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Problem-Based Learning (PBL) Versus Lecture based Learning (LBL): Effect on the Development of Critical Thinking, Problem Solving and Self Directive Learning Skills in Nursing Students

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Abstract

Background: Although there is much literature on Problem-Based Learning (PBL) in medical and nursing education, there is little from the cultural perspective. Therefore, the study aims to examine the outcome abilities including critical thinking, problem-solving, and self-directed learning of nursing students receiving PBL vs. traditional lecture.

Methods: A randomized controlled trial (RCT) design was used with 85 undergraduate students who studied in level seven and were enrolled to a psychiatric nursing course. Four instruments were used including: 20-items self-report PBL Evaluation Questionnaire (PBLEQ). The Self-assessment Scale on Active Learning and Critical Thinking (SSACT) scale consists of 14 items of two domains "active learning" and "critical thinking." All scales had good reliability with coefficient alpha >0.8.

Results: the survey response rates were 100%, the study results revealed that the experimental group was considered PBL is effective in their learning process ($t=3.568$; $p \leq 0.05$). The overall SSACT also showed a significant difference in experimental group at pre and post intervention ($t=6.413$; $p \leq 0.05$). There was also a significantly different percentage score between experimental and control group in pretest ($t=2.374$ $p \leq 0.05$).

Conclusion: This study offers information on student's perspective regarding the effectiveness of PBL in constructing professional knowledge, developing problem solving skills, developing self-directed learning, and improving motivation. Moreover, it promotes effective group collaboration and enhances active learning and critical thinking. Therefore, PBL is easily considered as an alternative method of teaching nursing students since, it helps students act as professionals in clinical situations with insufficient information and encourages them to think not only deeply, but also rigorously while developing lifelong learning skills.

Keywords: Active learner; Constructivists; Nursing; Problem solving; Self-directed learning; Traditional learning

Introduction

Universally, the curriculum of nursing is developed with two major components; theory and practice. Traditionally, the theory component is being delivered to student nurses through the lecture-based approach, whereas the simulation approach is introduced to ensure that students are able to grasp the psychomotor skills needed before they had been exposed to the real clinical environment. These traditional active learning approaches are helping nursing students to integrate the theory into practice. Nurse faculties rely heavily on traditional lecture-based approach, marked by large group lectures and instructor-provided assignments and learning objectives [1]. Therefore, it remains a challenge for educators to efficiently influence student nurses' learning process. Internationally, theoretical and clinical teaching is seen as an important part of nursing education. The literature suggests that clinical and theoretical learning is affected by many factors, including the characteristics of learners and teachers' teaching style, quality of supervision and feedback. Surprisingly, nursing education receives little attention from the nurse educators in Saudi Arabia (SA). It suffers from the lack of coherent theoretical base necessary to inform participants. There is also lack of substantial research in the area of effective methods of teaching which, is the 'heart' of students' professional nursing education [2]. Teaching by using problem based learning method in SA has many challenges such as time pressure which is everyone's enemy. Also, there are potential problems and deficits which might act as a barrier toward achieving a good environment for theoretical teaching. The theoretical and clinical teaching in SA lacks effectiveness which indicates a need for more active clinical settings to be able to make the theoretical components come alive in the practice and enthuse students to be engaged in learning process. For example, the current study setting and the three sisters 'colleges in Riyadh and Alhassa affiliated to King Saud Abdul-Aziz University for health sciences, Saudi Arabia's Bachelor of Nursing Science, the curriculum is implemented by using the two components; theory and clinical practice according to the traditional approach.

Clinical reasoning, critical thinking and problem-solving skills have been promoted in nursing education by transferring theory into practice. This is important as nursing graduates need to solve complex problems in the real life of nursing profession [3]. Therefore, all nurse educators must instill active participation, self-directed learning, critical thinking and problem-solving to student nurses.

Problem-based learning (PBL) has been a widely spread learning method adopted by many institutions [4] after medical schools, nursing schools and other health related curriculums globally [5].

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According to Othman et al., [6], PBL is a student-centered outcome-based learning and has become very crucial for higher learning and proven to improve the quality of learning among students at all levels and in various disciplines. According to Ozturk, Muslu and Dide [7] PBL was described as the 'most significant innovation in education for professions for many years' and has gained wide acceptance in medical, nursing and paramedical education. While several meta-analyses of evaluative research have been conducted for PBL in medical education, most of the nursing literature has focused. PBL is a process-focused instructional strategy. As opposed to a content-based one, it employs small groups that are centered on solving well-integrated clinical problems instead of large groups as in traditional instruction, with content delivered mainly through lecture and limited self-directed learning [8]. Most investigations of the use of PBL in nursing have studied its effects on critical thinking, problem-solving, and self-directed learning [9,10].

Critical thinking is considered as one of the essential principal competencies of nursing education which enhances clinical site-based learning and theoretical knowledge [6,11]. Hajrezayi et al., [12] said that critical thinking is a purposeful, self-regulatory judgment that results in interpretation, analysis, evaluation and inference. Kong et al., [13] added that critical thinking is a major component of the discipline of nursing as well as nursing education. Therefore, the positive effects of critical thinking clearly help improve the quality of care provided to patients [14]. Moghadam et al., [15] in their study identified the relationship between fostering critical thinking skills in nursing students and an evidence-based performance. PBL resulted in the increase of students' critical thinking and self-directed learning, which are needed to solve clinical problems [15].

Problem solving is recognized as a critical outcome of importance wherever PBL is mentioned [16], but studies of the effects of PBL on problem solving in the nursing literature are sparse. In one study by Uys et al., [8], investigators reported that the PBL group attained higher levels than the non-PBL group of problem-solving skills in 128 graduate students enrolled in nursing school. The majority of the responses of students in the PBL group that were given to the problems posed reflected highly constructive strategies (at the advanced beginner level or above), whereas responses of the students in the non-PBL group's responses were more often at the novice level. Enhanced problem-solving ability thereby affects the quality of and plays a vital role in the outcomes of the nursing care [17].

