

Improving Critical Thinking Nursing Students: Implementation of Problem Based Learning Scenarios

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Abstract: Critical thinking is the art of analyzing and evaluating thinking with a view to improving it. Critical thinking is an essential component of practice, communication, problem-solving ability, the ability to think critically is needed to solve problems both in academic and applied settings and research endeavors in nursing; however, still more research is needed on the utilization of problem-based learning scenarios and its impact on critical thinking. In this study, it was hypothesized that the implementation of problem-based learning (PBL) scenarios may lead to significant improvement of nursing students' critical thinking. Results supported this hypothesis. The study was conducted in the Nursing Administration Department, at Faculty of Nursing, Helwan University, Egypt using a quasi-experimental pre-post assessment design. The sample included 46 fourth-year nursing students enrolled in "nursing administration" course. The researchers developed five scenarios or problems related to core learning concepts and contents of the course and implemented them in a problem-based learning process. The tools used for assessment of nursing students' critical thinking were the California Critical Thinking Disposition Inventory, nursing student assessment sheet, and tutor performance evaluation checklist. The results showed generally low scores of critical thinking before the intervention, which demonstrated statistically significant improvements at its end ($p < 0.001$). Students' critical thinking and performance scores were positively and significantly correlated ($r = 0.98$, $p < 0.05$). In conclusion, critical thinking disposition in all its aspects can be improved among nursing students through the use of problem-based learning process. Hence, it is recommended to utilize this learning strategy in all nursing academic programs. The development of valid and reliable instruments to assess critical thinking skills among students is urgently needed.

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1. Introduction

Critical thinking has been described as the process of purposeful, self-regulatory judgment, which uses reasoned consideration to evidence, context, conceptualizations, methods, and criteria (*Raiskums, 2008*). The concept of critical thinking is described synonymously in the literature as creative, smart, high-quality, and in-depth thinking (*Thomas, 2005*).

Currently, critical thinking is considered an essential component of practice, communication, problem-solving ability, theoretical and conceptual understanding of nursing concerns and research endeavors that advance and broaden the knowledge base of nursing (*Yuan et al, 2008*). Today professional nurses need to develop critical thinking skills that will provide them with expertise in flexible, individualized and situation-specific problem solving (*Higgs and Jones, 2000*), and to help them to become self-directed learners (*Kathleen, 2010*).

Recent trends in education point to a shift from a traditional teaching paradigm of teacher-directed and traditional lecture format to a learning paradigm of self-directed, interactive learning, and problem

scenarios to meet the curriculum's objectives. Accordingly, nursing education strives to develop critical thinking abilities in students through emphasis on process, inquiry and reasoning (*Bowles, 2000*). Learners are presented with a clinical situation or issue about which they must engage in collaborative learning. This integrative group approach to learning develops interpersonal skills, teamwork, and personal growth for the participant (*Kathleen, 2010*).

Problem-based learning (PBL) is a strategy whereby a small group of students, with a facilitator, is presented with a real-life case or scenario that stimulates critical thinking, and develops students' self-directed learning skills. Students learn concepts and content by working through the activity that helps them become more effective in identifying, seeking out and assimilating knowledge, and foster the development of their analytical and creative skills (*John, 2011 and UMN, 2011*). Students take the responsibility for their own learning through exploring resources to provide an acceptable, justified solution (*Mennin et al., 2003*). It is up to the learners to identify key issues, and determine what additional information is needed. Through the process of

discussion and discovery, the group reaches to solutions to the problem, and re-groups to feedback and to evaluate their learning (*John, 2011 and UMN, 2011*). Moreover, this teaching method can be modified to fit almost any situation (*Chunta and Katrancha, 2010*).

In PBL, the traditional learning order is reversed, with the problem being presented first and acting as a stimulus for learning, rather than the problem being presented after the dissemination of relevant theory by the tutor (*Martin and Bill, 2008*). Although the PBL approach is student-centered, the facilitators or tutors are equally important to the process. The facilitator maintains the focus on learning, guides the process, meets the challenge, and provides appropriate feedback to each student and the whole group (*Kathleen, 2010*). Students are required to work cooperatively while acting as both learners and teachers (*Martin and Bill, 2008*).

