Nursing Students' Perspective of Metacognition Competency, Self-Regulation, and Problem-Based Learning Strategy

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Abstract

Background: Metacognition is a vital skill in critical thinking, self-regulation, problem solving, and lifelong learning for nursing students. ***Aim:*** The study attempted to explore the relation between metacognition competency, self-regulation, and problem-based learning strategy from a nursing students' perspective. ***Material and methods:*** A descriptive correlational research design with a convenience sample of 371 nursing students from four levels was used at Port Said University's Faculty of Nursing. ***Data collection tools*** The Self-administered Questionnaire of the Metacognitive Strategies Inventory, the Learning Self-Regulation Questionnaire, and the Problem-Based Learning Approach Perception Questionnaire. ***Results:*** Only a small percentage of the studied nursing students demonstrated high levels of metacognition competency, self-regulation, and problem-based learning perception (23%, 21.1%, and 20.2%, respectively). Furthermore, a statistically significant correlation between problem-based learning and self-regulation skills was discovered. ***Conclusion:*** There was a highly statistically significant positive correlation among metacognition competency, self-regulation skills, and problem-based learning strategies. ***Recommendations:*** Educational programs can help nursing students improve their metacognition competency and self-regulation skills. Furthermore, more research in this area is suggested to identify factors influencing the problem-based learning approach.

Key words: Metacognition competency, Nursing students' perspective, Problem-based learning, Self-regulation.

Introduction

Metacognition is a key component of several skill sets that are essential in education. Reflective judgment, critical thinking, decision making, and problem solving are included in metacognition, and the success of courses and overall performance is frequently influenced by learning strategies used by students during classroom lessons as well as at home learning. As a result, students who have strong metacognitive skills are better critical thinkers, problem solvers, and decision makers than those who do not **(Takácová, 2016)**. Metacognition is defined as consciousness of one's own thinking, which is concerned with controlling, supervising, and regulating other cognitive processes. In fact, metacognition includes the ability to reflect on what is known, analyze what is taught, solve what is analyzed, and apply what is learned **(Tosun & Senocak 2013).**

Martinez (2006) identified two main components of metacognition: metacognitive knowledge and metacognitive control. Metacognitive knowledge encompasses practical knowledge, declarative knowledge, and provisional knowledge. According to **Veenman, Van Hout-Wolters, and Afflerbach (2006),** practical knowledge refers to knowing how to perform a task successfully and how to do it. Declarative knowledge, on the other hand, refers to an individual's awareness of whether he or she is capable of performing a specific task or duty on his or her own. In the meantime, **Garner (1990)** asserted that provisional knowledge refers to meaningful when and why to use declarative and practical knowledge. **Ozturk (2016)** defined metacognitive control as metacognitive strategies comprised of mental processes such as predicting, planning, monitoring, and evaluating that aid students in their own learning.

When metacognition is activated in hard tasks, it increases the use of overall strategies such as task analysis, problem representation, prediction, planning, monitoring, checking, reflection, and success evaluation. The use of metacognitive strategies in the classroom

allows students to be more sensitive in understanding a problem and make fewer errors during the learning process, improving their self-regulation skills and self-confidence. On the other hand, a lack of metacognitive ability prevents students from not only succeeding academically, but also from engaging in the self-regulated learning necessary to become lifelong learners capable of adapting to any learning situation **(Hidayat, Zulnaidi, & Syed Zamri, 2018).**

Self-regulated learning (SRL) is an active, constructive process in which learners define learning goals and then seek to monitor, regulate, and control their thoughts, motivation, and behavior, guided and restrained by their goals and environmental contextual factors. As the individual's self-regulatory behaviors develop, they will require assistance, scaffolding, and explicit teaching. "Goal directed engagement" is a technique for teaching and learning self-regulation. Learners who are trained in self-control skills and fortified to analyze their work through replication and the setting of learning goals can build individual techniques that will help them advance their learning **(Oates, 2019).**

Above all, **Filho, Lima, and Bruni (2015)** stated that three components of SRL appear to be very important. The first and most significant component is that SRL includes those meta-cognitive strategies that students use to plan, monitor, and re-organize their thoughts. The second critical component is the students' ability to manage and control their attempts to complete curricular and academic assignments. The third component consists of the cognitive strategies (rehearsal, elaboration, and organization) that students employ to learn, recall, and completely understand curricular ideas.