Lekalakla-Mokgele, [10] emphasized that PBL is a student-centered method of instruction; it is an educational strategy in which students take responsibility for their own learning and appears to enhance self-directed learning skills. In addition, the self-directed learning aspect of PBL encourages the development of nursing students' ability to think critically, and critical thinking in turn enhances the nurses' abilities to logically assess and formulate interventions to impact patient care [18]. Self-directed learning is consequently an outcome in which individuals take the responsibility of their own learning, and has been shown to be facilitated by PBL [19]. Tseng et al., [18] reported that, nursing students who received instructions that employed PBL strategies demonstrated significantly more self-directed learning than nursing students did in the traditional program. In the current study setting, teachers and faculties face a lot of challenges to apply more active learning methods such as, problem based learning, this is because of increased numbers of students and decrease numbers of faculties teaching courses have clinical components. Therefore, the current study looked at investigating a trial of PBL vs. traditional lecture in examining the students' outcome abilities including critical thinking, problem-solving, and self-directed learning of nursing students, and to examine the correlations among these outcome abilities.

Aim of the Study

The aim of this study was to examine outcome abilities including critical thinking, problem-solving, and self-directed learning of nursing students receiving PBL vs. traditional lecture, and to examine correlations among these outcome abilities. More specifically the study was looked at:

- Comparing the effect of both teaching methods on developing students' knowledge as regard to major depressive disorders (group (Experimental group) (PBL) and LBL (control group)
- Assessing students experiences in PBL and LBL
- Finding the relationship between the participants demographic data (the intervention and control group) on their knowledge and their critical thinking, problem solving and self-directed learning
- Examining the correlation between the outcomes (knowledge, critical thinking, problem solving and self-directed learning) among the intervention group.

Research Questions

The research questions of this study are:

1. What is the difference between the knowledge of the PBL and LBL groups about depressive disorders?
2. What are the students' experiences in Problem Based Learning (PBL)?
3. What are the effects of participant's demographic data on their knowledge, critical thinking, problem solving and self-directed learning?
4. What is the correlation between outcomes in relation of critical thinking, problem solving and self-directed learning among the intervention group?

Hypothesis

1. PBL Students group (experimental) will demonstrate greater critical thinking, problem solving, and self-directed learning than LBL group (control).
2. LBL group (control) will demonstrate greater critical thinking, problem solving, and self-directed learning than PBL Students group (experimental).

Theoretical framework

The process of problem based learning has its roots in constructivist theory for Jean Piaget (1896-1980), which posits learners takes an active part in generating meaning of concepts and constructing their own understanding [20-22]. On the other hand, traditional lecture-based learning in which the learner adopts the role of passive observer, absorbing mounds of information from an external source, the teacher. According to constructivist approach, teaching nursing' subjects will emphasize on presenting students with real-life problem situations for them to formulate their own inquiry questions (depressed patient scenario), explore multiple interpretation and multiple concepts through collaboration. According to Ernest [23], the essentials of teaching for this purpose have several components, which include discussion between and among students, between students and their

teachers, projects and investigative type problems for critical skills development, problem solving, and creativity. Ernest [23] further suggested that, because of the varied, active, socially engaged and self-regulatory nature of learning, the resources of teaching should (a) be of a wide variety to facilitate many different approaches to teaching, (b) include authentic materials such as newspaper, official statistics, research articles and so on, so as to make learning more socially relevant, and (c) be relevant and easily accessible. There is a vast array of technological resources now available to facilitate students' collaborative and research efforts, and giving them some responsibility and leadership ability for their own learning. No longer is the teacher the only person with the keys to learning.

Computers, word processors, multimedia programs, and compact discs databases are some of the tools of technology that students can use to demonstrate their learning

The role of the teacher here, is to provide meaningful learning activities and problem situations in an environment that is conducive to students' learning needs, they must take students' interests into account. With collaborative learning being part of the problem based learning environment, so does the opportunity for interdisciplinary learning team work will be practiced by students themselves [24]. It is also an opportunity for students to showcase their stronger understandings, critical thinking, and problem solving. Although Gardner's MI theory was developed from brain research its principles are constructivist. It posits that the teacher must not only create a suitable working environment, but must also develop the kind of purposeful problem-related projects and other activities that engage students higher order thinking skills of analysis, synthesis, and application.

Research Methodology

Study design

A randomized controlled trial (RCT) design was used to answer the questions that PBL had an effect on nursing students' critical thinking, self-directed learning and problem-solving skills [25]. Therefore, the objective was to evaluate the effect of PBL on developing nursing students' critical thinking, self-directed learning and problem-solving skills.

Subjects and setting

All the 85 undergraduate nursing students level seven in CON-J, KSAU-HS, aged 20 to 23 with a total mean score of (21.61 ± 0.84) who were registered for Mental Health Nursing course for Fall semester 2018\2019 were invited to participate in the current study. These students belonged to two separate classes and were assigned randomly to either PBL (44 students) or LBL group (41 students). The students were assured that their participation was entirely voluntary and informed of their rights as research subjects. For those who agreed to participate, written consent was obtained.

Tools of the study

The tools of the study consisted of 4 main tools as following:

First tool: It was the sociodemographic sheet of the participants which contained data enquired about age, academic level, academic score (GPA), and number of studying hours. In addition to a questionnaire asking about students' previous experience with PBL.

Second tool: It was the PBL Evaluation Questionnaire, which was developed by Yuan [20] to assess the magnitudes of problem solving and self-directed learning of nursing students in the university. The scale consisted of 20 self-reported items of five sub-scales which measured: Professional knowledge, problem-solving skills, self-directed learning, motivation, and group collaboration. The scale had an acceptable Cronbach's alpha of 0.80 [20]. This scale also used a scored on 5-point Likert-type scale from 1 to 5 (1=very ineffective to 5=very effective). Possible range of the total scores started from 5 to 100. Higher scores will indicate stronger problem-solving skills and self-directed learning. The content validity index (CVI) was calculated as one. The internal consistency was established by using Cronbach's alpha, and equaled 0.80 and the test–retest reliability with a two-week interval, equaling 0.89.

Third tool: It was the self-Assessment Scale on Active Learning and Critical Thinking (SSACT) which was adopted from Khoiriyah, et al., [26]. The SSACT consisted of 14 items of two subscales: Active Learning and Critical Thinking. The scale had an acceptable Cronbach's alpha of >0.80 [20]. This scale also had responses assessed on a 5-point Likert-type scale (1=almost never true to 5=very true). Possible range of the total scores started from 5 to 70. Higher scores indicated good critical thinking skills. The SSACT had good reliability for each subscale as well as total scale (coefficient Alpha >0.8), which were strongly correlated with each other [26].