The effective PBL scenario must first engage students' interest, motivate further self-directed learning, and relate to the real world. It must require students to make decisions or judgments based on facts, information, logic, or rationalization; further. (*Rakhudu et al, 2012*). Reflection challenges nurses to think critically about their clinical practice, identify gaps, and seek practice changes based on current evidence. The educational methodology of PBL affords the nurse the necessary skills to be a reflective, self-directed practitioner possessing critical thinking abilities (*Price, 2004*). Hence, and has come to the forefront in nursing following the mandate by the National League of Nursing who stated that nursing programs must measure critical thinking as outcome criteria for accreditation (*Simpson and Courtney, 2002*).

Nevertheless, although PBL methods motivate learning and better prepare students for future practice, its utilization in nursing education is still less than the traditional methods of education (*Ivicek et al, 2011*). The issue is of major importance in nursing given the complexity of the situations future nurses are expected to be faced with, and the abilities they may acquire from PBL in dealing with these situations (*Khan et al, 2012*). However, a systematic review showed that still more research is needed on the utilization of PBL scenario and its impact on critical thinking (*Oja, 2011*).

Nursing educators worldwide are charged with the task of preparing a nurse workforce that is responsive to dynamic population changes that are increasing in complexity. Problem-based learning (PBL) as a pedagogical approach that has been proposed as a solution to address the challenge of producing nurses that are critical thinkers, life-long learners, and more equipped to handle the challenges

of their ailing communities. (*Rakhudu et al, 2012*). Therefore, this study was designed with the aim of improving critical thinking nursing students through implementation of problem based learning scenarios in a nursing administration course at the Faculty of Nursing, Helwan University. It was hypothesized that the implementation of problem-based learning scenarios may be lead to significant improvement of nursing students' critical thinking.

2. Participants and Methods

Research design and setting: A quasi-experimental pre-post assessment design was used in conducting the study during the period from September 2010 to January 2011. The study was conducted in the Nursing Administration Department, at the Faculty of Nursing, Helwan University, Cairo, Egypt. The faculty has six academic nursing departments namely, Adult Health, Child Health, Maternal and Newborn Health, Mental Health, Community Health, in addition to Nursing Administration. Its undergraduate library has a wide variety of nursing textbooks, in addition to computers connected to digital libraries through the internet.

Participants:

The study sample consisted of 46 fourth-year nursing students who were enrolled in the course entitled "nursing administration" during the first term of the academic year 2010-2011. Their age ranged between 20 and 23 years, with slightly more females (26). Thirty of them had secondary school certificate, while 16 had nursing technical institute diploma. The sample was divided into four groups, each having a facilitator (three assistant lecturers and one clinical instructor).

Data collection tools:

Three tools were used for data collection, namely the California Critical Thinking Disposition Inventory (CCTDI), nursing student assessment sheet, and tutor performance evaluation checklist.

California Critical Thinking Disposition Inventory (CCTDI):

This tool was developed by *Facione et al. (1994)* to assess critical thinking. It consists of 75 items grouped into seven dispositional characteristics: truth seeking (12 items), open-mindedness (12 items), analyticity (11 items), systematic (11 items), self-confidence (9 items), and inquisitiveness (10 items), and maturity (10 items). The response was along a continuum of 6-point Likert ranging from "strongly agree" to "strongly disagree." These were scored from 6 to 1, respectively. The negative items' scores were reversed so that a higher score indicates more positive characteristic. The CCTDI reports eight scores: seven scores for each dispositional characteristic and an overall score. For each of the seven subscales and the total scale, a higher score indicates a more positive

disposition. The tool reliability was assessed through measuring its internal consistency, which proved to be good with Cronbach alpha coefficient ranging from 0.71 to 0.80 for the seven scales, and 0.91 for the total scale.

Student assessment sheet:

This tool was developed by the researchers based on *Tang et al. (1997)* and *Arzuman (2010)* to be used by the facilitators in evaluating nursing students groups during the PBL sessions. It consists of 20 items grouped into four areas or abilities: 1) application of knowledge base, e.g., generate objectives; 2) problem analysis, e.g., identify problem and generate possible mechanisms; 3) self-directed learning, e.g., evidence to accomplishment of own study and evidence of reading diverse bibliographic sources; 4) group work, e.g., active participation, following discussion, and working towards achievement of group learning goal. Each part includes five items. Each item achieved by the student is given a score of "5" for a total score 100. A higher score means better group performance.

