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Impact of Problem-Based Learning on Students`Critical Thinking Dispositions, Knowledge Acquisition and Retention

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Abstract
Background: The recent campaign seeks to shed light on the move to a new delivery system approach in nursing schools, where student centered learning such as problem-based learning (PBL) was introduced to replace the teacher centered learning in an effort to promote nursing students critical thinking ability, enhance their knowledge acquisition and retention, autonomy, and professional identity. **Aim:** to examine the impact of problem based learning on students' critical thinking dispositions, knowledge acquisition and retention. **Methods**: The study was used quasi-experimental design and conducted at the Nursing Administration Department, Faculty of Nursing, Mansoura University. The total number of the nursing students enrolled in the 3rd year (2011-2012) (n= 385 nursing students) Only 200 students, were agreed to participate in this study, which divided randomly into two groups. 100 students were experimental group and100 students were control group. Data was collected by using three tools: The California Critical Thinking Disposition Inventory (CCTID) questionnaire. It was developed by Facione & Facione (1992), to measure the student's disposition of critical thinking. Student guide and four ill structure scenario, It was developed by the researchers about actual or potential problems related to four managerial skills namely (motivation, manage change, leadership, and communication), and Knowledge test, which developed by the researchers, used to assess students knowledge acquisition and retention. **Conclusion:** There were statistical significant improvements in students` critical thinking post PBL than pre intervention. Also, self-confidence item of critical thinking had high percent of change post intervention followed by inquisitiveness and maturity. Increasing of total mean score of knowledge acquisition and retention of the experimental group than total mean score of knowledge acquisition and retention of control group. No statistical significant correlation between students` total knowledge of experimental group and their critical thinking post intervention. **Recommendation:** The study recommended that: Problem-based learning should be incorporated into the curriculum to encourage engagement and relatedness. Teachers should continue to incorporate strategies that employ higher-order thinking skills into the curriculum (e.g. PBL, case studies, and comprehensive projects). Instruction in the facilitation of PBL should be incorporated into teacher education programs and professional develop seminars.
Keywords: PBL- Critical thinking dispositions, Knowledge acquisition, Knowledge retention

1. Introduction

Do you ever ask yourself, when you're teaching, how much are my students taking in; is there a better way to learn the same material; are they really learning to think for themselves and developing skills that will be useful later in life; or – one of the worst questions – how much will they remember after the test or examination? These are questions often asked by academics and they point to recurrent challenges across disciplines, programs and semesters of teaching (Cotton 2011). Because all of this, in the learning event, learning approaches that show how to reach information sources, how to obtain knowledge, how to evaluate knowledge and how to acquire knowledge through life experiences, how to enhance skills of thinking and use it in problem solving can be applied. One of these learning approaches is called problem-based learning.

Problem-based learning (PBL) was first implemented in a medical education curriculum by Toronto's McMaster University in the late 1960s. It is an innovative instruction strategy, which are student centered and not teacher oriented like classroom teaching. PBL is a learner-centered educational method, which learners are progressively given more and more responsibility for their own education and become increasingly independent of the teacher for their education. PBL produces learners can continue to learn on their own in life and in their chosen careers. The responsibility of the teacher in PBL is to provide the educational materials and guidance that facilitate learning. PBL is based on real world problems. Many argue that PBL is a powerful and engaging learning strategy that leads sustained and transferable learning (Jones et al. 1996 and Stepien et al. 1993). PBL fosters the development of self-directed learning strategies, enhance student 'critical thinking and make it easier for students to retain and apply knowledge to new or unfamiliar situations. PBL deviates from conventional instructional mode by restructuring traditional teacher/student interactions toward active, self-directed learning by the student (Evensen & Hmelo 2000 and Maxwell et al. 2001).

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. Offers an innovative and engaging learner-centered approach enhancing nursing student's ability to

think critically (Choi 2004). PBL is implemented to engage the students in active learning. As principles for good practice in undergraduate education, presents students with a problem or situation to apply previous knowledge and acquire new knowledge. It has been recognized as an instructional method to increase motivation for learning, empower learners to conduct research, integrate theory into practice, and apply knowledge and skills to develop a viable solution to a defined problem (Savery 2006)

PBL is challenging, and enjoyable learning approach that has resulted from the process of working towards understanding or resolving a problem. PBL pedagogy, promotes learning through the concept of 'learning by doing', which creates an opportunity for students to learn by experiencing the process of problem solving. The teacher in PBL acts as a facilitator and responsible to monitor students' progress, stimulate their meta-cognition, sets the tone and plays a major role in setting group norms conducive to learning. In early work on PBL, the role of the facilitator was primarily to ask meta-cognitive questions such as "Why?" "How do we know that?" and "Is there anything else?" The facilitator was not advised to provide information or to directly evaluate student contributions. However, it is important for the facilitator to model reasoning with questions such as "Do you know what that means?" and "What are the implications of that?" By modeling this meta-cognitive approach, it is assumed that students will soon begin critically examining information in the same way (Wee 2004).