Fourth tool: Fourth tool consisted of 16 Questions developed by the researchers based on the case study (depressive disorders) to test the ability of the students in both groups for problem solving and critical thinking skills pre/post assessment. The questions consisted of 2 types based on MCQ style, 14 questions required only one answer, whereas only two questions required more than one answer (Choose all answers that apply) asking about manifestation of mild depression and suicide teaching plan and each had 3 answers. The total score was ranged between 0 -20 as 0 is a minimum score, while 20 is the maximum.

To ensure the content validity and relevance of these MCQs questions, it was distributed to a jury compromised of 5 experts in psychiatric and nursing education within the CON-J, Jeddah. All comments and suggestions were incorporated to ensure that the contents of the questions were appropriate

Pilot study

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 were not included in the study.

Data collection procedure

- Once the official permission to conduct the study was obtained from research unit at CONJ, KAIMRC, and IRB, the data collection process was started.
- All students who were enrolled to the psychiatric nursing course were invited to participate in the study through leaflet and brief discussion and/or explanation during the day courses.
- The study included the random assignment of students to either the control or intervention group. The total number of students (85) was divided into 2 groups randomly, where 41 students were assigned to the control group and 44 to the experimental one. The students' list was prepared by the academic affairs unit and used as a sampling frame. The second last number of student identification number was selected by using a table of random numbers and allocate to each group alternately (Figure 1).

The students' written consents were taken before the start and they were also well-informed that they can withdraw from the research at any time.

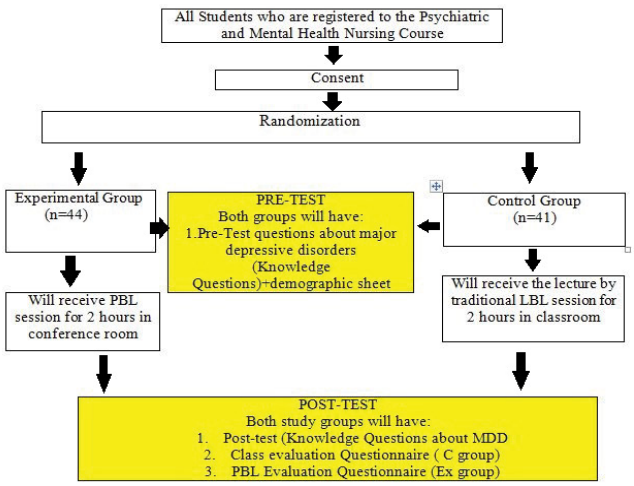

Figure 1: The study flow.

Experimental and control group

Before starting the actual session of teaching the (mood disorders: major depressive episode) both groups were given an experiential learning session which consisted of a brief introduction about the PBL definition, importance, advantages and disadvantages and its effectiveness in developing their critical thinking, and their metacognitive abilities. This introduction was given to clarify the reasons which make this research significant and the procedure they must undergo, especially with this being the 1st experience for all students.

A module of "Mood Disorder (major depressive episodes)" *was developed by the researchers using the following key steps in the PBL tutorial process that will be divided into 3 sessions as followings:*

1. Developing a case presentation
2. Identifying key information
3. Generating and ranking hypotheses
4. Generating an enquiry strategy
5. Defining learning objectives
6. Reporting back
7. Integrating new knowledge

PBL group

The participants of this group were divided into 4 sub-groups with 11 students each. Each group was facilitated by one facilitator. They were taught through the PBL instructional program which was applied to the prepared module of mood disorders "depressive psychotic disorders". The PBL group was met two to three times a week for two hours per session, for a total of 3 tutorial sessions.

The PBL process was ultimately administered in the following stages:

First sessions

The objective of this session was at the end of this phase, the students were expected to 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.

Steps

1. Assign participants to their roles in the PBL as reported in the Figure 2.
2. **Introduction of scenario and problem initiation.**

Students were presented with a real-world, complex and open-ended problem such as that that might be faced in the workplace or daily life. The students clarified the occurrences in the scenario and defined the problem and also noted the unclear concepts. The facilitator encouraged the students to reflect on the subject and debate openly and helped them understand the scenario. Students also identified learning issues and possible sources of information.

Self-directed learning

The students were encouraged to search for advanced information in textbooks, journal articles and internet sources such as the Medline database. They were also asked to share their drafted informative handouts with their peers and prepared critical thinking questions for a group discussion in the next tutorial session.

Second session

The objective of this session was at the end of this phase, the students were expected to be able to demonstrate reflection, provide feedback about the tracked knowledge and revaluate and modify their learning goal and issues.

Steps: In the brainstorming phase, a small group discussion occurred as the students used their personal ideas and previous understanding to produce possible explanations for the evaluation of the knowledge and skills required to deal with the situation, while the facilitator circulated among the small groups of students to observe group process and asked questions to stimulate thinking. The concepts woven into the scenario were clarified and the research subjects were determined. The tutor also assisted the students to focus their discussion on the scenario to keep within the allotted time frame. The facilitator encouraged an in-depth understanding and commented on the students' handouts. Then, the students shared what they had learnt and debated on the critical thinking questions and provided possible explanations for the situation.

Third session

The objective of this session was at the end of this phase, the students were expected to be able to analyze and provide feedback about the developed materials, revaluate and modify it and develop the final presentation for the case scenario's essential information.

Steps

1. Presenting a care plan: The students engaged in an independent study by gathering and analyzing the scenario's practical and essential information. When the students meet in the small group, they would critically discuss the practical application of the information to the scenario. Each group prepared a care plan for the problems and shared it in the group. The facilitator helped the students understand why some situations are often more complex than they have initially appeared. Following the completion of the scenario, students critically reflect on both the content learned and the process.
2. Evaluation and reflection: The students engaged in self-evaluation, peer evaluation and reflection on what they had learnt and how they had learnt it. The facilitator helped the

