

Effectiveness of Problem-Based Learning versus the Traditional Lecture and Learning Styles among the under graduate Nursing Students

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Abstract

Background: In Problem-based learning (PBL), students work cooperatively to solve complex, real-world problems. **It is** considered as the most significant educational innovation in the past 35 years. PBL is a powerful class room **activity**, which uses real-world problems to motivate students to identify and apply research concepts and information, work collaboratively and communicate effectively. **The study aimed to** evaluate the effectiveness of problem-based learning versus the traditional lecture and assess the learning styles of the undergraduate students in nursing education. **Design:** Quiz-experimental research design was adopted for this study. A convenient sample of all 80 undergraduate nursing students in the Faculty of Nursing Sohag University were included in the study from March to May 2015. **Tools:** Data were collected using Focus-group interview method and two questionnaire **sheets**. **Results:** The current study showed that there was an improvement in **the** achievement outcome in the post-test in PBL group (9.83%) than in the lecture group (7.57%). High percentage of students (58.8%) preferred visual style of learning while audio and tactile styles were preferred among 31.2% and 10.0% respectively. **Conclusion:** PBL is effective and improved students' achievement outcome. **Recommendation:** Applying the new PBL curriculum and introducing students to the PBL program help them to work cooperatively in identification of the appropriate learning questions.

Key words: Problem-based learning, Traditional lecture, Learning styles, and Understanding students in nursing education.

Introduction

Problem-based learning (PBL) is an educational design that emphasizes critical-thinking skills, problem-solving, and active participation. It encourages learners to identify their own knowledge and skills and apply them to novel situations or to use them, by combining previous knowledge or principles, to achieve specific goals (Williams and Beattie, 2008). In other

words, PBL results from the process of working towards the understanding of a problem in a powerful class room process, where students study more for meaning and less for reproduction (Oja., 2011).

Shin & Kim, (2013) reported that, PBL is an approach that can teach nurses how to apply theory to clinical practice and by developing their problem-solving skills, which could be used to overcome environmental constraints within clinical practice. Although lecture is the most

common method of teaching used in education, many studies concluded that, students prefer PBL to traditional lecture because in PBL students become self-directed life learners hence the effectiveness of PBL process to under graduate nursing program on student test performance (Akram et al., 2013).

Problem-based learning can be used in a variety of ways, depending on the goals of the course or program, setting, and students' educational needs. It may be used as a principal approach or used to test and reinforce knowledge from prior courses (Mc Loughlin & Darvill, 2007).

PBL has been incorporated into some undergraduate nursing programs but its effectiveness has not yet been reported (Yuan et al., 2011). As knowledge in health care continues to expand and new technology develops, the demand for graduates to be able to efficiently solve complex problems has also increased (Sangestani & Khatiban, 2012). **However, nursing education currently relies heavily on traditional lecture-based formats, marked by large group lectures and instructor-provided assignments and learning objectives (Mathews, 2011).**

In addition, **students receiving PBL have consistently outperformed those students receiving traditional programs regarding measures** of diagnostic skills and clinical reasoning. Those students who are using PBL tend to access resources more frequently with a more intentional style of learning because PBL reshapes the learning style and developing patterns that define the proactive lifelong learning when the student transitions from a novice to an expert learner (Oja, 2011).

Karr et al., (2006) have documented that, although health professionals believe **that**, environmentally related health problems should be managed. **They also**

reported that., the student are unprepared to do so **due to** a lack of education, inadequate resources and time limitations.

When considering the application of a PBL curriculum in nursing education. The nursing educator is confronted with the problems created by the disparity of information provided by the results of previous studies. It is important for educators to find the appropriate teaching method that enhances the knowledge and clinical performance skills of nurses. In addition, many studies that examined PBL in the context of nursing training have focused on descriptive and comparative studies and prescriptive accounts related to the implementation of PBL, with small sample sizes (Tavakol et al. 2009).