PBL operates in several major steps, as in the "Seven-jump" model (Maastricht PBL model). The steps can be summarized into three major stages namely; initial stage, PBL stage, and final stage (Masek & Yamin 2010). In the first stage, the first activity involves a group formation, whether administratively or randomly assigning students into a small group during the first meeting session. The group is then presented with a PBL problem and they begin to analyze and understand the problem. Amongst the specific activities in this stage include; the formulation of learning objectives, identifying knowledge gaps, generating hypotheses, defining the learning issues and the concepts to be learned and this is mostly done by defining "what they know", "what they do not know" and further "what they need to know". In this case, the facilitator guides students to learn through the PBL process cycle (Hmelo-Silver 2004).

The PBL stage begins with students performing an independent self-study. Students are expected to master the knowledge that relevant to the problem to be solved. Then, students conduct a group brainstorming and discussion session. They exchange and share their information with all the learning issues and hypotheses, and should reach an acceptable definition that is agreed upon by all members (Wee 2004). Meanwhile, the facilitator monitors the group's progress through direct observation and formative assessment. The direct observation involves coaching roles such as probing and questioning, in order to trigger students' meta-cognition. The facilitator then provides feedback immediately after formative assessment and always encourages students to keep up with self-assessment. In the final stage, students prepares for a project presentation and assessment during the last meeting session. Students partially present their proposal of solution. The facilitator evaluates students' work based on either group or individual presentation (Kolmos & Holgaard 2007).

Optimizing patient care requires nurses to be expert clinical decision-makers and critical thinkers to recognize changes in patient conditions, to prioritize care, and provide effective nursing interventions (Jacobson et al. 2010). So, nursing and multidisciplinary college faculty enhancing student's success through improving critical thinking, student's knowledge acquisition, retention and to be independent learners. Thus, in the recent development of pedagogical approach, one new method that has been claimed promoting students' critical thinking ability is using problem based learning (PBL) (Garcia & Pintrich 1992). This method is derived from constructivism and focuses on students' existing knowledge as a starting point in assisting them to construct and arrange new knowledge (Neimer et al. 2010).

The students become an independent learner and critical thinker when they analyze, evaluate and synthesis information from a variety of sources and present their own justified interpretation. This is known as employing 'higher order thinking skills'. Learning higher order cognitive abilities such as critical thinking (CT) has always been the ultimate goal of education (Spendlove 2008 and Sulaiman 2011).The concept of critical thinking in education was first discussed in the 1950□s. In the past 20 years, nurse educators have come to realize the importance of critical thinking in nursing education despite a consensus on the definition of critical thinking. More recently, the NLN□s expectation is that evidence of critical thinking be provided as an outcome of nursing education (National League for Nursing Accrediting Commission 2008).

Although the word critical can mean to find fault or to criticize, critical thinking is not a negative activity, it is a process where you ask questions, challenge assumptions, examine claims, and identify alternatives or answers. A super-streamlined conception of critical thinking Robert H. Ennis, define (CT) as the identification and evaluation of evidence to guide decision making. A critical thinker uses broad in-depth analysis of evidence to make decisions and communicate his/her beliefs clearly and accurately. CT is reasonable, reflective thinking that is focused on deciding what to believe and do. Critical thinking is the thoughtful, deliberate process of deciding whether you should accept, reject, or reserve judgment about a particular idea. It is also a measure of your confidence in the idea itself. Use critical thinking whenever you make a decision, solve a problem, take an action, or decide what to believe (Ennis et al. 2005).

CT has two major dimensions: cognitive skills and disposition skills. Cognitive skills related to students ability to engage in activities such as analysis, inference, evaluation, explanation and self-correction to problems, decisions or judgments. While dispositions are attributes or habits of minds integrated into students beliefs or actions that are conducive to CT. Disposition skills also motivate students to use cognitive skills when engaging in higher order thinking such as problem solving, decision making and problem-based learning (Ennis et al. 2005). There are a variety of critical thinking disposition, namely: truth seeking, open mindedness, analyticity, systematicity, self-confidence, inquisitiveness and maturity (Facione et al.2000).

An Understanding CT help student to be purposeful, self-regulatory judgment which results in interpretation, analysis, and evaluation, as well as explanation of the judgment is based. CT is essential as a tool of inquiry. As such, CT is a liberating force in education and a powerful resource in one's personal and life. The ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit. Thus, educating good critical thinkers means working toward this ideal. It combines developing CT skills with nurturing those dispositions which consistently yield useful insights and which are the basis of a rational and democratic society (Rakhudu et al. 2012).