Students must have a problem-based learning method (PBL), directed by teachers who always offer spirit and reward when they ask questions and find their own solutions to genuine problems, in order to become autonomous learners and self-regulatory **(Surya, Syahputra, & Juniati, 2018).** The problem is encountered chiefly in the learning process, and it acts as an emphasis or incentive for problem-solving or cognitive skills, as well as for the exploration of information needed to grasp the problem's mechanisms and potential solutions **(Sarathy, 2018).** As a result, PBL arose as a novel response to the issues that contemporary medical education faced in terms of the quality of student results and readiness for practice **(Hamdan, Kwan, Ghafar & Sihes, 2014).**

PBL is an active teaching strategy that permits students to take the lead and become responsible for their own learning. It also allows students to collaborate and develop the ability to learn independently as well as solve problems through an investigative process, analyze data, and suggest solutions over the course of their lives. The teacher's role in PBL is that of a facilitator of collaborative learning. The PBL attempts to enable students to make decisions based on existing knowledge with a focus on problem solving, making them additional reflective and accountable for their own learning **(Da Silva, de Arajo, Rodriguez, & Vasquez, 2018).**

The scenarios in the PBL programme are based on real-life client circumstances, and they are created by faculty in partnership with working nurses to ensure that they are accurate representations of nursing practice. The scenario is tailored to a specific topic, ensuring that students will get insight into a certain area of expertise or discover a collection of concepts, ideas, or procedures. In addition, the scenario must be created to encourage pupils to learn within the educational programme **(Rakhudu, Davhana-Maselesele, & Useh, 2017).**

Metacognition skills are important for students to have because they are used to monitor and regulate reasoning, understanding, and problem-solving, all of which are important components or outcomes of nursing curricula. By carefully designing learning activities within courses and the curriculum, teachers can aid students' progress in metacognitive skills in the classroom and in the field. These abilities are gained through deliberate questioning, modeling techniques, and reflection **(Medina, Castleberry, & Persky, 2017).**

Students also develop collaborative learning skills by working in small groups with colleagues. Group learning allows students to share, compare, and discuss the information they have discovered and erudite, allowing them to improve their clinical reasoning skills. Furthermore, the development of positive interpersonal relationships and effective teamwork encourages the development of leadership skills required to solve problems in healthcare **(Huber, 2014).**

The significance of the study

As metacognitive techniques improve students' attempts to solve problems, metacognitive teaching improves their ability to solve problems. Metacognitive education is used to assist students in coordinating their thoughts, social behavior, self-regulation, oral skills, self-learning, self-direction, self-awareness, and self-reinforcement.

Metacognitive preparation can also help students control their awareness while also integrating their learning and problem-solving processes. Furthermore, knowing when and how to use metacognitive approaches is important for students' performance during the problem-solving process. While nursing students experience a variety of critical problems throughout their careers, it is critical to prepare them to deal with them and to use metacognitive skills to make appropriate decisions based on process organization.

Aim of the study

This study aimed to explore the relation between metacognition competency, self-regulation, and problem-based learning strategy from a nursing students' perspective. This can be accomplished among the university's students through the following objectives, namely:

1. Assess the nursing students' metacognition skill level.
2. Examine nursing students' level of self-regulation.
3. Determine nursing students' perceptions related to problem-based learning strategy.
4. Explore the relation between metacognition skills, self-regulation, and problem-based learning strategies.

Research questions

1. What is the level of nursing students' metacognition?
2. What is the self-regulation level among nursing students?
3. What is the nursing students' perception-related problem-based learning strategy?
4. Is there a relation between metacognition skills, self-regulation, and problem-based learning strategies?

Subjects and methods

Study design

A descriptive correlational research design was used.

Setting

The current research was carried out at Port Said University's Faculty of Nursing, which is associated with Egypt's Ministry of Higher Education. The PBL technique was embraced by this faculty, which was founded in 1991.

Subjects

A convenience sample of 371 nursing students was recruited at each of the four levels: 57 students at Level I, 82 students at Level II, 102 students at Level III, and 130 students at Level IV. Prior to the study, the subjects' agreement was sought.

Study instruments

The data collection tools used in this study were divided into four sections: 1) Personal Characteristics of Nursing Students; 2) Metacognitive Strategies Inventory; 3) Learning Self-Regulation Questionnaire (LSRQ); and 4) Problem-Based Learning Approach Perception Questionnaire (PBLQ).