Tutor performance evaluation checklist:

This tool was developed by the researchers based on *University of New Mexico School of Medicine [UNMSM], (2002)* and *Academic Support Center [ASC], (2007)* to be used by students groups and by the researchers in evaluating the performance of the facilitators in class during PBL sessions. The checklist includes 31 items divided into six areas: 1) attendance (3 items), e.g., attend tutoring hours faithfully and go to activity station; 2) personal characteristics (6 items) e.g., interact appropriately with other tutors, and enthusiasm with students; 3) facilitating the tutorial process (11 items) e.g., help students explore pre-existing knowledge and praise correct responses; 4) facilitating group dynamics (6 items) e.g., ensure opportunity for equitable participation and facilitate conflict resolution; 5) serving as a resource (2 items) e.g., act primarily as a facilitator; and 6) evaluating performance (3 items) e.g., facilitate regular group and self-assessment and reflection. Each item is checked as "done" or "not done," scored "1" and "0" respectively. The items scores were simply summed up and converted into a percent score. A higher score means better performance of the facilitator or tutor. The reliability of the tool proved to be good (Cronbach alpha coefficient 0.72).

The content validity of the three tools was tested through experts' opinions of three associate professors of nursing administration from the faculties of nursing at Port Said, Ain-Shams and Mansoura universities.

The study intervention

The researchers developed five scenarios or problems guided by information from related sources (*Huber, 2006 and Sullivan et al., 2009*). These problem scenarios were related to the core learning

concepts and contents of managerial skills such as management function, recording and reporting, time management, job description, and conflict. Each scenario consisted of a core concept map, learning goals, and was based on a real nursing management situation. They were intended to be used in applying the steps of PBL based on *Puccio et al. (2007)*. The five scenarios were reviewed by the same panel of experts for their relevance to the managerial skills in the clinical setting.

Study maneuver

The study maneuver involved a pre-intervention phase, an implementation phase, and an evaluation phase.

Pre-intervention:

The pre-intervention phase was used to collect baseline data using the California Critical Thinking Disposition Inventory (CCTDI) questionnaire sheet. This was pilot- tested on five students to identify ambiguous items, and finalized accordingly. Official permissions were obtained from the Dean of the Faculty of Nursing at Helwan University to conduct the study. The researchers met the nursing students to explain the purpose and procedures of the study, and how to fill out the data collection tools. Those who gave their consent to participate were handed the forms for completion. Each form took 45-60 minutes to be filled out. This phase was carried out at the beginning of October 2010.

Implementation phase:

At the beginning of the course, the researchers explained the PBL strategies for tutors and nursing students based on *Arzuman (2010)*. An electronic guidebook for PBL learning was prepared and distributed to them. The 46 students were divided into four PBL tutorial groups. Small group work with five learning scenarios was 2 hours per week for 15 weeks. The tutors acted as facilitators who stimulated students towards self-directed learning, kept the learning process going, deeply probed students' knowledge, and modulated the challenge of the scenario situation.

The PBL steps: (See, Annex. 1, 2)

The researchers were design diagram and develops the PBL steps guided by *Tan, (2003) Walsh, (2005) and Arzuman, (2010)* to be implementing the PBL steps and application of new knowledge to the problem. Each learning scenario was completed within 5 or 6 learning hours through the PBL steps: *the first*; meeting and identifying the problem, *the second*; problem analysis and learning issues, *the third*; discovery and reporting, *the fourth*; solution presentation, and *the fifth*; overview, integration, re-evaluation and reflection

The facilities available to students during PBL sessions included computer sets with data show,

whiteboard, and flipchart with marker pens. The data of implementation phase were collected from October to December 2010.

Evaluation phase:

The California Critical Thinking Disposition Inventory (CCTDI) questionnaire sheet was filled out again by participating nursing students after completion of the intervention to assess the effect of PBL strategies on improving students' critical thinking. This phase data were collected before 25 January 2011.

Ethical considerations

The study protocol was approved by the Dean of Faculty; Students gave written informed consents to participate, after receiving clear explanations of the study aim and maneuvers. They were informed about their right to refuse to participate or withdraw any time without giving reason. Confidentiality was assured to all participants, and all the forms used were anonymous.

Statistical analysis

Data entry and statistical analysis were done using SPSS 14.0 statistical software package. Quantitative continuous data were compared using the non-parametric Mann-Whitney or Kruskal Wallis tests as normal distribution could not be assumed. Pearson correlation analysis was used for assessment of the inter-relationships among various scores. Statistical significance was considered at p-value <0.05.