Effectiveness in nursing education should result in profound and deep understanding of the material being presented. This does mean that learners are being able to remember, repeat and retain information, as well as they have developed the skills that allow them to find and use this information and to expand their thinking abilities. Because the students were more likely to acquire and retain information when that information was rehearsed or used to solve problems. In studying the curriculum of a nursing program, knowledge acquisition and retention by nursing students is play a primary concern of nursing instructors, because when you read a book or article about something new, you have two main concerns: Retaining the new knowledge you just acquired and being able to access the new knowledge efficiently later on. What are methods you folks use to annotate what you learn? Knowledge acquisition is one of the most common variables of interest in evaluating PBL effectiveness that can be measured in a specific manner. Knowledge can be specific according to concepts, principles, and procedures (Meitner et al. 2005).

Knowledge acquisition means the attainment of information due to instruction. Successful acquisition is measured by the amount of information the student is able to immediately recall based on predetermined learning objectives. Knowledge should extend beyond rote memory. For this study, knowledge acquisition is operationally defined as the score on a unit assessment administered after instruction (post-test). Knowledge retention means the maintenance of knowledge acquire through instruction for an extended amount of time. The amount of content retained signifies the level of thinking at which the student acquired the information. For this study, knowledge retention is operationally defined as the difference score on the unit assessment administered after instruction (follow-up post-test) (Anderson 2007).

While the importance of acquisition and retain of basic knowledge remains important as a fundamental goal in nursing education, the development of critical thinking has emerged as equally important to support nurses to solve problems effectively, and to provide the most appropriate intervention which will enhance the quality of care (Clifford et al. 2004). Can we find a balance with instructional strategies that facilitate the acquisition of basic knowledge yet develop and nurture critical thinking? So, the intention of this study to examine the impact of problem based learning on students' critical thinking dispositions, knowledge acquisition and retention.

2. Research hypothesis

Students taught using PBL will demonstrate greater critical thinking dispositions, acquire more content and retain more knowledge.

3. Aim of the study

- To examine the impact of problem based learning on students' critical thinking dispositions.
- To compare the impact of problem based learning and traditional methods of learning (lecture) on improving students' knowledge acquisition and retention of managerial skills (motivation, manage change, leadership, and communication).

4. Materials and Methods

4.1 Design:

The study was used quasi-experimental design.

4.2 Setting:

The study conducted at the Nursing Administration Department, Faculty of Nursing, Mansoura University.

4.3 Subjects:

The total number of the nursing students enrolled in the 3rd year (2011-2012) (385) nursing students who study nursing administration course. These nursing students divided into 13 groups assigned to different clinical settings as Main Mansoura University Hospital, Mansoura Emergency Hospital, Mansoura Child Hospital, Oncology center, Specialized Medical Hospital. Only the nursing students who agreed to participate in this study were 200 students, whom divided randomly into two groups.

Group I: Experimental group. Consisted of 100 nursing students, who were trained to learn by using problem-based learning educational strategy.

Group II: Control group. Consisted the other 100 nursing students, whom learned by the traditional educational strategy (lecture).

4.5 Tools of data collection:

The data will be collected by using three tools:-

Tool 1. The California Critical Thinking Disposition Inventory (CCTID) questionnaire. It was developed by (Facione & Facione 1992) and included two parts:

a) Socio Demographic data for information regarding administration students include: name, age, six, students education, address.

b) CCTID questionnaire to measure the student's dispositions of critical thinking. It consists of a 75 items grouped under seven subscale namely; truth seeking (12 items), open-mindedness (12 items), analyticity (11), systematicity (11) critical thinking self-confidence (9) inquisitiveness (10) and cognitive maturity (10 items). Students responded using a 4-point Likert scale ranged from "strongly agree" to" strongly disagree".

Tool 2. Educational tools which included two parts:

First part: Students guide

Problem based learning hand book was designed by the researchers to provide guidelines and strategies that were facilitating administration students` participation in PBL group.

Second part: Four ill structure scenarios

Problem-based learning problems must present as ill-structured problems, it was developed by the researchers based on information related literature and about actual or potential problems related to four managerial skills namely (motivation, change management, leadership, and communication).

Tool 3. Knowledge test

It developed by the researchers, used to assess knowledge acquisition and retention of the experimental group after problem based learning apply and control group after having lecture on managerial skills (motivation, communication, leadership and change). It was consist of three parts .the first part consist of 23 true and false question, the second part consist of 14 item of multiple choose questions and third part was situation consist of three open-end questions.