Section (I): Nursing Students' Personal Characteristics:

Researchers created this section to identify personal characteristics of nursing students such as age, gender, grade level, pre-educational qualifications, and previous grades.

Section (II): Metacognitive Strategies Inventory:

An adopted self-reported questionnaire that was developed by **Takáčová (2016**) to assess nursing students' metacognitive strategies used during problem-solving sessions included 27 items divided into five domains: social metacognition (six items), planning/goals (six items), knowledge (five items), learning monitoring (five items), and consolidation strategies (five items).

System of scoring

A four-point Likert scale (1-4) was ranged from "completely disagree" to "completely agree." The obtained scores ranged from 27 to 108, with a higher score indicating a high level of use of metacognitive strategies. The scores of the items were added up for each domain, and the total was divided by the number of items, yielding a mean score for each part.

Section (III): Learning Self-Regulation Questionnaire (LSRQ):

An adapted questionnaire was developed by **Schutt (2009)** to examine nursing students' self-regulation skills during PBL sessions. This questionnaire had three domains with 13 items each: 1) active participation in PBL sessions (four items); 2) following the tutor's suggestions (five items); and 3) students' reasons for continuing to broaden their nursing knowledge (four items).

System of scoring

A three-point scale was used, ranging from "not true" (1) to "highly true" (3). To classify student scores, data was divided into quartiles: extremely low level when given for a total score (13-28); low level when given for a score (29-32); moderate level when given for a score (33-35); and high level when given for a score (36-39) **(Weinberg & Abramowitz, 2008).**

Section (IV): Problem-Based Learning Approach Perception Questionnaire (PBLQ):

An instrument adapted from **Othman and Shalaby (2014)** was used to identify nursing students' perceptions-related to problem-based learning strategies. This questionnaire contained 38 items divided into six domains: construction professional knowledge (four items), problem-solving skills development (four items), motivation improvement for learning (four items), effective group collaboration (five items), the tutor's role in the PBL session (nine items), and PBL barriers (nine items) (12 items).

System of scoring

The scale ranged from strongly disagree to strongly agree on a five-point Likert scale (1–5). The data was divided into quartiles to classify student scores as follows: extremely low level when a total score was given (38–123), low level when a score was given (124–136), moderate level when a score was given (137–155), and high level when a score was given (156–190) **(Weinberg & Abramowitz, 2008)**. The item scores were added together for each domain, and the total was divided by the number of items, yielding a mean score for each portion.

Administrative and ethical considerations

The Dean, Vice Dean for Education and Student Affairs, and academic coordinators from all grade levels provided ethical approval. The Ethical Research Committee at Port-said University's College of Nursing also gave their approval. Additionally, after a clear and simple explanation of the study objectives, all nursing students signed an oral agreement. Participation was entirely voluntary, and each student had the right and decision to withdraw from the study at any time. The collected data's confidentiality was maintained. The tools' content was only used for research purposes.

Validity of the study instruments

The researchers translated the metacognitive strategies inventory and the learning self-regulation questionnaire into Arabic. A multilingual, qualified individual performed the retranslation. The instruments' validity was tested by a bilingual panel of seven specialists from nursing administration departments at various Egyptian institutions. From the standpoint of an expert, the tools were deemed valid.

Reliability of the instruments

The internal consistency of the instruments was tested using a Cronbach's alpha test to

ensure their reliability. The three tools' internal consistency and reliability values were 0.82 for the metacognitive strategies inventory, 0.85 for the learning self-regulation questionnaire, and 0.90 for the problem-based learning approach perception questionnaire.

Pilot study

A pilot study was conducted on 37 nursing students, representing 10% of the target nursing students. Participants in the pilot study were chosen at random to assess the clarity and applicability of the instruments. There were no changes made, and the pilot sample was included in the study results. The time required to complete the questionnaire ranged between 35 and 40 minutes.

Fieldwork

The collection of data occurred from the beginning of January to the end of March 2018. The researcher obtained official permission from the dean of the nursing faculty. After receiving their permission to participate, the study's purpose and the approach to completing the questionnaires were clearly explained to all participants. The researcher met with them at different grade levels based on their schedules and distributed the study tools to them. As a result, some students filled the tools at the time of distribution, while others returned them later.

Statistical analysis

SPSS version 22.0 was used to analyze the data. A one-sample Kolmogorov–Smirnov test was used to determine the data's normality. Numbers and percentages were used to label qualitative data. The mean, mean percent, and standard deviation of continuous variables are shown. The Pearson correlation coefficient was used, and the statistical significance level was set at 0.05.