3. Results

In the pre-intervention phase, students' critical thinking disposition was widely variable in its seven areas. As **Table 1** illustrates, the lowest mean scores of critical thinking among students were in the domains of truth seeking, maturity, and open mindedness. At the other extreme, inquisitiveness and self-confidence had the highest mean scores. Meanwhile, students' critical thinking mean scores demonstrated statistically significant improvements at the end of the PBL intervention, compared to the pre-intervention phase. This occurred in all the seven areas, in addition to the total critical thinking disposition ($p < 0.001$).

Concerning the factors that may influence students' critical thinking scores, **Table 2** shows no statistically significant relations with students' age, gender, or type of secondary education. This was noticed at the pre as well as the post-intervention phases.

Figure 1 displays the ecologic correlation - by groups - between students' scores of performance and critical thinking, and tutors' performance as evaluated by the researcher (tutor researchers) and by the students themselves (tutor students). It shows that only students' critical thinking and performance scores are positively and significantly correlated. Computation of Pearson correlation revealed a strong statistically positive correlation between these two scores ($r = 0.98$, $p < 0.05$).

Table 1. Pre-post intervention scores of critical thinking disposition of nursing students in the study sample.

Critical thinking scores	Time (means±SD)		Mann Whitney Test	p-value
	Pre (n=46)	Post (n=46)		
Truth seeking	31.4±45.2	58.9±3.1	73.47	<0.001*
Open mindedness	35.3±3.8	55.2±1.7	73.50	<0.001*
Analyticity	41.4±4.9	54.8±0.9	75.21	<0.001*
Systematic	37.7±6.0	48.9±3.6	55.14	<0.001*
Self-confidence	48.6±6.5	59.2±3.5	65.03	<0.001*
Inquisitiveness	46.9±5.7	59.9±0.4	73.67	<0.001*
Maturity	31.3±11.6	59.7±1.3	74.93	<0.001*
Total	272.6±26.8	396.7±8.7	69.50	<0.001*
Total (% score)	38.9±3.8	56.7±1.3	69.51	<0.001*

(*) Statistically significant at $p < 0.05$

Table 2. Relation between students' scores of critical thinking in the problem based learning strategies and their characteristics at pre-post intervention.

	Pre- intervention			Post- intervention		
	Total Score (mean±SD)	Mann Whitney Test	p-value	Total Score (mean±SD)	Mann Whitney Test	p-value
Age (years):						
<21	394.9±11.6			273.3±28.8		
21	396.8±6.7	0.63	0.73	285.7±20.0	H=3.70	0.16
22+	400.7±1.2			277.4±23.5		
Sex:						
Male	398.5±5.7			278.6±24.9		
Female	395.3±10.3	2.42	0.12	278.3±25.7	0.03	0.86
Secondary education:						
General	396.2±9.9	0.39	0.82	276.7±27.2	0.28	0.60
Technical	398.0±5.4			281.5±21.4		

(*) Statistically significant at $p < 0.05$

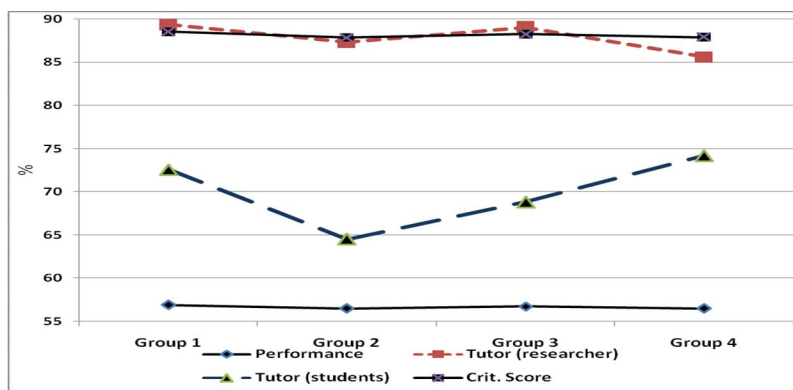
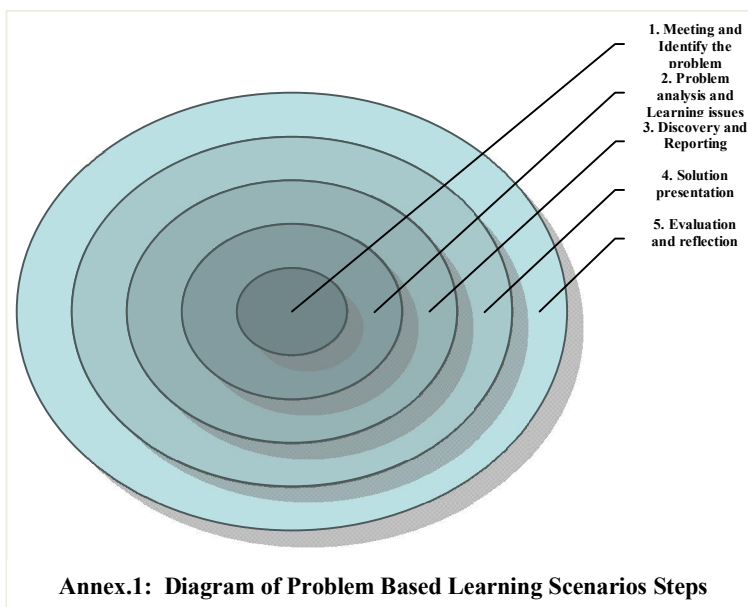