Learning style is the characteristic method of gaining knowledge, skill, or attitudes through study or experiences and it addresses the approach to learning and the manner that individual learns best. Nurses function in a challenging environment where they are required to utilize various methods of learning to process, integrate, and disseminate information when appropriate (Jameset al., 2011). In addition, Cautley et al., (2012) articulated that the ways that an individual acquires knowledge, skills, or approach their study or experiences is their learning style.

The educators' awareness of the various learning styles of the students and directing their efforts towards matching the teaching and learning styles may help in creating an effective learning environment for all the students. Each learning style requires different educational materials and when students' learning styles and instructors' teaching styles are aligned, it results in improvement of students understanding of the course content **while** a mismatch between learning styles and curriculum has led to low levels of academic achievement (Poonam et al., 2013).

Significance of the study:

PBL is argued as a learning method that can promote the development of critical thinking skills (Şendağ, 2009). In PBL learning, students learn how to analyze a problem, identify relevant facts and generate hypotheses; identify necessary information/knowledge for solving the problem and make reasonable judgments about solving the problem. Implementing PBL in schools and Universities is a demanding process that requires resources, a lot of planning and organization (Azer&Samy, 2011).

Yuan et al., (2008) found that, nursing students enjoy the problem-based learning format and report that, it leads to improvements in a variety of outcomes, including critical thinking, application of knowledge, active participation in learning, group cooperation, and self-direction and it enhanced their knowledge, understanding, and retention of the subject course (Pourshanzari et al., 2012).

Aim of the study:

The study aimed to evaluate the effectiveness of problem-based learning versus the traditional lecture and assess the learning styles of the under graduate students in nursing education.

Research Hypothesis

1. Students' knowledge about problem based learning **will improve**.
- 2- Students' achievement outcome after application of problem based learning **will improve**.
3. The 3rd year nursing students **will be able to** identify their preferred learning styles.

4- There is a **positive** relation between problem based learning and learning styles of the undergraduate students

Subjects and methods:

Research design: Quasi-experimental research design was **utilized** for this study.

Setting: This study was conducted in the Faculty of Nursing at Sohag University.

Subjects: A **purposive** sample was used in this study where all the undergraduate nursing students in the Faculty of Nursing, Sohag University were asked to participate (80 students).

Tool for data collection: Data were collected using Focus-group interview method and two questionnaires were developed based on review of the related literature to evaluate the effectiveness of problem-based learning versus the traditional lecture and assess the learning styles of the undergraduate students in nursing education.

1- A questionnaire sheet was **developed** to collect data pertinent to this study which designed by the **researchers**. It consisted of three parts:

Part I: It included two questions related to the **demographic** characteristics of the students as age and sex.

Part II: It consisted of ten questions to assess student's knowledge **in relation to** PBL.

The correct answer was given 1 and 0 for incorrect answer. Satisfactory level was considered when the score of correct answers of the students' knowledge about PBL is more than 60%.

Part III: Achievement outcome sheets included four questions for each item regarding knowledge about the four items in

pediatric nursing course (rheumatic fever, cerebral palsy, nursery school and diabetes mellitus).

- **The questionnaire contains** close-ended questions (multiple-choice questions) and list questions **which were** filled by the students in the presence of the researchers.

2- Learning Style Inventory (LSI)**questionnaire:** (The McGraw Hill Companies) – it consisted of 24 questions to assess of students' learning style which contained multiple-choice questions.

3- A structured feedback questionnaire was used to **assess** for the experience of students concerning PBL method of learning. They were one page long, with 11 questions. They comprised a series of statements requiring a Likert-type response on a 1-3 scale, where 3=agree, 2 = neutral and 1=disagree.

Pilot study:

Pilot study was done involving 10% of the study sample (8 students) to test the applicability of tools and estimates the time needed. Those participants in the pilot testing were **not excluded from the main study as there were no modification in the data collection tools.**

Tool validity and reliability: The tool was tested for its reliability of Arabic version by Alpha Cronbach's test ($\alpha=0.86$). The tool was tested for its validity by 5 experts in the nursing and pediatrics field where its value was 93.1% **agreement among the experts.**

Field work:

Data **were** collected from March to May 2015. Data collection was done by the researchers during academic achievement day. The actual work started by third week, the researchers first introduced themselves to **the students** and gave them a complete back

ground about the study and the questionnaire format which predesigned in order to collect the required data. Then the researchers explained the research aims, and invited them to participate in the study by filling out the questionnaire. **After that,** the questionnaire was distributed to **the 80** students and collected on the same day **and** focused interview group about PBL was done for study group (**pre-test**).