Results

According to **table 1,** slightly less than three-quarters of nursing students (72.5%) were females, with more than one-third (35.8%) enrolled in the fourth level. Before enrolling in the faculty, more than three-quarters (79.5%) of students had completed secondary school, and 37.5% had received excellent grades in previous grades. Furthermore, according to the table, 70.4% of students did not obtain pre-enrollment information for the faculty's learning system. On the other hand, nearly two-thirds of the students (66.3%) were aware of problem-based learning at the start of the study, more than half (53.4%) did not benefit from that knowledge. 55.0% of students were dissatisfied with the educational system of problem-based learning.

Table 2 depicts the nursing students' metacognition competencies. It is observed that nursing students had a 48.3% mean percent score of total metacognitive competencies, with a higher mean percent score for monitoring of learning competency (49.8%), followed by a 49.3% mean percent score for planning/goals competency, and the lowest mean percent score was found for knowledge competency (46.8%).

Table 3 shows the nursing students' self-regulation skills. The table highlights that the mean scores of total self-regulation skills among nursing students were (16.28±7.69), with a higher mean score (7.19 ±3.29) for the follow of the instructor's suggestions, followed by the continue to broaden his or her nursing knowledge skill (5.08±2.57), while the skill of participating actively in learning classes of problem-based learning had the lowest mean score (4.01±1.83).

Table 4 reveals that the total mean percent score of students' perceptions toward the problem-based learning approach was 44.2%. The perception of the barriers of the problem-based approach had the highest mean percent score, 49.2%, followed by the mean percent score of students' perceptions of the role of the tutor during problem-based sessions, 43.1%. On the other hand, nursing students' perception toward motivational improvement had the lowest mean percent score (39.2%).

Table 5 illustrates that more than half of the nursing students had low levels of metacognition competency, self-regulation, and problem-based learning perception (51.2%, 53.6%, and 55.3%, respectively). While the lowest percentage of them (23.0%, 21.1%, and 20.2%, respectively) had high levels of metacognition competency, self-regulation, and problem-based learning perception.

Table 6 demonstrates a correlation matrix between nursing the studied students'

metacognition competency, self-regulation skills, and problem-based learning perception. The table shows a highly significant correlation between metacognition competency, self-regulation skills, and perceptions of problem-based learning approaches (.325** and.516).In addition, a significant correlation (.439 **) was discovered between problem-based learning and self-regulation skills.

Table 1: Frequency distribution of the studied nursing students' personal characteristics (n = 371)

Personal characteristics	N	%
Gender		
Male	102	27.5
Female	269	72.5
Grades levels		
First level	58	15.7
Second level	72	19.4
Third level	108	29.1
Forth level	133	35.8
Pre- educational qualifications		
Technical institute	76	20.5
Secondary school	295	79.5
Previous grades		
Excellent	139	37.5
Very good	129	34.8
Good	36	9.6
Accepted	10	2.7
Not Answered	57	15.4
Pre-enrollment information for faculty's learning system		
Obtained	110	29.6
Not obtained	261	70.4
Preliminary awareness for problem-based learning in the beginning of the study		
Had	246	66.3
Not had	125	33.7
If yes; do you get benefit from being aware?		
Yes	198	32.9
No	51	53.4
Don't know	122	13.7
Are you satisfied with the problem-based learning as an educational system?		
Yes	167	45
No	204	55

Table 2 : Descriptive statistics of the studied nursing students' metacognition competencies (n=371)

Metacognition competencies	Min-Max	Mean ±SD	Mean%
Social metacognition	6-20	9.56±3.75	47.8
Planning/Goals	6-21	10.34±4.33	49.3
Knowledge	5-18	8.44±2.82	46.8
Monitoring of learning	5-16	7.97±2.36	49.8
Consolidation strategies	5-17	8.11±4.26	47.7
Total	27-92	44.4±17.52	48.3

Table 3: Descriptive statistics of the studied nursing students' self-regulation skills (n=371)

Self-regulation skills	Min-Max	Mean ±SD	Mean%
Follow the instructor's suggestions	6-12	7.19 ±3.29	59.9
Continue to broaden his or her nursing knowledge	4-11	5.08±2.57	46.3
Participate actively in learning classes of problem based learning	4-9	4.01±1.83	44.5
Total	14-32	16.28±7.69	50.87