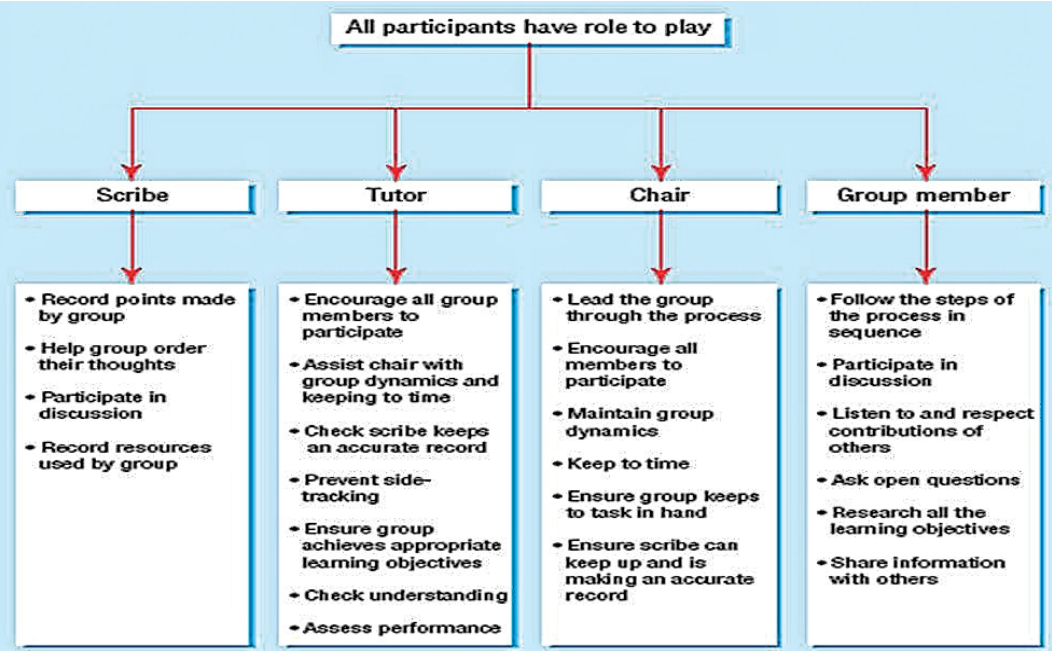

Figure 2: Roles of participants in a PBL tutorial.

students in the evaluation of the group's achievements. Before and after each session, the facilitators discussed the learning objectives and the students' progress in each PBL group, and shared their experiences for solving the problems they faced during the implementation of the intervention. Finally, large group discussions occurred to demonstrate the final presentation and evaluation.

LBL group

The participants of this group consisted of 41 students. All of these participants were taught by using LBL for mood disorders "depressive psychotic disorders" as usual in a classroom for 2 hours, by a single lecturer.

Posttest administration

Questionnaires were distributed again and filled by both experimental and control groups after finishing the program.

Data management and analysis

At the beginning and at the end of the intervention, the sociodemographic, PBL Evaluation Questionnaire, SSACT and pre and post-test questions were completed by the participants from both study groups. The scores of both PBL Evaluation Questionnaire and SSACT were described in terms of item mean and standard deviation using the Statistical Package for Social Science SPSS 21.0 (Software package, Chicago, Illinois, USA). Independent sample t-tests were performed to compare item means of PBL evaluation within experimental group. Whilst the SSACT items mean and standard deviation were compared between and within the study group.

Ethical Considerations

Ethical approval was obtained from the IRB of the KSAU-HS. Participation was thereby entirely voluntary. Moreover, information about the study was given to every participant to assure the protection of human rights. Students also had an opportunity to determine their willingness to participate in the study as a signed, informed consent was obtained from each student before data collection. Students were free to refuse to participate or withdraw from the study at any time. Confidentiality was ensured through the use of code numbers. The list of code numbers and names was stored separately from the actual data. The obtained data from the participants was used only for the study. Students were apprised that all findings would be reported as group results and would be submitted for publication.

Results

Table 1 showed the comparison between the descriptive demographic characteristics of both the experimental and control group. The total mean of exp. Group age was 21.86 ± 0.93 compared to 22.37 ± 0.80 for control group with no significant difference between them as P=0.810. The majority, (95.5% and 100%), of both groups were from urban areas and were single. The total means of Exp. GPA was 3.35 ± 0.44 compared to 3.40 ± 0.62 for the control group. Concerning the studying hours, the total mean was 13.66 ± 17.40 for expr., and 16.63 ± 21.56 for the control group with no significant difference P=0.592. Additionally, the majority (90.9%) of the experimental group have previously heard about PBL while 87.8% of the control group did not, with no significant difference P=0.733. Both of the studied groups have thereby been previously familiar with PBL (97.7%and 87.8%) respectively, with no significant difference P=0.102.

Additionally, the majority of both groups received their PBL through their university education, with significant difference as P= 0.014. On the other hand, more than two third (65.9%) of exp. and (43.9%) of the control group were unable to decide which method of teaching they seem to prefer, with no significant difference P=0.122.

Figure 2 represents the comparison between the pre and post PBL evaluation of the experimental group. The figure shows that there was an improvement in all PBL evaluation questionnaires with the highest score given to the promotion of effective group collaboration

Demographic characteristics	Experimental (n=44)		Control (n=41)		p-value
	No.	%	No.	%	
Age (years)					
≤21	15	34.1	15	36.6	0.810
>21	29	65.9	26	63.4	
Mean ± SD.	21.86 ± 0.93		22.37 ± 0.80		
Residence area					
Urban	42	95.5	41	100.0	^{FE}p= 0.495
Rural	2	4.5	0	0.0	
Marital Status					
Single	41	93.2	40	97.6	^{FE}p= 0.617
Married	3	6.8	1	2.4	
GPA					
2.5 – <3	4	9.1	5	12.5	^{MC}p= 0.796
3 – <3.5	14	31.8	9	22.0	
3.5 – <4	23	52.3	23	56.1	
4+	3	6.8	4	9.8	
Min. – Max.	2.50 – 4.10		2.50 – 4.70		0.705
Mean ± SD.	3.35 ± 0.44		3.40 ± 0.62		
No. of studying hours					
Min. – Max.	2.0 – 103.0		1.0 – 103.0		0.592
Mean ± SD.	13.66 ± 17.40		16.63 ± 21.56		
Did you hear about PBL?	40	90.9	36	87.8	^{FE}p =0.733
Were you previously taught by PBL?					
No	1	2.3	5	12.2	^{FE}p= 0.102
Yes	**43**	**97.7**	**36**	**87.8**	
If your answer is yes, answer the following:					
Where?	**(n=43)**		**(n=36)**		
High school	7	16.3	5	12.2	^{FE}p= 0.014*
University	36	83.7	36	87.8	
Which do you prefer?					
No answer	29	65.9	18	43.9	0.122
PBL	9	20.5	13	31.7	
TBL	6	13.6	10	24.4	

FE: Fisher Exact t: Student t-test
p: p-value for comparing between the two studied groups
*Statistically significant at p ≤ 0.05

Table 1: Comparison between the two studied groups according to demographic characteristics.

(71.78) in pre compared with (83.71) that of the post test, followed by (78.41) development of self-directed learning and (76.7) for the post of both construction of professional knowledge and improvement of motivation.