Scoring system was (40 mark) for an overall score of Knowledge test which ranges from (40:34 marks) > 85% for excellent, (33:30 marks)) >75% for very good, (29:26 marks) > 65% for good and (25: 20 marks)) >50% for accept.

4.6 Methods

- Official permission to conduct the study was obtained from the Dean and the head of Nursing Administration Department, Faculty of Nursing, Mansoura University.
- The student's oral consent was taken before the beginning and had the right to withdraw from the research at any time.
- Tools of data collection were tested for its content validity and relevance by a jury consisted of 5 experts in nursing administration department.
- A pilot study was carried out on 20 students to evaluate the clarity and applicability of the tools and necessary modifications were done based on their responses. These students are not included in the study.
- The researchers were developed scenario of ill structure problem on managerial skills module (motivation, communication, leadership and change management) and was distributed to student to solve the problems.
- The data was collected by the researchers from study subject after instruct them about problem based learning.
- The researchers were distribute the tool I (California Critical Thinking Disposition Inventory (CCTID) questionnaire) after translated to Arabic to all students in experimental group pre and post application of problem based learning, to evaluate effect of problem based learning on students critical thinking.
- The knowledge test was distributed to the students in experimental group immediately after application of problem based learning and to the students in control group immediately after traditional method of learning (lecture) to measure knowledge acquisition of four managerial skills module (motivation, communication, leadership and change management). The knowledge retention test was administered for both groups three months after the knowledge acquisition by the researchers

4.6.1 The process of problem based learning phase:

- At the beginning, one session was conducted for nursing students of experimental group using student guide to introduce the concept and importance of PBL and prepare the students for applying PBL. The guide distributed to the students one week before the PBL course. It contained important information related to the process of PBL, role expectation of the tutor and students.
- Experimental group (100 students) divided into two medium groups, each medium group included 50 students, which divided into four small groups, and each small group was included (12 or 13 students) during the PBL session. Medium group of PBL can be mentored by one ‘‘floating facilitator’’ among four small groups. In this model, the researchers (tutors) spend 10–15 min with each small group combined with periodic medium group discussions during the PBL process. The students and tutor met in a class twice a week for one hour.
- Introduce of scenario and problem initiation. Students are presented with a problem that is often ill-defined and complex. Students identify learning issues and possible sources of information. Each two small groups in one medium group were provided with the same scenario and were asked to follow the PBL process. Members were asked to assign a recorder and leader for the group. At the end of this phase the students will be able to identify their learning goals on individual and group levels, list learning issues of the illustrated scenario and list duties and responsibilities of each student within the small group.
- In the brainstorming phase small group discussion occurred and the tutor circulated among the small groups of students to observe group process and ask questions to stimulate thinking. The tutor also assisted the students to focus their discussion on the scenario to keep within the allotted time frame. At the end of this phase the students will be able to demonstrate reflection, provide feedback about the tracked knowledge and revaluate and modify their learning goal and issues
- Next, students engage in independent study by gathering and analyzing essential scenario information. When the students meet in the small group they critically discuss the practical application of the information to the scenario. Following completion of the scenario, students critically reflect on both the content learned and the process. Then each two groups have the same scenario meeting together for discussion and after that medium group discussion to provide feedback about the developed materials, revaluate and modify the developed materials and developed the final presentation form. And then large group discussion occurred to demonstrate reflection, demonstrate the final presentation and evaluation.

4.7 Statistical analysis:

The collected data were organized, tabulated and statistically analyzed using SPSS software statistical computer package version 13. For quantitative data, the range, mean and standard deviation were calculated. For comparison between means of two groups of parametric data, student t-test was used. For comparison between two mean values of the same group pre and immediately post as well as 3 months post intervention, paired t-test was used. For qualitative data, comparison between two groups and more was done using Chi-square test (X2). Correlation between variables was evaluated using Pearson’s correlation coefficient (r). Significance was adopted at $p<0.05$ for interpretation of results of tests of significance (Dawson & Trapp 2001 and Petrie & Sabin 2005).

5- Result

Table 1. Personal characteristics of the studied nursing students.

Variables	The studied nursing students (n=200)			
	Experimental group (n=100)		Control group (n=100)	
	N	%	N	%
Age (years): Range Mean SD	19-22 20.16±0.66			
Sex: Males Females	33 67	33.0 67.0	34 66	34.0 66.0
Residence: Urban Rural	32 68	32.0 68.0	35 65	35.0 65.0
Education: Secondary Technical	78 22	78.0 22.0	76 24	76.0 24.0

Table 1. Shows personal characteristics of the studied nursing students experimental and control group. It was observed that all students in both groups were in age group (19-20) with mean age (20.16 +0.66). The highest percent of them (67%-66%) were females and (68%-65%) living in rural area. Most of them (78%-76%) having secondary education.