Methods for data collection:

- Before starting this study, administrative approval was taken from authorities in the setting. Permission was obtained from **the dean** of Faculty of Nursing, Sohag University.

- After obtaining **written** permission from the students for data collection, the students were interviewed by the researchers.

--The 80 students were equally and randomly assigned into two groups, the first included 40 students who received PBL (study group) the second group involved 40 students who received the traditional lectures (control group). Each group was re-divided into 4 groups; each included 10 students. A total 4 PBL sessions were given to students in the study group (**one session/week**) and at the end of each PBL session, the tutors evaluated students' performance.

- **After** the last session of PBL, **the post-test** was given a week after **completing** the intended learning objectives for the two groups.

All students were underwent a second-semester course (pediatric nursing course). -- Students taught by using the two methods of education, the traditional method of education, i.e. the lecture, was assigned as the control group and the PBL as the study group and selecting the problem by the supervisor.

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A PBL tutor motivated the discussion for the students.

- The Participants were invited to **answer** the questionnaire in the presence of the researcher for each question to assess students' knowledge about PBL, their academic achievement and their learning styles.

- The Participants were asked to read each question carefully and to answer the questions honestly.

- The researchers were available for more clarification whenever needed. Once the participants **answered** the questionnaires, the researchers collected it from the participants.

- Data collection was done during the routine work of the faculty.

-The participants **took** about 15-20 minutes to **fulfill** the questionnaire.

- During the last session of PBL, the intended learning objectives developed by the course instructors were shared among the students to ensure that, **the related knowledge of the basic subject** has been learned by the students.

- All test items were written in multiple choice questions and list formats. – These items **asked about the contents of the same four topics** to the lecture group and PBL group which about (nursery school, rheumatic fever, renal failure, cerebral palsy **among children**).

- Evaluation was done through evaluation of the effectiveness of problem-based learning versus the traditional lecture and assessment the learning styles of the undergraduate students in nursing education by learning styles inventory **and the results of the pre and post-tests**.

- In each method, a pre-course test at the beginning and a post-course test at the end of each course were given to each group.

Ethical consideration:

The researchers explained to students the aim, and methodology and benefit of the study. The students were clearly informed that their participation is voluntary and have the ethical right to participate or refuse the participation in the study. It was further emphasized that their responses are confidential, and had their right to withdraw from the study any time without giving further explanation. Privacy and confidentiality were resolutely kept in all data collection procedures.

Statistical analysis:

Data collected and analyzed by computer program SPSS" ver. 21" Chicago. USA. Data expressed as mean, Standard deviation and number, percentage. Person's correlation used to determine significance. N.S. $P > 0.05$ no significant, $*P < 0.05$ significant, $** P < 0.001$ moderate significance and $*** p < 0.000$ highly significance.

Results:

Regarding **demographic** characteristics of students **in table (1)**, the current study revealed that (46.25%) were from the females and (53.75%) from males, where the mean age of them was 21.48 ± 3.68 years.

Tables (2): Showed the basic knowledge of nursing students regarding PBL and the improvement of their knowledge after **sessions** about PBL. The improvement of knowledge was a highly significant regarding the questions of definition of problem based learning, why problem-based learning is an effective approach?, what is the teacher role in problem-based learning?, identify the role of

the leader, recorder and facilitator from the following?, problem-based learning usually includes several steps, how does problem-based learning work?, rearrange the steps of the PBL model by using a problem solving technique?, The benefits of the problem-based learning, (P=0.000, P=0.000, P=0.000, P=0.000,P=0.000, P=0.003, P=0.000,andP=0.000 respectively).

On the other hand, there was no significant improvement **in the** students' knowledge regarding the questions of what are the steps of problem-based learning by using a model of problem solving technique?, what are the skills which learned through the problem-based learning, and select the negative aspects of the problem-based learning, (P=0.456, P=0.264, P=0.073 respectively).