Table 2 illustrates that there is a high significant difference between pre assessment data of instrument PBL evaluation questionnaire and the post educational intervention regarding the whole items of the scale as P <0.05.

Table 3 presents that there is no significant difference between the pre and post assessment of the control group in regard to the whole items of instruments in the PBL evaluation questionnaire (P< 0.05), except for the item of promotion of effective group collaboration as the total mean in pre assessment was 77.44 ± 16.59 compared to 70.12 ± 17.48 and t=1.858 and P value was 0.071.

Figure 3 illustrates the significant difference between the pre and post of the experimental group in regard to active learning, critical thinking and the overall SSACT total score. Even though there was a difference between the pre and post of the control group, it wasn't significant (Figure 4).

Table 4 represents the comparison between the pre and post assessment of active learning and critical thinking in both the experimental and control group, where there was significant difference between the pre and post measurement of the groups as t=5.182 at p*(<0.001*) and t 2.136* P= 0.039 respectively. In regard to the critical thinking scale, a significant difference was detected between the pre and post measurement of the experimental group as t=7.039 at P <0.001*, while there was no significant difference between the pre and post assessment of the control group, as t=0.789 at P=0.435. Moreover, there was a significant difference between the measurements of the

Instrument PBL evaluation questionnaire	Experimental (n=44)		t	sig
	Pre %	Post %		
Construction of professional knowledge	64.06 ± 21.27	76.70 ± 18.15	3.676*	0.001*
Development of problem-solving skills	61.08 ± 21.73	75.99 ± 20.88	3.396*	0.001*
Development of self -directed learning	67.33 ± 22.06	78.41 ± 20.33	2.831*	0.007*
Improvement of motivation	66.76 ± 22.30	76.42 ± 21.09	2.162*	0.036*
Promotion of effective group collaboration	71.78 ± 20.67	83.71 ± 21.26	3.404*	0.001*
Overall instrument PBL evaluation	65.91 ± 19.19	77.96 ± 18.30	3.568*	0.001*

Table 2: Comparison between pre and post according to instrument PBL evaluation questionnaire in experimental group.

Instrument PBL evaluation questionnaire	Control (n=41)		t	Sig.
	Pre %	Post %		
Construction of professional knowledge	66.46 ± 14.24	70.88 ± 14.36	1.390	0.172
Development of problem-solving skills	64.79 ± 13.82	67.38 ± 15.28	0.812	0.422)
Development of self -directed learning	71.95 ± 17.35	72.87 ± 15.03	0.280	(0.781)
Improvement of motivation	73.17 ± 19.02	72.26 ± 16.54	0.235	(0.815)
Promotion of effective group collaboration	77.44 ± 16.59	70.12 ± 17.48	1.858	0.071
Overall instrument PBL evaluation	70.41 ± 12.90	70.73 ± 12.60	0.117	0.907

t_0: Paired t-test; t: Student t-test
*Statistically significant at p ≤ 0.05

Table 3: Comparison between pre and post according to instrument PBL evaluation questionnaire in control group.

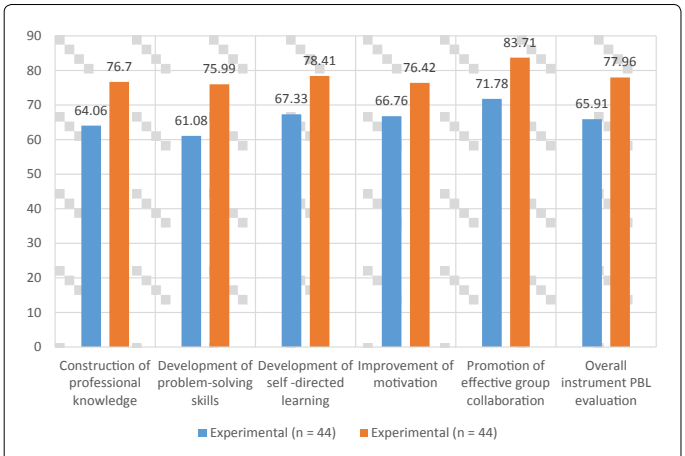

Figure 3: Difference between pre and post of experimental group as regards to PBL evaluation.

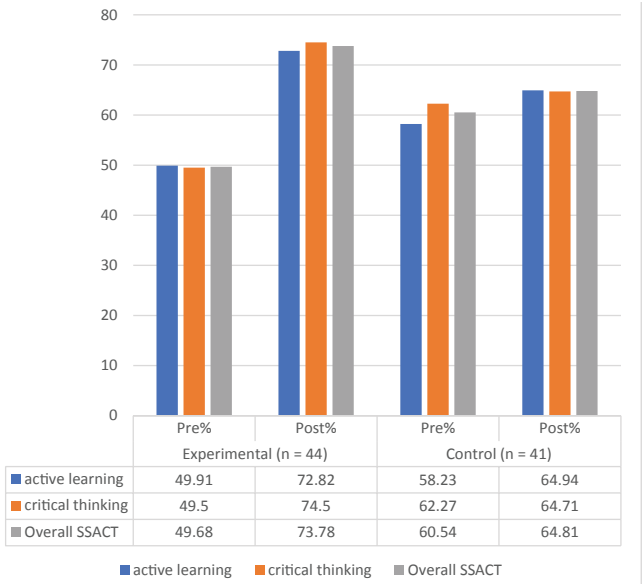

Figure 4: Comparison between experimental and control group as regard to active learning and critical thinking (SSACT).

Active learning and critical thinking (SSACT)	Experimental (n=44)		Control (n=41)	
	Pre%	Post%	Pre%	Post%
Active learning				
Percent Score	49.91 ± 21.9	72.82 ± 18.82	58.23 ± 13.0	64.94 ± 12.71
t_0 (p_0)	5.182* (<0.001*)		2.136* (0.039*)	
Critical thinking				
Percent Score	49.50 ± 20.1	74.50 ± 17.51	62.27 ± 12.3	64.71 ± 13.34
t_0 (p_0)	7.039* (<0.001*)		0.789 (0.435)	
Overall SSACT				
Percent Score	49.68 ± 20.6	73.78 ± 17.22	60.54 ± 11.1	64.81 ± 12.17
t_0 (p_0)	6.413* (<0.001*)		1.482 (0.146)	

t_0: Paired t-test; t: Student t-test
*Statistically significant at p ≤ 0.05

Table 4: Comparison between pre and post according to instrument active learning and critical thinking (SSACT) in each group.

overall SSACT (pre and post) of both groups, as t =6.413 at P <0.001, while there were no significant differences in the overall SSACT of the pre and post measurements of the control group, as t=1.482 at P (0.146).