Figure 1. Mean degrees of critical thinking of the studied nursing students pre and post-intervention.

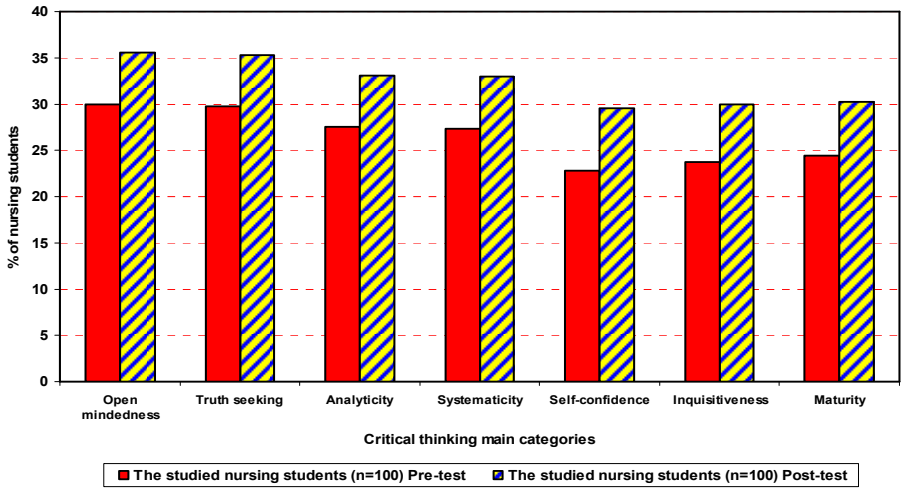

Figure 1. represents mean degrees of critical thinking of the studied nursing student's pre and post program. Figure revealed that statistical significant improvement in all items of critical thinking post intervention than pre intervention.

Figure 2. Mean total degrees of critical thinking of the studied nursing students pre and post-intervention.

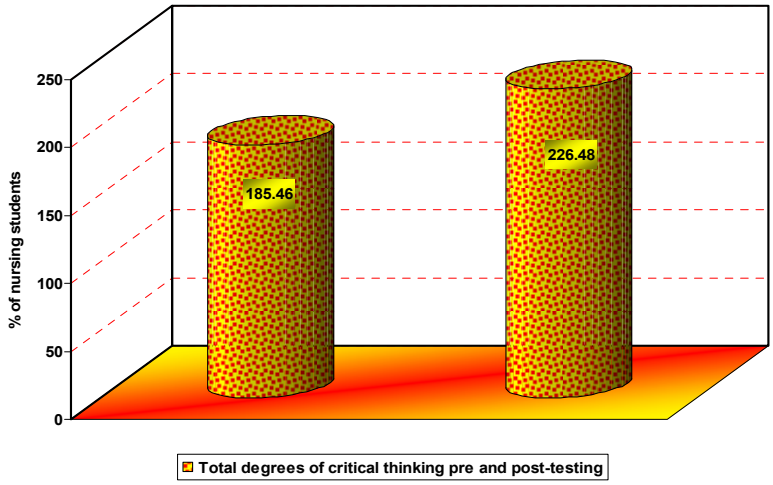

Figure 2. show mean total degrees of critical thinking of the studied nursing student's pre and post intervention. It was observed that statistical significant improvement in total degrees of critical thinking post intervention with mean scores (226.98 $\pm$ 21.04) than pre intervention with means score (185.46 $\pm$ 37.35).

Figure 3. Percent of change in critical thinking of the studied nursing students post- intervention than pre.

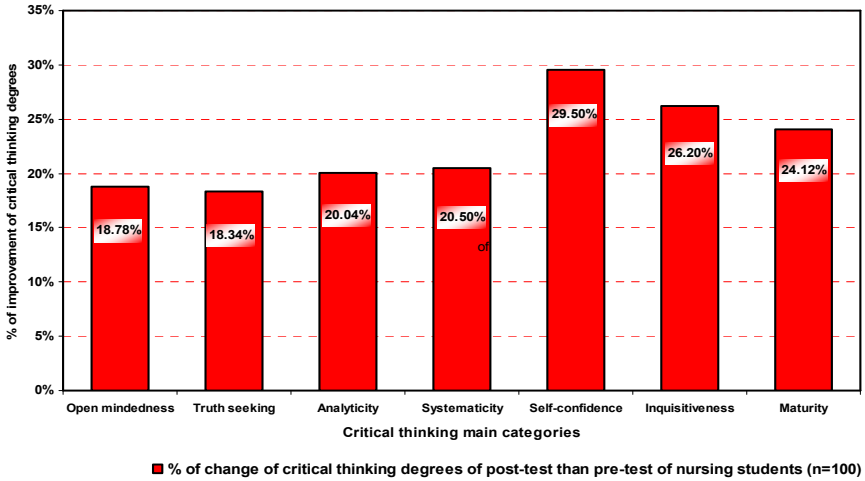

Figure 3. represent percent of change in critical thinking of the studied nursing student post intervention than pre. The figure show that self-confidence item had high percent of change (29.60%) followed by inquisitiveness (26.20%) and maturity (24.12%). While truth seeking and open-mindedness had low percent of change (18.34%, 18.78%) respectively.