Figure 1. Ecologic correlation between students' scores of performance and critical thinking, and tutors' performance as evaluated by the researcher (tutor researcher) and by the students themselves (tutor students).



Annex.2: Problem Based Learning steps (Application of new knowledge to PBL).

Step I - Meeting and identify the problem: the group learning activities were to define the problem, and write down the unclear terms or concepts on the white board. Tutors encouraged students to think and discuss openly, and helped students understand the scenario. This step took one learning hour.

Step II - Problem analysis and learning issues: the learning activities were to apply previous knowledge and own ideas to produce possible explanations using brainstorming. The problem thus becomes clearer, allowing students to evaluate what knowledge and skills they needed to solve the problem. The learning issues were identified. When all core concepts were identified, they were grouped together and the search topics were defined. Individual group members volunteered or were assigned by the group to search for each of the concurrent topics. The tutor helped the group to maintain group dynamics and moved the group through the tasks, and assisted the group to ensure that each key concept in the scenario was included. This step took one learning hour.

Step III - Discovery and reporting: the learning activities were to work on the identified search topics. Students used the library textbooks and internet databases as web nursing center, PubMed, nursing Journal Full-text, etc., in addition to subject matter experts' consultations. Assigned students developed informative handouts for their peers and prepared critical thinking questions for group discussion. The tutor stimulated students towards self-directed learning, gave comments on each paper to assist students to probe the knowledge deeply. This step took two learning hours.

Step IV - Solution presentation: the learning activities were group discussion and critical analysis of the information retrieved. Students generated a number of possible hypotheses to explain the situation. The knowledge acquired was discussed and debated critically. The group identified further gaps in knowledge and further learning needs. The tutors encouraged students to think about the questions involved in the learning situation broadly and critically. They encouraged students to ask each other to explain topics in their own words or by the use of drawings and diagrams. They also assisted the students to manage group conflict, and modulated the challenge of the problem. This step took one learning hour.

Step V - Evaluation and reflection: The learning activities involved three concurrent types of evaluations. In first type, the researcher evaluated tutors' performance in the tutorial session. In second type, the researcher evaluated students groups' achievement of learning objectives, and encouraged students to reflect on their performance in the tutorial session, listened to their responses, and helped them solve any difficulties faced during the PBL tutorial process. The third evaluation was the students' group evaluation of tutor performance as facilitator during the PBL tutorial sessions. This step took one learning hour.

4. Discussion

The present study findings indicate low initial scores of critical thinking among nursing students. The implementation of PBL intervention led to statistically significant improvements in students' scores, which leads to acceptance of our research hypothesis. The results give support to similar previous studies that demonstrated the positive effect of PBL scenarios on students' critical thinking abilities (Yeo, 2008; Lin et al., 2010; Kowalczyk, 2011; Marshall et al, 2011).

The generally low scores of the seven domains of critical thinking among the current study nursing students can certainly be attributed to the educational system followed in secondary schools in Egypt. It is mainly a pedagogical system with traditional teacher-centered rather than student-centered learning, where the student is mostly a passive recipient. This is true for all types of secondary education, whether general or technical, as revealed by the lack of significant differences between the two types in students' scores of critical thinking. Such traditional educational systems do not empower students to be self-confident and have maturity in thinking. On the contrary, PBL fosters self-directed learning and independence among students (Tseng et al., 2011).