Table 5 demonstrates the comparison between the GPA of the subjects in each group. Clearly, there was a significant difference between the pre and post measurements of the experimental group according to their GPA as $\chi^{2=}$6.313 at P (0.066), whereas there was no significant correlation between the pre and post of the control group, as $\chi^{2=}$0.572 at P (1.000).

Table 6 shows the comparison between the pre and post of the experimental and control groups according to their grades in the MCQ tests related to depressive disorders. The results revealed that there was a significant difference between the pre and post measurements of the experimental group, as t=2.917 at P 0.006, while there was no significant difference between the pre and post assessment of the control group, as t= 0.189 at P (0.851).

Table 7 reveals the relation between the instruments, PBL evaluation questionnaire in pre and demographic characteristics, in the experimental group. Moreover, there were no significant correlations between the subjects' ages, areas of residency, marital statuses and GPAs in pre-post measurements of the experimental group at p ≤ 0.05.

Table 8 demonstrates that the study subjects' information about PBL has no significant correlation between the pre and post assessment measurement of the experimental group at p ≤ 0.05.

Discussion

This study was done to compare the effect of PBL versus TBL in relation to critical thinking, problem solving and self-directed learning among Level 7 nursing students in the College of Nursing, Jeddah. As measured by the pre and post-test quizzes (Table 4), the students' achievements in the PBL group showed better results compared to LBL group. The comparison between the experimental and the control groups also revealed that students who had undergone the LBL had no difference in terms of score for the pre and post-test, whereas the PBL counterpart showed an improvement in their scores. Khatiban & Sangestani [27] found similar findings, where the PBL method of learning seemed to enhance the students' general knowledge as well as their skills in the nursing process. The better achievements of the PBL groups may be due to their interest, as the PBL method of learning is clearly more fun and fuller of engaging activities. Moreover, Torre et al., [28] and Alsaher and Gaber [29] reported that PBL provides an effective learning environment which is said to be conducive for the development of critical thinking through the stimulation of the students' interests, creating meaningful discussions, exposure to thoughts and views of others, and fostering a trusting and supportive atmosphere.

PBL being the inquiry-based method of learning in solving problems, will easily encourage students to learn and contribute actively in their learning. Consequently, the result of the present study demonstrated that having a small group in PBL was effective enough to motivate students and encourage active learning, as they significantly in the latter (Table 3). This could be due to the fact that the students in the PBL group were exposed to continuous interaction, which encouraged them to participate actively and work together towards achieving the set goal. Students therefore seem to work better and do better in a small group. They function actively and effectively, know

Grade	Experimental (n=44)				Control (n=41)				χ^2 ($^{MC}p_1$)	χ^2 ($^{MC}p_2$)
	Pre		Post		Pre		Post			
	No.	%	No.	%	No.	%	No.	%		
A	0	0.0	0	0.0	0	0.0	0	0.0	5.564 (0.108)	0.831 (0.891)
B	0	0.0	1	2.3	1	2.4	2	4.9		
C	1	2.3	6	13.6	4	9.8	4	9.8		
D	4	9.1	7	15.9	8	19.5	7	17.1		
F	39	88.6	30	68.2	28	68.3	28	68.3		
χ^2 ($^{MC}p_0$)	6.313 (0.066)				0.572 (1.000)					

χ^2: Chi square test; MC: Monte Carlo
*Statistically significant at p ≤ 0.05

Table 5: Comparison between pre and post according to grade in each group.

Test questionnaire	Experimental (n=44)		Control (n=41)		t (p_1)	t (p_2)
	Pre	Post	Pre	Post		
Min. – Max.	2.0 – 14.0	4.0 – 16.0	4.0 – 16.0	3.0 – 16.0	2.374* (0.020*)	0.548 (0.585)
Mean ± SD.	8.39 ± 2.48	10.05 ± 2.91	9.80 ± 3.02	9.68 ± 3.19		
t_0 (p_0)	2.917* (0.006*)		0.189 (0.851)			

t_0: Paired t-test; t: Student t-test
*Statistically significant at p ≤ 0.05

Table 6: Comparison between pre and post according to grade in each group.

Demographic Variables		Experimental group				Control group			
		Overall PBL%		Overall SSACT%		Overall PBL%		Overall SSACT%	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
Age (years)	≤21	61.05 ± 22.79	84.12 ± 16.59	44.88 ± 21.05	79.05 ± 15.16	78.35 ± 13.0	76.08 ± 13.68	62.50 ± 12.06	61.04 ± 16.11
	>21	68.42 ± 16.93	74.77 ± 18.60	52.16 ± 19.60	71.06 ± 17.83	67.50 ± 11.77	68.77 ± 11.82	59.82 ± 10.86	66.19 ± 10.36
	t (p)	1.214 (0.23)	1.638 (0.10)	1.138 (0.21)	1.478 (0.14)	2.544* (0.01*)	1.682 (0.10)	0.680 (0.50)	1.208 (0.23)
Residence area	Urban	65.76 ± 19.63	77.29 ± 18.46	49.79 ± 20.37	73.47 ± 17.29	70.41 ± 12.90	70.73 ± 12.60	60.54 ± 11.11	64.81 ± 12.17
	Rural	69.08 ± 2.79	92.11 ± 1.86	47.32 ± 21.47	80.36 ± 20.20	-	-	-	-
	t (p)	0.236 (0.814)	1.122 (0.268)	0.167 (0.868)	0.548 (0.587)	-	-	-	-
Marital status	Single	65.02 ± 19.44	77.60 ± 18.77	50.09 ± 20.64	73.34 ± 17.48	70.46 ± 13.06	71.05 ± 12.59	60.31 ± 11.15	65.27 ± 11.95
	Married	78.07 ± 10.96	82.89 ± 10.77	44.05 ± 12.92	79.76 ± 14.43	68.42	57.89	69.64	46.43
	t (p)	1.860 (0.159)	0.770 (0.498)	0.743 (0.514)	0.732 (0.528)	0.154 (0.878)	1.032 (0.308)	0.826 (0.414)	1.557 (0.128)
GPA	2.5 – <3	44.74 ± 35.89	57.57 ± 36.10	38.39 ± 11.80	73.66 ± 19.31	66.84 ± 15.16	72.63 ± 17.01	59.64 ± 15.13	74.64 ± 8.69
	3 – <3.5	68.14 ± 16.64	81.86 ± 15.88	51.66 ± 21.25	67.86 ± 17.65	75.73 ± 8.66	72.37 ± 8.48	58.73 ± 6.83	63.10 ± 18.15
	3.5 – <4	68.76 ± 16.34	78.95 ± 15.30	52.41 ± 19.87	76.48 ± 17.48	68.99 ± 13.28	70.37 ± 14.25	61.02 ± 12.46	64.05 ± 9.44
	4+	61.84 ± 13.93	79.39 ± 8.76	34.52 ± 23.24	80.95 ± 5.15	71.05 ± 17.26	66.78 ± 3.78	62.95 ± 7.49	60.71 ± 12.02
	F (p)	2.039 (0.124)	2.033 (0.125)	1.183 (0.328)	0.907 (0.446)	0.718 (0.547)	0.213 (0.887)	0.157 (0.924)	1.366 (0.268)