Figure 4. Mean total knowledge scores of the studied nursing students immediately post-intervention (knowledge acquisition) and 3 months post-intervention (knowledge retention).

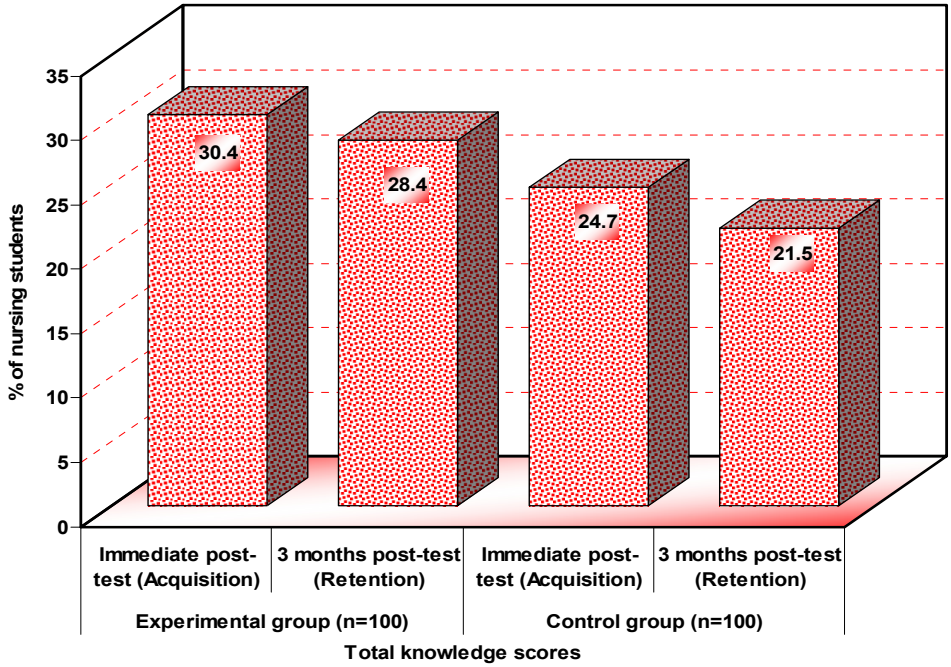

Figure 4. show mean total knowledge scores of the studied nursing students immediately post intervention (knowledge acquisition) and 3 months post intervention (knowledge retention). It was observed that increasing of mean score of knowledge acquisition and retention of experimental group (30.4, 28.4) than mean score of knowledge acquisition and retention of control group (24.7, 21.5). Also increasing mean score of knowledge acquisition than mean score of knowledge retention in both group (30.4, 28.4) against (24.7, 21.5) respectively.

Table 2. Correlation between total knowledge scores of the studied nursing students (Experimental group) and their critical thinking degrees post-testing.

Critical thinking main categories	Total knowledge score of the studied experimental nursing students post-testing (n=100)	
	r	P
Open mindedness	0.132	0.189
Truth seeking	0.074	0.464
Analyticity	0.064	0.527
Systematicity	0.063	0.534
Self-confidence	0.109	0.279
Inquisitiveness	0.071	0.485
Maturity	0.184	0.067
Total critical thinking degrees	0.093	0.358

Table 2. Represent correlation between total knowledge scores of experimental group and their critical thinking post intervention. The table revealed that no statistical significant correlation between total knowledge of students of experimental group and their critical thinking post intervention.

6. Discussion

In today`s complex health care system, critical thinking has been identified as an essential component to accomplish safe, competent patient care and it has been linked to the success of nursing student in their transition

to clinical practice (Lai 2011). So , the recent campaign seeks to shed light on the move to a new delivery system approach in nursing schools, where student centered learning such as (PBL) was introduced to replace the teacher centered learning in an effort to promote nursing students critical thinking ability, enhance their knowledge acquisition and retention, autonomy, and professional identity. In response to these demands, nursing schools have to introduce several steps to improve their teaching and learning system through their transformation agenda (Department of Polytechnic Education 2010).

