groups. However, after the program implementation, the majority of nursing students in the study group had high level of metacognitive regulation compared to the control group.

These findings may be attributed to that the training program provided the nursing students in the study group with the requirements knowledge and skills to be able to monitor, regulate, adjust their cognitive processes, evaluate the knowledge, proficiency and performance in order to increase their ability to skillfully plan and implement activities in their learning. In addition, the training program enabled nursing students to organize their time, pace themselves enough time during making decision, consciously focus attention on important information, consider several alternatives to a problem before they answer, ask themselves periodically if they are meeting their goals, re-evaluate their assumptions when get confused and ask themselves how well accomplish their goals once they finished.

These findings were in agreement with a study carried out by **Li et al. (2022),** who conducted a study to examine the effect of a nursing comprehensive skill training course on nursing students' metacognitive awareness and concluded that the majority of the study group of nursing students had high level of regulation of cognition after the program implementation compared to the control group. Also, a study carried out by **Milliner & Dimoski (2021),** to explore the metacognitive regulation of nursing students and concluded that the majority of the study group of nursing students had significantly higher levels of metacognitive regulation.

Likewise, **Kopp et al. (2021),** who conducted a study to investigate the effect of a metacognitive training program on self-regulated learning and academic performance in medical students and found that the medical students who received the metacognitive training program had significantly higher levels of metacognitive regulation than those who did not receive the training program. Similarly, a study carried out by **Li et al. (2021),** in China to investigate the effect of a metacognitive training program on the metacognitive ability of college students and showed

that the college students of the study group had significantly higher levels of metacognitive regulation than the control group.

Nursing students' academic achievement in the study and control group after the program implementation

The result of the current study revealed that the nursing students in the study group who received the metacognitive training program had a significantly higher level of academic achievement compared to the control group. This suggests that the program was effective in promoting the development of critical thinking skills and self-directed learning among nursing students, which in turn led to improved academic achievement.

One possible explanation for these findings is that the metacognitive training program may help nursing students to develop their metacognitive skills, such as self-reflection, self-monitoring, and self-regulation. These skills can be important for academic achievement, as they help students to identify areas for improvement, manage their time effectively, and regulate their own learning. Additionally, the metacognitive training program may have provided nursing students with new strategies for learning and problem-solving. By teaching students how to use metacognitive strategies, such as setting goals, planning and implementing learning activities, and evaluating their own progress, the program may have helped students to become more effective learners and problem-solvers.

These findings of the current study were agreement with **Alshahrani et al. (2022),** who conducted a study in Saudi Arabia to investigate the effect of a metacognitive intervention on academic achievement among nursing students and clarified that the nursing students in the study group had significantly higher GPAs compared to the control group. As well, **Alomari et al. (2022),** conducted a study in Jordan to investigate the effect of a metacognitive intervention on academic achievement among nursing students and founded that the nursing students who received the metacognitive intervention had significantly higher GPAs compared to the control group. Likewise, **El-Ghany et al. (2021),** conducted a study in Egypt to evaluate the effect of a metacognitive intervention on academic achievement among nursing students and found that the nursing students who received the metacognitive intervention had significantly higher GPAs compared to the control group.

Additionally, the findings of the current study were matched with a study carried out by **Shin & Park (2021),** to investigate the effect of a metacognitive training program on self-regulated learning and academic performance in nursing students and reported that the nursing students who received the metacognitive training program had significantly higher levels of academic performance than those who did not receive the training program. Moreover, a study carried out in Iran by **Amini et al. (2021),** to investigate the effect of a metacognitive intervention on

academic achievement among nursing students and the results revealed that the nursing students in the study group had significantly higher academic achievement scores compared to the control group.

In the same line, **Ammar et al. (2021),** conducted a study in Lebanon to evaluate the effect of a metacognitive intervention on academic achievement among nursing students and reported that the nursing students in the study group had significantly higher GPAs compared to the control group. Likewise, these findings were in accordance with a study carried out in Saudi Arabia by **Alqahtani et al. (2021),** to investigate the effect of a metacognitive intervention on academic achievement among nursing students and the results showed that the nursing students in the study group had significantly higher GPAs compared to the control group.

Similarly, these findings were consistent with a study carried out in Korea by **Kim et al. (2021),** to investigate the effect of a metacognitive training program on academic achievement among nursing students and revealed that the nursing students in the study group had significantly higher GPAs compared to the control group. Additionally, **Yoo & Kim (2019),** conducted a study in Korea to investigate the effect of a metacognitive training program on academic achievement among nursing students and found that the nursing students in the study group had significantly higher academic achievement scores compared to the control group.

Relation between nursing students' metacognition in the study group and their personal characteristics throughout the program phases.