t: Student t-test; F: F for ANOVA test;
p: p-value for comparing between the different categories
*Statistically significant at p ≤ 0.05

Table 7: Relation between Instrument, PBL Evaluation Questionnaire in Pre and Demographic Characteristics in Experimental Group (n=44).

Demographic characteristics		Experimental group				Control group			
		Overall PBL%		Overall SSACT%		Overall PBL%		Overall SSACT%	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
Did you hear about PBL?	Yes	65.46 ± 19.54	78.65 ± 18.11	50.54 ± 20.58	75.80 ± 16.60	70.07 ± 13.67	70.87 ± 10.90	59.87 ± 11.08	63.69 ± 11.09
	No	70.39 ± 16.87	71.05 ± 21.59	41.07 ± 14.51	53.57 ± 8.38	72.89 ± 4.42	69.74 ± 23.41	65.36 ± 11.27	72.86 ± 17.65
	t (p)	0.549 (0.613)	0.680 (0.539)	1.190 (0.295)	4.498* (0.005*)	0.938 (0.361)	0.107 (0.920)	1.036 (0.307)	1.610 (0.115)
Were you previously taught by PBL?	Yes	65.91 ± 19.41	78.61 ± 17.99	49.38 ± 20.30	74.34 ± 17.03	69.59 ± 12.95	69.77 ± 11.86	60.86 ± 10.93	63.74 ± 12.57
	No	65.79	50.0	62.50	50.0	76.32 ± 12.13	77.63 ± 17.0	58.21 ± 13.46	72.50 ± 3.70
	t (p)	0.006 (0.995)	1.572 (0.123)	0.639 (0.526)	1.413 (0.165)	1.095 (0.280)	1.318 (0.195)	0.495 (0.623)	1.534 (0.133)
If your answer is yes, answer the following									
Where?	High school	62.78 ± 14.86	74.62 ± 27.13	44.13 ± 18.23	72.19 ± 20.87	-	-	-	-
	University	66.52 ± 20.30	79.39 ± 16.08	50.40 ± 20.76	74.75 ± 16.49	69.59 ± 12.95	69.77 ± 11.86	60.86 ± 10.93	63.74 ± 12.57
	t (p)	0.462 (0.647)	0.636 (0.528)	0.743 (0.462)	0.360 (0.721)	-	-	-	-
Which do you prefer?	No answer	66.92 ± 15.42	80.54 ± 13.59	44.77 ± 17.89	76.29 ± 16.38	69.15 ± 14.53	73.03 ± 13.50	58.23 ± 11.21	67.16 ± 11.74
	PBL	68.57 ± 30.34	77.05 ± 24.21	62.70 ± 25.82	67.26 ± 19.98	71.05 ± 12.60	68.02 ± 12.51	64.15 ± 13.15	63.87 ± 10.34
	TBL	57.02 ± 15.74	66.89 ± 26.83	53.87 ± 13.05	71.43 ± 17.02	71.84 ± 11.08	70.13 ± 11.47	60.0 ± 7.10	61.79 ± 15.25
	F (p)	0.763 (0.47)	1.425 (0.25)	3.154 (0.053)	1.010 (0.373)	0.156 (0.856)	0.599 (0.554)	1.091 (0.346)	0.673 (0.516)

t: Student t-test; F: F for ANOVA test p: p value for comparing between the different categories
*Statistically significant at p ≤ 0.05

Table 8: Relation between Instrument PBL Evaluation Questionnaire in Pre and Demographic Characteristics in Experimental Group (n=44).

how to organize the work, distribute responsibility, break up complex tasks, and provide useful feedback on the work that has been done by Chen et al. [30]. Similar findings by Yuan et al., [25], Alsaher and Gaber [29] found that PBL engages students to participate enthusiastically through collaborative learning among their peers with the guidance of their teachers. Along with the studies by Van Berkel & Dolmans [31], and Torre, Vleuten, & Dolmans [28] the authors therefore regarded PBL as a constructionist approach to education. Finally, the PBL methods of learning clearly integrates the ideas of knowing and doing as students apply what they know with the intention of solving realistic, clinical problems.

The results of the present study also showed significant scores in the motivation among the PBL group of students (Table 2). Choi et al., [32] revealed similar finding in her study when she found that the PBL groups had an increased involvement in learning as well as an increased motivation for seeking new information. The PBL group of students also participate more actively while finding the resources and information needed [25]. Moreover, findings of the current study were

congruent with the studies done by Yuan et al., [25] and Wosinski et al., [33]. The authors found that PBL students were more motivated, and engaged in discussion as they took more responsibility of their own learning.

In addition, when looking at students' preferences of the two educational approaches, it was found that the experimental groups prefer PBL as a method of learning after they had experienced how PBL was conducted and how it benefited them. Studies by Papanna and Kulkarni [34] showed similar preferences as student leaned towards PBL as a learning method. In the present study, both the two groups of students, (the control and the experimental) received some general information related to PBL. It was found that there were no differences in preferences of PBL in the control groups, probably because they did not experience how PBL was conducted (Table 1).