This study was conducted using the pre-test and post-test however were deployed to compare the significant gain in critical thinking for a single group of PBL treatment. The result of the present study indicated that, there were a statistical significant improvement in total degrees of critical thinking post intervention with mean scores (226.98 + 21.04) than pre intervention with means score (185.46 + 37.35). This means that PBL helped the nursing students to improve thinkers by enhancing their abilities to think of many different ways to learn about a new topic, to question what they are doing and promoting their readiness to learning through figuring out solutions to nursing practice problems. Moreover, PBL providing effective learning environment to be conducive for the development of critical thinking through stimulating students' interest, creating meaningful discussion, exposure to thoughts and views of others, and fostering a trusting and supportive atmosphere.

This findings are agreement with a studies conducted by Tiwari et al (2006). This examined the use of PBL as a teaching method to enhance critical thinking skills. PBL was found to be more effective in the development of critical thinking than traditional classroom lecture. Learning environments, in which students actively participate, such as PBL, are more effective to develop critical thinking skills than passive learning environments. Similar finding was recognized in a study conducted by Yuan et al (2008) who concluded that students, who experienced PBL showed greater improvement in critical thinking skills, motivated them to learn, allowed them the opportunity to share opinions with others, to

Moreover, studies conducted in Mainland China have recognized that students with problem based showing fostering critical thinking skills, improving self-directed learning and cooperative group work when compared with traditional lecture (Dehkordi & Heydarbejad 2008). Also PBL engages students in activities that reveal their thinking process, so that they can monitor the effectiveness of their ability to analyze, reason, and acquire knowledge which enables them to assume increasing responsibility for their own learning (Gwee 2009 and Frambach 2012). Although, the result of Sulaiman (2011) which indicated that there was no statistical difference for critical thinking, between the control and the experimental groups, but some further analysis indicated that PBL students had better skills in making inference and assumption than the traditional method students.

The majority of research on PBL shows promise in the use of PBL to promote critical thinking. In this respect, Capon & Kuhn (2004) found that the PBL students possessed a high ability in relating to the concepts, understanding the meaning, applying it to a specific case and able to integrate and apply the two business concepts taught. The development of critical thinking ability should be a primary goal of education (Pithers & Soden 2000). Also, Ball & Knoblauch (2004) and Hmelo-Silver (2004) concluded that students exposed to PBL consistently display growth in problem-solving and critical thinking skills.

In other context of comparison, using the Bloom's taxonomy of cognitive domain, PBL students scored higher in multiple choice question tests that measured the knowledge of applications and evaluations (Dehkordi & Heydarnejad 2008). In Kasai et.al. (2006) the knowledge applications that were measured by the essay test indicated that the PBL students scored higher when compared to the traditional method students. Additionally, students in PBL programs showed an increase in transfer and application of knowledge, and in analysis and application required in clinical trials, each considered essential to problem-solving (Albanese & Mitchell 1993). PBL has been found to be effective in promoting higher-order thinking (Norman & Schmidt 2000 and Vernon & Blake 1993).

Also, this study found that self-confidence item of critical thinking had high percent of change post intervention than pre (29.60%) followed by inquisitiveness (26.20%), maturity (24.12%), open-mindedness (18.78%) and at the later truth seeking (18.34%). This result may be due to PBL promoting nursing students ability to manage learning tasks without having directed by others, keep an open mind to other points of view, translate learning needs into learning goals and improve student's ability to observe.

Bosse (2007) found that students participating in PBL tutorial sessions appear to exhibit problem-solving skills, analytical thinking skills and personal and interpersonal attributes. PBL places an importance on being an active responsible participant in one`s education rather than being a passive of information to increase autonomy, maturity and self-confidence.

Gibson & Campbell (2000) supported the present study and reported that improved learning and self-confidence among PBL students compared to lecture students. PBL increased student` learning activities as critical thinking skills, personal accountability for self-directed learning and enhance the skills of independent study, reasoning, group interaction and active participation (Harris & Hofer 2011).

Regarding total mean scores of the studied nursing students knowledge immediately post intervention (knowledge acquisition) and 3 months post intervention (knowledge retention)., the result revealed that,