Table (3) indicated a significant improvement of the level of the students' knowledge about problem based learning after the **sessions**(P= 0.000), where the level was satisfactory among 85% of nursing student after the lecture versus 15% before **sessions**.

Table (4): stated that, there was a highly significant difference between nursing students receiving traditional lecture (group I) and those receiving PBL (group II); 7.57 ± 1.50 Vs 9.83 ± 0.39 regarding the achievement outcome **in the post test stage**.

Regarding students' learning style, **table (5)** showed that, high percentage of students (58.8%) preferred visual style of lecture, 31.2% preferred audiostyle while 10% preferred tactile.

Table (6): revealed that, there was no significant difference between preferred learning style and achievement outcome among nursing students in group I and II (P= 0.870, 0.176 respectively).

Table (7):indicated that, majority (92.0%) of **students** agreed that, the PBL course developed their problem-solving skills, 100.0% agreed that tutors motivate them to self directed learning, 83.0% agreed that, the course helped **them to develop their** ability to work as a team member. 67.0% agreed that the course improved **their** expression skills.

Regarding teaching facilities (PBL room), the researchers observed that, the students **were** satisfied about tutor's role in PBL session (96.0%), problem scenario (82.0%), group dynamics (70.0%), and tutor evaluation (88.0%).

In addition,62.0% of **students** agreed about satisfaction of the method of evaluation of the course and its fairness. **Fifteen percent** disagreed that, the course content was well prepared while 80.0% agreed. Moreover, 87.0% agreed that, they like the new way of learning in comparing to the traditional way of learning while 10.0% disagreed. **Ninety percent** agreed that, they **were** generally given enough time to understand the things that they had to learn while 10.0% disagreed that, the time was not appropriate comparing to the traditional course. **Ninety seven percent** agreed that, they would like to use PBL in other courses while 3.0% disagreed

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Table (1): Demographic characteristics of participating students

	No. (n= 80)	%
Sex:		
Male	37	46.25
Female	43	53.75
Age: (years)		
Mean ± SD	21.48 ± 3.68	
Range	20.0 – 24.0	

Table (2): Student's knowledge regarding to problem based learning during pre and post lecture (n=80)

	Pre-test(n= 40)		Post-test(n= 40)		P-value
	No.	%	No.	%	
1-a-Definition of problem based learning:					0.000*
Incorrect	35	87.5	1	2.5	
Correct	5	12.5	39	97.5	
1-b-Why Problem-based learning is an effective approach?					0.000*
Incorrect	13	32.5	0	0.0	
Correct	27	67.5	40	100.0	
2. What is the teacher role in problem-based learning?					0.000*
Incorrect	18	45.0	3	7.5	
Correct	22	55.0	37	92.5	
3. Identify the role of the leader, recorder and facilitator from the following?					0.000*
Incorrect	28	70.0	5	12.5	
Correct	12	30.0	35	87.5	
4. Problem-based learning usually includes several steps:					0.000*
Incorrect	21	52.5	5	12.5	
Correct	19	47.5	35	87.5	
5. How do problem-based learning work?					0.003*
Incorrect	14	35.0	3	7.5	
Correct	26	65.0	37	92.5	
6. What are the steps of problem-based learning by using a model of problem solving technique?					0.456
Incorrect	37	92.5	35	87.5	
Correct	3	7.5	5	12.5	
7. Rearrange the steps of the PBL model by using a problem solving technique?					0.000*
Incorrect	33	82.5	5	12.5	
Correct	7	17.5	35	87.5	
8. The benefits of the problem-based learning include all of the following except					0.000*
Incorrect	23	57.5	7	17.5	
Correct	17	42.5	33	82.5	
9.What are the skills which learned through the problem-based learning?					0.264
Incorrect	38	95.0	34	85.0	
Correct	2	5.0	6	15.0	
10.Select the negative aspects of the problem-based learning?					0.073
Incorrect	23	57.5	15	37.5	
Correct	17	42.5	25	62.5	

Chi-square test

*Statistical significant difference (P < 0.05)

Table (3): Students' Knowledge level about problem based learning

Level of knowledge	Pre-test (n= 40)		Post- test (n= 40)		P-value
	No.	%	No.	%	
Unsatisfactory	31	77.5	6	15.0	0.000*
Satisfactory	9	22.5	34	85.0	

*Statistical significant difference (P < 0.05) Satisfactory: more than 60% of correct answers.