Table 4: Descriptive statistics of the studied nursing students' perception of problem-based learning approach (n = 371)

Problem-based learning domains	Min-Max	Mean ± SD	Mean%
Perception of the problem-based learning approach's barriers	12-58	28.54±8.64	49.2
Perception of the tutor's role throughout problem-based learning sessions	10-33	14.20±5.44	43.1
Promotion of effective group collaboration	5-22	9.17±2.89	41.6
Development of problem-solving skills	4-18	7.41±2.01	41.1
Constructing professional knowledge	4-19	7.71±2.13	40.6
Improvement of motivation perception	4-16	6.37±1.78	39.2
Total	39-166	73.4±22.89	44.2

Table 5: Metacognition competency, self-regulation skills, and problem-based learning levels as reported by nursing students (n=371)

Levels of study variables	N	%
Metacognition competency		
Low	190	51.2
Moderate	96	25.8
High	85	23.0
Self-regulation responses levels		
Low	199	53.6
Moderate	94	25.3
High	78	21.1
Problem-based learning perceptions		
Low	205	55.3
Moderate	91	24.5
High	75	20.2

Table 6: A correlation matrix between the studied nursing students' metacognition competency, self-regulation skills, and problem-based learning approach

Study variables	Sig	Metacognition competency	Self-regulation skills	Problem-based learning perception
Metacognition competency	*r*	-	-	-
	p	-	-	-
Self-regulation skills	*r*	.325**	-	-
	p	.001	-	-
Problem-based learning perception	*r*	.516**	.439**	-
	p	.000	.001	-

r: Pearson coefficient *****. Correlation is significant at the 0.01 level (2-tailed)***

Discussion

Metacognition is defined as the learners' perception of their knowledge and regulation of problem-solving behavior, which allows them to monitor applied conscious methods, control preparation for exercise by following instructions, and recognize problem challenges **(Takácová, 2016).** In this regard, the current study's findings revealed that more than half of nursing students lacked metacognition skills. This could be owing to a wide range of pupils' levels of metacognition, which could be related to a lack of opportunities, role models, or exertion put into learning it. However, most students with low metacognitive skills had weak text knowledge, low consolidation techniques such as a lack of collaborative working skills, and low social metacognition such as bad team management, poor planning, and monitoring, according to the findings.

Tosun and Senocak (2013) agreed, claiming that people with higher metacognitive levels are better at planning, managing information, monitoring, correcting mistakes, and evaluating than people with lower metacognitive levels. **Eldar and Miedijensky (2015)** also demonstrated that providing a supportive environment can aid them in comprehending their own beliefs and endorsing their metacognitive knowledge. Moreover, **Braund (2017)** discovered that teachers play an important role in assisting students in developing their metacognition. Students who have strong metacognitive thinking skills and strategies are also more likely to succeed across subject domains. **Stephanou and Mpiontini (2017)** discovered that students had a moderate level of metacognitive regulation when doing schoolwork. On the one hand, this specific finding reflects the students' difficulties in planning, directing, and evaluating their behavior within a learning task. Similarly, **Chen, Björkman, Zou, and Engström (2019)** discovered that nursing students possessed moderate levels of metacognitive ability. This finding contradicts the findings of **Ata and Abdelwahid (2019),** who discovered that the highest proportions of nursing students had high levels of metacognitive thinking.

According to the present study findings, nursing students had a higher mean percent score for monitoring of the learning domain as a metacognition strategy, while the knowledge strategy had the lowest mean percent score. This could be attributed to students' ability to keep faculty equipment organized and to continuously prepare themselves for success during each session. At the same time, they are unable to draw meaningful conclusions from the studied text and comprehend knowledge gained by faculty. This finding contradicts the findings of a study conducted by **Salari, Hamzah, and Hambali (2013),** who investigated metacognitive strategies and nursing students' achievement and discovered a higher mean of students' metacognitive strategies for knowledge of the cognition subscale. **Mulendema, Ndhlovu, and Mulenga (2016)** also concluded that the subscales with the lowest correlation levels in relation to procedural knowledge were monitoring and evaluation. These lower levels could be attributed to their lecturers' teaching methods and approaches.