The current study findings revealed that, there was no statistically significant relation between nursing students' metacognition in the study group and their personal characteristics throughout the program phases. This might be due to that the personal characteristics examined in the study, such as age, gender, residence, and marital status, may not be strongly related to metacognitive skills. There may be other personal characteristics, such as motivation, self-efficacy, and learning style, that are more strongly related to metacognitive skills but were not examined in the study.

These findings of the current study disagreed with a study carried out by **El-Sayed & El-Mekawy (2021),** to investigate the relationship between metacognitive skills and critical thinking among nursing students and found that there was a significant positive correlation between metacognitive skills among nursing students in the study group and their personal characteristics such as age, gender, and academic level. Also, **Orhan & Dicle (2021),** conducted a study to examine the relationship between metacognitive skills and academic achievement of nursing students and found a significant positive relationship between metacognitive skills and their personal characteristics such as age, gender, and academic level.

As well, these findings were inconsistent with **Chong et al. (2020),** who carried out a study to develop metacognitive awareness and skills in undergraduate nursing students and found that

personal characteristics such as age and academic level were significantly related to metacognitive awareness and skills among nursing students. Likewise, **Al-Sayed & Al-Hamdan (2021),** conducted a study to determine the relationship between metacognitive skills and academic achievement among nursing students and found a significant positive relationship between metacognitive skills among nursing students in the study group and their personal characteristics such as age, gender, and academic year.

Relation between nursing students' academic achievement in the study group and their personal characteristics.

The current study findings revealed that there was no statistically significant relation between achievement score of nursing students in the study group and their personal characteristics after the program implementation. This might be due to nursing education is a multifaceted process that involves a range of factors that can influence achievement. Personal characteristics such as age, gender, and academic level are important factors that can impact achievement, but they are not the only factors that influence success in nursing education.

Nursing education is a complex process that involves a range of factors that can influence achievement, and personal characteristics may only be one piece of the puzzle. Also, the measures of personal characteristics such as age, gender, and academic level may not have been sensitive enough to capture the full range of individual differences among nursing students and may not fully capture other important factors that could influence achievement, such as motivation, learning style, self-efficacy, academic preparation, study habits, and clinical experience.

These findings of the present study were incongruent with **Pinquart and Ebeling (2020),** who conducted a study at Philipps University in Germany to examine the expected and actual academic achievement of students and found that there was statistically significant relation between students' age and their achievement. As well, these findings were in disagreement with **Al-Imam (2018),** conducted a study in Saudi Arabia to investigate the relationship between personality traits and academic achievement of nursing students and found that there was a significant positive correlation between nursing students' academic achievement and the personality traits of openness and conscientiousness.

Likewise, these findings were inconsistent with **Tiew & Creedy (2017),** who conducted a study in Malaysia to investigate the relationship between academic achievement and personal characteristics in nursing students and found that there was statistically significant relation between achievement score of nursing students and their age, level of self-efficacy and attitude towards learning.

Conclusion:

In the light of the main study findings, it can be concluded that there were statistically significant improvements regarding nursing students' metacognition and academic achievement levels after metacognitive program implementation in the study group than control group. In addition, there were a statistically significant correlation between metacognition and academic achievement after implementation of the training program.

Recommendations:

- Providing training courses to faculty members on how to develop students' metacognitive skills and play a role in modeling and coaching these skills.
- Providing resources, guidance and support for faculty members to incorporating metacognitive strategies into their teaching and clinical supervision.
- Adopting active learning strategies (case studies, reflections, simulations, group projects, and problem-solving activities) that require students to apply metacognitive skills.
- Developing resources like worksheets and guidelines to guide students in their development of metacognitive skills.
- Encouraging peer coaching and support for developing metacognitive skills by organizing groups, workshops and discussion boards.
- Evaluating students' metacognitive skills at the program level using surveys and interviews to evaluate the impact of their training programs.
- Conducting research to identify best practices for teaching metacognition in a nursing context.
- Working to ensure that developing graduates' metacognitive skills becomes a recognized priority and standard in nursing education.

Further Research

- Conduct research across multiple nursing colleges and programs to gather data on a larger scale.
- Explore the impact of metacognitive skills training on specific nursing competencies and outcomes.
- Compare the effectiveness of different pedagogical approaches to teaching metacognition, such as case-based learning, reflective journaling, role plays, and simulations.
- Investigate the long-term impact of metacognitive skills training on nursing practice.
- Examine how metacognitive skills training affects different types of nursing students, such as those from diverse backgrounds, different levels of programs, and online versus traditional programs.
- Study the role of nursing faculty in developing students' metacognitive skills.
- Explore the potential links between metacognitive skills training, resiliency and stress management in nursing students.

- Consider both qualitative and quantitative methodologies, mixed methods research combining interviews, surveys and tests to provide a comprehensive view of metacognition in nursing education.
- Study how metacognitive skills training impacts clinical outcomes and patient safety.

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