Table (4): Comparison between both groups regarding the achievement outcome

	Group I (n= 40)	Group II (n= 40)	P-value ¹
Baseline data:			0.167
Pre test:			
Mean ± SD	0.50 ± 0.60	0.70 ± 0.50	
Median (Range)	0.0 (0.0 - 2.0)	0.0 (0.0 - 2.0)	
Post-test:			0.000*
Mean ± SD	7.57 ± 1.50	9.83 ± 0.39	
Median (Range)	7.5 (5.0 – 10.0)	10.0 (9.0 – 10.0)	
P-value ²	0.000*	0.000*	

Mann-Whitney test *Statistical significant difference (P < 0.05) 1-Comparison between Group I and Group II. 2-Comparison between Pre-test and Post-test in each group.

Table (5): Percentage distribution of PBL and lecture students regarding their learning Style

Style	No. (n= 80)	%
Visual	47	58.8
Audio	25	31.2
Tactile	8	10.0

Table (6): The Relation between group I and group II regarding their achievement outcome and learning styles

Achievement outcome		Learning Style			P-value
		Visual	Audio	Tactile	
Group I	Mean ± SD	7.50 ± 1.48	7.88 ± 1.64	7.50 ± 1.73	0.870
	Median (Range)	7.0 (5.0-10.0)	7.5 (6.0-10.0)	8.0 (5.0-9.0)	
Group II	Mean ± SD	9.89 ± 0.32	9.82 ± 0.39	9.50 ± 0.58	0.176
	Median (Range)	10.0 (9.0-10.0)	10.0 (9.0-10.0)	9.5 (9.0-10.0)	

Kruskall-Wallis test

Table (7): Distribution of the students according to their student's PBL experience

Items	Neutral	Agree	Disagree
The PBL course developed my problem-solving skills.	2.0	92.0	6.0
The tutors of this course motivated me to SDL.	0.0	100.0	0.0
The course helped me develop my ability to work as a team member.	1.0	83.0	26.0
The course improved my expression skills.	3.0	67.0	30.0
Overall, I was satisfied with the quality of the course.	1.0	46.0	53.0
I was satisfied about:			
Tutors role in PBL session	0.0	96.0	4.0
Problem scenario.	12.0	82.0	6.0
My Group dynamics.	1.0	70.0	29.0
Tutors evaluation	2.0	88.0	10.0
I am satisfied about the method of evaluation of our course and I think it is fair	3.0	62.0	35.0
The course content was well prepared	5.0	80.0	15.0
I like the new way of learning in comparing to the traditional way of learning	3.0	87.0	10.0
The time allocation was appropriate comparing to the traditional course	0.0	90.0	10.0
I would like to use PBL in other courses	0.0	97.0	3.0

Discussion:

PBL is an effective teaching /learning strategy which helps to generate and develop critical thinking and ‘clinical decision making’ skills which would enable nurses to function effectively in this changing environment (**Simpson and Courtney, 2009**). Presenting clinical problems is the starting point for learning in PBL. By working through these problems, students think critically about the nature of the problem, generate ideas, and acquire the knowledge and skills required to become a doctor (**Onyon, 2012**).

Many studies were conducted to compare PBL with the traditional lecture based learning (LBL). As regard acquiring knowledge, studies reported variable results. In some studies, PBL did not show any preference over LBL on the trainees' knowledge (**Smits et al., 2003; Choi et al., 2014**). On the other hand; many studies showed that, students got better scores in PBL method(**Tack and Plasschaert,2006; Lin et al., 2010**).

Shin & Kim, (2013) found that, the effect of PBL in nursing education is 0.70 standard deviations (medium-to-large effect size) and that; PBL has positive effects on the outcome domains of satisfaction with training, clinical education and skill course.