The current study found that more than half of nursing students had low levels of self-regulation. This may be attributed to a low level of metacognition skills when using consolidation and volitional strategies, which leads to less concentration and effort among students when performing tasks. Furthermore, due to the nature of the study in nursing faculty, which consists of a clinical and theoretical component, the workload associated with PBL may increase cognitive demands, affecting students' ability to regulate themselves. This finding was supported by **Hj Ramli, Alavi, Mehrinezhad, & Ahmadi (2018)** in Malaysia, who discovered that most students had low levels of academic self-regulation skills and justified that higher levels of apparent cognitive demands limited the students' aptitude to use executive functioning skills, such as critical thinking strategies, self-regulation for complex action, and overriding emotional responses from engaging in goal-directed behavior.

Self-regulation, according to **Adaros (2017),** encompasses all contextual, motivational, and metacognitive factors that lead to rapid academic progress and achievement. In the same study, **Roth, Ogrin, and Schmitz (2016)** found that self-regulated

students require necessary volitional methods to avoid external and internal distractions as well as sustain students' concentration, effort, and motivation when executing activities. **Ozan, Gundogdu, Bay, and Celkan (2012)** discovered that overall self-regulated skills were low among faculty students. **Toharudin, Rahmat, and Kurniawan (2019)** revealed that most students had a good level of self-regulation in all categories. This indicates that a student's self-regulation during the learning process is excellent, and that confidence is inversely proportional to self-regulation. **Ding & Zhu (2018)** found that a learning style conquered by a high level of SRL aptitude might have a positive influence on nursing students' teaching as well as nursing education after employment.

In terms of self-regulation domains, the study findings revealed that following the instructor's suggestions rather than participating actively in PBL nursing classes resulted in the highest mean score of self-regulation responses experienced by nursing students. This could be attributed to the main tutor's role in debriefing sessions, which was centered on directing students to take on more prominent and effective roles during sessions. If the students follow these suggestions correctly, they are more likely to remember, elaborate on, and integrate metacognitive information from the session. In contrast, **Al-Hatem, Masood, and Al-Samarraie (2018)** discovered that developing students' SRL through active contribution in an environment that involves students in the process of goal setting, task strategies, self-monitoring, and self-evaluation is difficult.

Furthermore, the findings revealed that majority of nursing students had a low perception of the PBL approach. This result was regarded as the barriers of the PBL approach, which received the highest mean score from the students. These obstacles are related to difficulties in finding information, a heavy workload, and a lack of commitment to their role. As a result, students require time, guidance, and encouragement to be successful with new ways to apply basic PBL rules and concepts. These findings were consistent with **Maxwell, Bellisimo, and Kentfield (2010)** who concluded that students had a negative perception of PBL. This occurred as a result of some tutors placing their students in groups confronted with freeloading, where one or two students dove in and led the problem-solving efforts while others hung back and relied on them to assign tasks and monitor results. Similarly, **Cho and Brown (2013)** clarified that students had a negative perception of PBL. This could be because PBL necessitates extensive planning and professional development, a supportive environment, and effective instructional strategies, all of which are not always available.

On the other hand, **AL-Dress, Khalil, Irshad, and Abdulghani (2015)** discovered that students had a positive attitude toward PBL and emphasized the importance of PBL in the curriculum. Furthermore, **Aldayel et al. (2019)** at Al-Imam Mohammad Ibn Saud Islamic University claimed a high level of student perception of PBL sessions. It referred to the students' perceptions of the benefits of PBL sessions, who believed that PBL was a useful tool for increasing their knowledge of basic science. **Aldayel et al. (2019)** also demonstrated that students' attitudes toward PBL were more positive than negative. In comparison to the previous, the current findings clarified that nursing students' perception of motivational improvement had the lowest mean percent score. This finding was consistent with **Cook and Artino-Jr. (2016),** who investigated motivation to learn: an overview of contemporary theories revealed that students experienced mild frustration and a lack of learning motivation when they perceived PBL barriers that affected cognitive aspects such as achievement effects, interests, and goals. **Leggett and Harrington (2019)**, on the other hand, found that academic students regarded the motivation domain as a critical building block for PBL success. This is in line with what the studied students stated: PBL was an instructional practice that aimed to increase levels of engagement, motivation, and academic achievement.