Additionally, the traditional teaching methods do not endow upon students the important motives for learning such as inquisitiveness and truth seeking, which are the cornerstone of effective learning (Crawford, 2011). In congruence with this, (Roderick, 2001) mentioned that students who lack one or more of the aspects of disposition toward critical thinking or who have an opposite disposition such as those who are intellectually arrogant, disorganized, indifferent toward new information, or lack reasoning are more likely to encounter problems in using their critical-thinking skills. This situation may lead to closed-mindedness among students.

The positive impact of PBL on students' critical thinking abilities of analytical and systematic approach is certainly related to the adoption of the steps of PBL in their trials to solve the scenarios presented to them. This is supported by the close positive significant correlation between their critical thinking and their performance scores. Thus, the groups that apply the PBL steps better get higher performance scores. The finding is in congruence with the results of a Mexican study that demonstrated a significant positive correlation between medical students' critical thinking and their motivation to achieve a good academic performance (Urrutia Aguilar et al, 2011).

Another asset of the PBL approach is its capacity to develop students' truth-seeking abilities with open-mindedness. This is facilitated by the group approach

in learning, where the aim of the group is to reach to the proper solution of the problem, with no aim other than seeking the truth, which is the only way to solve the problem. This raises the value of PBL in health-related sciences such as nursing, since the solution of the patient problem is only possible if the care provider seeks the truth with open-mindedness and no previous prejudices or bias that may lead to erroneous diagnosis and consequent poor management. In the present study, the scenarios used were developed based on true life situations of nursing practice. This could have motivated the students as they get the feeling that they are in real practice.

Moreover, the debates within the group increase students' self-confidence. Additionally, students' self-confidence is further promoted by giving them the opportunity to evaluate their own performance, and the tutor's performance as well. Students have never been exposed to such experience in traditional learning where the tutor is mastering every element of the educational process, with no role for the students except receiving the information delivered to them with no argument. In agreement with this, Chunta and Katrancha (2010) highlighted that PBL improves students' communications skills, and encourages them to defend their views with evidence and reasoning.

These present study findings could not reveal any association between students' age, sex, or type of secondary education and their critical thinking scores. The lack of significant relation with age is undoubtedly due to the very narrow range of age of the students, with no expected variations. Meanwhile, the lack of association with sex and type of secondary education before the intervention indicates that the lack of critical thinking abilities is alike among boys and girls, and in general and technical educational systems. After implementation of the PBL intervention, the improvement in critical thinking scores regardless students' sex or educational system indicates that PBL is successful in all situations.

A finding of interest in the current study is the lack of any correlation between the performance of tutors, as judged by the students and the researchers, and students' scores of performance or critical appraisal. This indicates that PBL is mainly student-centered, and the role of the tutor, although of importance, is secondary to the role of the students. In fact, in PBL, the tutor acts as a facilitator and mentor, rather than a source of information for solution of the problem (Landsberger, 2010).

Meanwhile, there was a discrepancy between students' and investigator's evaluation of tutors' performance. This might reflect a difference in the views of students of what they need from the tutor and those of the investigator who may have a more academic look at the compliance of the tutor with the

role of facilitator and in following the PBL steps. Nonetheless, *Paul and Elder (2008)* emphasized that critical thinking is based on concepts and principles rather than strict application of step-by-step procedures. A similar discrepancy between students' and teachers' evaluations has been reported (*Urrutia Aguilar et al, 2011*). Another possible reason may be related to the validity and reliability of the assessment tool. In this respect, *Simpson and Courtney (2002)* mentioned that the development of an assessment instrument in a challenge for future research on critical thinking, especially in nursing education.

Conclusion & Recommendations

The study findings lead to the conclusion that critical thinking disposition in all its aspects can be improved among nursing students through the use of PBL strategies. The study adds to the evidence of the merits of PBL in developing future nurses' abilities of clinical reasoning and decision making deemed essential for their practice. Hence, it is recommended to utilize this learning strategy in all nursing academic programs. The development of valid and reliable instruments to assess critical thinking skills among students is urgently needed. Additionally, course planners should receive training in developing problems and scenarios that improve the critical thinking abilities of nursing students and leading to the intended learning objectives.

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