The current study showed a significant improvement of the level of the students' knowledge about problem based learning after the educational lecture where the level was satisfactory among 85% of nursing student after the **sessions** versus 15% before. Similarly, this study stated that, there was highly significant improvement of the achievement outcome among nursing students receiving PBL in comparison to those receiving traditional lecture. This finding is supported by the study of **Mc Parland et al., (2004)**who concluded that, **the** performance of the students holding PBL was better than those with LBL in both multiple-choice questions and the viva.

Similarly,Tiwari, Lai and Yuen, (2006)who investigated the impact of PBL on nursing students' critical thinking by comparing the critical thinking of the students participating in problem-based

learning with that of the students undertaking the traditional lecture method. They concluded that, there were significant differences in the development of students' critical thinking dispositions between those who undertook the PBL and lecture courses, respectively.

Also, In a study conducted by **Lin et al., (2010)** found that, nursing students who received PBL as the training method showed more satisfaction, critical thinking and self-motivated learning. **In addition, Jiyin et al., (2016)** who found that PBL is superior to traditional lecture-based teaching in Chinese education and PBL methods could be an optional, supplementary method of teaching.

On the other hand, concerning the knowledge, **Smits et al., (2003)** conducted a study in a postgraduate medical training program concerning the management of mental health problems for occupational health physicians in the Netherlands. **They** showed that, in both PBL and LBL groups, knowledge had equally increased right after the programs and decreased equally after the follow-up. **They** concluded that, problem-based program appeared to be more effective than the lecture-based program in improving performance. Both programs, however, were equally effective in improving knowledge levels.

The present results showed that, **more than half** of students preferred visual style of lecture followed by audio and tactile styles. This result was supported with findings of those obtained by **Alkhasawneh et al., (2013)** who mentioned that, the learning preference of the students was the read/write preference followed by the kinesthetic. These results disagree with the findings of **the study** conducted by **Nuzhat et al., (2011)** who reported that, the auditory mode was the most preferred learning style. **Also**, these results are not in accordance with results of a study done by **Poonam et al., (2013)** who stated that, the most common preference was

kinesthetic, followed by visual, auditory and read and write, and also

Moreno et al. (2009) reported that, PBL participants obtained higher scores compared with the LBL group and PBL participants spent more time on group work and literature analysis. **Hwang and Kim (2006)** determined that, the level of knowledge in the PBL group was significantly higher than that of students in the LBL group in cardiorespiratory section of nursing courses in Chicago. **Meo, (2013)** concluded that medical students in PBL group obtained significantly higher scores of knowledge and skills compared to LBL approach in a respiratory physiology course.

The current study showed that, the improvement of the achievement outcome was not affected by the students' preference of learning style whether visual, audio or tactile, which indicates that, the improvement of achievement outcomes was related to the application of PBL **rather than the style of learning**. These results are supported by the report of **McParland et al. (2004)** who concluded that, there were no differences between PBL and LBL in the learning style and attitude of students. Similar results were reported by **Dobson, (2010); Choudhary et al., (2011) and Urval et al., (2014)**, who found that, learning style preferences are not related to a student's academic achievements.

In the current study the majority of nursing students who received the PBL type was satisfied and had good impression toward PBL as a method of learning. Similarly many studies investigated the students' satisfaction regarding PBL and found that students prefer PBL (**Tack and Plasschaert, 2006; Kawai et al., 2007; Dehkordi and Heydarnejad, 2008; Tsou et al., 2009**). However, **Smits et al., (2003)**, found that, the PBL group was less satisfied with the course.

Finally, there are conflicting results concerning the comparison between PBL and

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LBL. This could be attributed to several factors as the differences among the intervention and control groups, as well as the lecturer and tutor, the way to carry out the problem-based learning method and the interval time to the exam.

In conclusion:

PBL is an effective method of learning and improved significantly the students' achievement outcome **in addition to the positive impression of nursing students regarding PBL.**

Recommendation:

Applying the new PBL curriculum and introducing students to the PBL program will help them to work cooperatively in identification of the appropriate learning questions.

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