The study clearly showed a significant correlation between self-regulation skills and the problem-based learning approach. This result could be explained by the fact that problem solving is a cognitive mental process that requires more self-regulated students who

can choose and organize information to transform a given situation into a goal situation. According to **Zimmerman and Labuhn (2012),** self-regulation is viewed as a process by which students alter their mental aptitudes into theoretical skills. This finding is in the same line with **Demirören, Turan, and Öztuna (2016),** who showed that the self-regulated learning subscales were positively correlated with the problem-based learning subscales. Furthermore, this result agrees with **González (2019)** who revealed that PBL was an appropriate approach for fostering and optimizing students' oral communication, structure scenarios to self-regulate their learning while emerging creative tasks and cooperating.

The findings also revealed a significant positive correlation between metacognition competency and self-regulation skills. This could be due to metacognition is a way of learning to learn, and it becomes more meaningful as students become more conscious of themselves and their ways of learning, control and plan their own learning, monitor the way they learn, and self-assess. This finding is consistent with the findings of a study conducted by **Cera, Mancini, and Antonietti (2013)** who investigated the relationships between metacognition and self-regulation in learning.

Their findings reported that self-regulated learning is connected to metacognitive skills such as planning, monitoring, evaluation, and concentration. This finding is congruent with **Nader-Grosbois (2014),** who found that self-regulation linked to metacognitive strategies. Also, **Demir and Doganay (2019)** demonstrated the same result. Furthermore, **Oppong, Shore, and Muis (2019)** discovered that despite the fact that students who gained metacognitive skills such as planning, monitoring, and assessing might become better self-regulated learners and ultimately achieve superior academic performance, self-regulatory learning processes and metacognitive learning processes were distinct.

Moreover, the study findings revealed a relation between metacognition competency and the problem-based learning approach. To solve problems effectively, metacognitive nursing students must have monitoring, regulation reasoning, and knowledge comprehension skills. In this stream, **Baykara (2011)** asserted that metacognition competencies influence the PBL approach. Similarly, **Jeong, Cho, and Seo (2018)** stated that meta-cognitive competencies may have an impact on nursing performance among university students. As a result, new strategies must be developed to provide students with higher-level thinking skills and enable them to make sound decisions in new situations based on their knowledge. **Kuvac and Koc (2019)** discovered that PBL could be a useful tool for increasing metacognitive awareness of procedural knowledge, planning, and debugging. Furthermore, it is consistent with the findings of **Pratama's (2018)** study, which was conducted among student nurses and found that PBL strategies can improve students' metacognitive abilities.

Finally, the findings demonstrated a highly statistically significant positive correlation between metacognition competency, self-regulation skills, and problem-based learning among nursing students. Thus, when students are confronted with a novel challenge, metacognitive methods can help them achieve a positive outcome by assisting in the monitoring of regulatory thinking and how it is applied to effectively understand and solve difficulties. **(Tosun & Senocak, 2013).** According to **Senomoglu (2009),** students must understand how their minds work, or how important cognitive activities such as remembering, learning, and problem solving are realized, in order to solve problems effectively.

Metacognition, which includes students being aware of their own knowing and learning styles and being able to effectively organize their own learning, necessitates students' understanding of how their minds work, or how important cognitive activities such as remembering, learning, and problem solving are realized in order to solve problems effectively **(Demirel and Turan, 2010).**

Conclusion

A substantial association between problem-based learning and self-regulation skills was discovered in this study. A highly

statistically significant positive correlation was also discovered between metacognition competency, self-regulation skills, and problem-based learning. Nursing students must utilize metacognition strategies in conjunction with self-regulation abilities to determine what information and attitudes they require for lifelong learning and problem solving.

Recommendations:

Based on the findings of this study, it is suggested that:

- Training courses by the college should be considered for academic staff who have not previously engaged in such learning methods, as well as for junior and new staff.
- Develop and implement teaching and learning strategies that improve metacognition in the nursing education field.
- Academic staff can help students by educating them about the various tactics available to them, as well as showing them how to detect when one strategy isn't working and how to switch to another.
- Provide opportunities to focus on clinical reasoning and to develop PBL-based curricula.
- Developing the learning environment and extending it to provide the requirements needed for implementing the PBL approach empowers students to perceive and adapt to the PBL approach.
- The Faculty administrative board should cooperate with the Ministry of Health and develop protocols for effective PBL applications in the practical arena.
- Future research should concentrate on the tactics used by undergraduate nursing students to succeed with PBL, as well as
- Self-regulation in achieving the goals of improving clinical reasoning and teamwork abilities.
- Also, further research into metacognition needs to be more clearly defined and embedded within a universal theoretical framework.

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