The present study also revealed that the PBL method of learning develops students' critical thinking (Table 3) and problem-solving skills (Table 2). An analysis of the scores of critical thinking in this study showed that the PBL students had significantly scored higher, compared to LBL students. In other words, PBL encouraged students to brainstorm, analyze the situation critically, and try to solve the issues as agreed in the group. Tiwari et al., [35] reported similar findings. Therefore, PBL is more student-centered and interactive in a way that pushes students to analyze and find a solution to a specific problem. The results of this study also support earlier findings that PBL not only increased the score in construction of professional knowledge but also problem-solving skills [30,36]. Additionally, Mahmoud and Hyder [37], and Alsaher and Gaber [29] and Wosinski, et al., [33] reinforce the current study's results as they stated that students' evaluation after PBL was better than that of the traditional lecture which indicated that PBL is a welcomed alternative to lecture-based teaching since it incites clinical problem solving, fruitful class discussion and a higher score of academic achievement. Moreover, the result of the present study was supported by Li et al., [38] at Central South University, in China who found that all PBL participants had better results for written and clinical examination, and an overall better performance than that of other methods of learning.

Additionally, the results revealed that there was a significant difference between the pre and post measurements of the experimental group according to their grades in the MCQ tests related to depressive disorders t=2.917 at P 0.00. On the other hand, there was no significant difference between the pre and post assessment of the control group as t= 0.189 at P (0.851). This may be due to the ability of the PBL environment to help students participate and interact actively in nursing classes, and support their intellectual development through which students create strategies to learn, understand and retain knowledge. The results of the current study were also supported by Torre, Vleuten, & Dolmans, [28] Alsaher and Gaber [29], Schmidt et al., [39] who concluded that PBL encourages and provides opportunities for the elaboration of knowledge that facilitates the comprehension of new information and enhances the long-term retention of memory. In addition, PBL not only facilitates critical thinking which enables students to fulfill their expected role but also inspires the use of their knowledge to make subject matter more interesting. The content subsequently appears more relevant. This ultimately led to an increased motivation among nursing students and an improved knowledge acquisition and retention. Moreover, Frambach etal., [40] reported that PBL is the best way of teaching for nursing students since it helps them to better acquire scientific conceptions and integrate and organize the knowledge. Therefore, PBL clearly promotes both the acquisition of content knowledge and the development of thinking skills and cognitive reasoning strategies. In addition, after finishing each class, the students reported that PBL enabled them to engage in learning activities that disclosed their thinking process, so that they can monitor the effectiveness of their ability to analyze, reason, and acquire knowledge. The same information and feedback were reported by Gwee [41], and Frambach, et al., [40].

On the other hand, Tables 7 and 8 revealed that the relation between the PBL evaluation questionnaire in the pre and demographic characteristics in the experimental group had no significant correlations between the subjects' ages, areas of residency, and marital statuses, previous information about PBL and GPA in pre-post measurements of the experimental group, at $p \leq 0.05$. The interpretation that might be given for these obtained results is that the application of the PBL module was implemented in the CONJ for the first time, whereas the lecture-based learning was the main way of teaching. The difference between LBL and PBL, is that LBL is teacher based while PBL is a learner-centered educational method, as the students are progressively given more and more responsibility for their own education and become increasingly independent for their education. Besides that, PBL also produces learners with the ability to continue their learning within their practical lives and chosen careers. With repeated practice of PBL, students not only acquire the skills to have the habit of thinking critically, but also improve some dimensions of construct and metacognitive skills [26,36].

Despite the arguments that were given against this method, PBL is thereby considered a method of teaching which renders students the experience of various clinical scenarios and situations. PBL fosters the development of self-directed learning strategies, enhances critical thinking and makes it easier for students to retain and apply knowledge to new or unfamiliar settings. Finally, PBL deviates from the conventional, instructional mode by restructuring traditional teacher/student interactions towards a more active, and self-focused learning by the student [29,30,42-44].

Conclusion

This study offers information about the perspective of students regarding the effectiveness of PBL in constructing professional knowledge, developing problem-solving skills, developing self-directed learning, improving motivation and promoting effective group collaboration. Moreover, PBL also enhances active learning and critical thinking. There was thereby a significant difference between the pre and post measurements of the experimental group according to their grades in the MCQ tests related to depressive disorders, whereas there was no significant difference between the pre and post of the overall SSACT, and critical thinking measurements of the control group. On the other hand, demographic background (age, residence area, and marital status, pervious information about PBL and GPA) of the PBL and LBL groups had no significant correlation with all the evaluation questionnaires between the subjects in the pre-post measurements, at $p \leq 0.05$.

Recommendations

Based on the results of the current study, it is recommended that:

- PBL methods of teaching should replace the lecture-based methods since it encourages students' clinical problem-solving skills, fruitful in-class discussions and helps them achieve higher scores academically.
- Faculty should help future nurse professionals to become self-directed learners and to be knowledgeable participants in

evidence-based practices of nursing through the incorporation of active 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 the use in other classes and real-life situations.

- Faculty should continue to support students to understand the research process based on developing their skills in regards to identifying how to employ data to influence others.
- Continuous Evaluation of the learning objectives, and incorporating a variety of appropriate instructional strategies and assessments into the curriculum in order to achieve the learning objectives.
- Holding workshops in the facilitation of PBL should be incorporated into the faculty's professional development. This includes, educational programs. These training activities should also provide the attendees to practice the PBL instructional strategy as either a participant or a facilitator.
- The university students (adult stage) requires the faculty to use PBL, since it's a strategy which creates an autonomy-supportive learning environment in order to develop autonomy-supportive behavior that promotes supportive relationships, and open dialogue between the faculty and students. In addition, PBL is a more student-centered method of instruction, informative feedback, and active collaboration in the learning situations.

Research Implications

- The results of the current study will be communicated to the curriculum committee in college of nursing in Jeddah, to employ the PBL method of teaching instead of LBL.
- Communicate the results of the study to other sisters' colleges in Riyadh and Alhassa affiliated to King Saud bin Abdul-Aziz University for health sciences to try and even one module and observe the differences between PBL and LBL.
- Encourage faculties in college of nursing in Jeddah to motivate students to actively read and participate in lectures by stimulating them to apply the case studies. These scenarios, followed by questions that are covering the lecture objectives, require students to solve problems and critically think to sort professional knowledge and apply nursing processes related to each learning module.

Limitations

Despite the success of the first trial of PBL in the CONJ, the results of the study were limited due to the self-report aspect of the instruments from students who were enrolled to the psychiatric course at one point in time. Although random sampling was done, a small number of students may make generalization of the findings limited.

Conflict of Interest

The authors declare that there are no conflicts of interest. This study involved undergraduate nursing students of CONJ, KSAU-HS, Jeddah, KSA who registered for Mental Health Nursing as required to fulfill the requirement for the Bachelor of Nursing.

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