increasing of total mean score of knowledge acquisition and retention of the experimental group (30.4,28.4) than total mean score of knowledge acquisition and retention of control group (24.7,21.5). This may be really contributed to the PBL that help students to participate actively in nursing classes, help them to develop cognitive strategies that students use it to learn, understand and retain the knowledge. In addition to PBL facilitate critical thinking that enable students to fulfill the need of their expected role and use of knowledge by students make subject matter more interest and the content subsequently appears more relevant. This ultimately leads to increased motivation to learn among nursing students and enhance knowledge acquisition and retention.
Schmidt et al. (2011) agreed with this study and concluded that PBL encourages and provides opportunities for elaboration of knowledge facilitate the comprehension of new information related to the problem and enhance long-term memorability. Also, Frambach (2012) at faculty of health, Maastricht University reported that PBL is the best for nursing students which tend to better acquire scientific conceptions and integrate and organize the knowledge. PBL promote both the acquisition of content knowledge and the development of thinking skills and strategies.
Mahmoud and Hyder (2012) support the present study who stated that student's evaluation post PBL were better than non PBL and indicated that PBL is a welcome alternative to lecture-based teaching which encouraged clinical problem solving, fruitful in class discussion and high score of academic achievement.
The result of present study was supported by Li et al. (2013) at Central South University, china who found that all PBL participants had better results for written examination, clinical examination and overall performance than other methods of learning.
On the line with this result many studies as Tarnvik (2007), Gewee (2009), Macallan (2009) and Callis et al. (2010) who revealed that PBL students were better at applying basic science knowledge to clinical case and gaining high knowledge score in post PBL exam than lecture based learning. Also. Young (2005). showed That PBL students had significantly higher overall scores on the completion of the semester compared with the lecture students. In this respect, Dods (1997) conducted a study to investigate the effectiveness of PBL in promoting knowledge acquisition and retention, which reported that students taught using PBL, had greater retention of knowledge and improved student achievement and understanding.
On the other hand, the study conducted by Andrews & Jones (1996) was contrast to the present study and reporting that nursing students in the PBL group had significantly lower knowledge acquisition compared with those who received the lecture method. Although, there was agreement on the contribution of PBL to factors such as knowledge retention, student satisfaction, motivation, and critical thinking. But, there was much less agreement on the role of PBL in knowledge acquisition [(56).] Moreover, Vernon & Blake (1993) concluded that PBL students are at a disadvantage when compared to traditional students on content knowledge. While, others Alleyne et al (2002), Dods (1997).and Lieux (1996) found no difference in the content knowledge of students exposed to PBL compared to traditional instructional strategies.
The current study clarifies that no statistical significant correlation between students` total knowledge of experimental group and their critical thinking post intervention. This result may be due to knowledge acquisition and retention need only direct recalling and remember learning information, and not need analytical, reasoning and critical thinking skills. On the line with this result many studies agreed that both variables were independent (Burris 2005 and Anderson 2007). Also, Burris & Garton (2007) implied within this view that factual knowledge can be adequately learned for subsequent recall and application without students' engaging in aspects of critical thinking as they construct knowledge. Moreover, the low correlation between content knowledge and critical thinking ability of students suggests that strategies efficient at achieving one educational goal may not lend themselves to the other.
Similarly, Paul & Elder (2001) believed that students' attainment of foundational skills and factual knowledge occurs without active engagement in critical thinking and assumed that retention and transfer of knowledge for advanced problem solving is facilitated through rote or transmission models of learning. In essence retention requires that students remember what they have learned, whereas transfer requires students not only to remember but also to gain a conceptual understanding and be able to use what they have learned.
In contrasting with this result the findings of Tiwari et al (2006) and Deal & Pittman (2009) illustrate that students with better knowledge acquisition had a good ability in thinking critically.

7. Conclusion

There was a statistical significant improvement in students` critical thinking post PBL than pre intervention. Also, self-confidence item of critical thinking had high percent of change post intervention followed by inquisitiveness and maturity. It is proved statistically increase of total mean score of knowledge acquisition and retention of the experimental group than total mean score of knowledge acquisition and retention of control group. No statistical significant correlation between students` total knowledge of experimental group and their critical thinking post intervention.

8. Recommendation

As a result of this study, it is recommended that:

-Teachers should continue to incorporate strategies that employ higher-order thinking skills into the curriculum (e.g. PBL, case studies, and comprehensive projects). This not only helps students to retain the information they are learning, but also provides stimulation during the learning process and helps to further develop higher-order thinking skills for use in other classes and real-life situations.

-Teachers should continue to evaluate the learning objectives and incorporate a variety of appropriate instructional strategies and assessments into the curriculum in order to achieve the learning objectives.

-Teachers should continue to develop the "art" of teaching so that students are motivated to learn. Teachers should focus on creative interest approaches, dynamic presentations, application activities to which students can relate, and unique assessments (e.g. portfolios, presentations, case studies, service projects).

-Instruction in the facilitation of PBL should be incorporated into teacher education programs and professional develop seminars. These training activities should include ample opportunity to the attendees to practice the instructional strategy as a participant and a facilitator.

-Teacher should create an autonomy-supportive learning environment in order to develop stronger relationships with their students and foster higher levels of engagement. Autonomy-supportive behavior would include open dialogue between instructor and student, more student-centered methods of instruction, informative feedback, and encouragement.

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