Comparison of Effectiveness between PBL and LBL in Improving Student Learning Outcomes

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Abstract

This research explores the differences in test results and the use of some generic skills in the Problem-Based Learning (PBL) model and the Lecture-Based Learning (LBL) model. This research was conducted with a mixed research method, namely quantitative method and qualitative method. The researcher implemented the two models in two different classes, the control class (N = 28) and the experimental class (N = 72). Both learning method successfully activate the use of self-directed learning skills, teamwork skills, critical thinking skills, and problem-solving skills. However, PBL is better in motivating and increasing awareness about lectures so there is a better use of these skills in lectures. Students are very challenged to solve clinical problems relevant to the nursing profession with their group of friends. This in turn has an impact on the higher test results obtained by the experimental class than the control class. Therefore, researchers suggest applying it widely in all nursing majors.

Keywords: *Problem Based Learning, Lecture-Based Learning, Nursing Education, Generic Skills.*

Introduction

Nurse competency is still one of the health problems in Indonesia. Many prospective nurses in Indonesia have not passed the nurse competency test[1] mainly because of lack of activeness, focused learning, and clinical experience[2]. Many stakeholders have expressed concern about graduates who have lacked many of generic attributes which are essential for them to enter the workforce[3].

Nursing education programs should prepare students for lifelong learning in order to adapt to a diverse, evolving, and challenging patient care environment[3,4]. To be a successful nurse, one must have personal attributes, such as: resilient, gregarious, methodical, optimistic, patient, and empathic. Nurses also need to have generic skills, such as critical thinking, assessment and good communication, and be able to balance multiple tasks at the same time[5].

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In medical education, PBL has become an important method and strategy to involve students in active learning to find answers to clinical problems in nursing practice[6,7]. There are many PBL models that have been developed and adapted to educational goals[8], one of which is the Aalborg University PBL model. The Aalborg University PBL model, designated as a PBL center by UNESCO, has never before been implemented in Indonesian nursing education.

Objectives: The application of this model in the context of nursing education in Indonesia is an innovation. Therefore, the researcher applies it and wants to explore the differences in the effectiveness of PBL with the LBL method in the Biochemistry course in 2020. The results of this study are expected to contribute to the development of PBL and can provide insights and changes in lecture practice on the research campus.

In addition, researchers want to know how this model can be applied naturally so that it becomes an example for other lecturers, including how to measure it, its effect on the ability to learn independently and solve problems, and the significance of increasing student knowledge. This research is expected to be the forerunner to the application of PBL in all nursing education courses throughout the research campus itself.

Materials and Method

The design of this study, which is an experimental research approach, uses a mixed method concurrent triangulation design in which qualitative and quantitative data are collected and analyzed at the same time[9]. The research emphasis on quantitative method and qualitative method is used to analyze more comprehensively why things happen[9,10,11]. **Quantitative Research Components**

Quantitative instruments used in this research: pre-test and post-test, self-evaluation, and awareness and motivation surveys. The developed pre-test instrument was equivalent to a post-test standard with three cognitive levels of Bloom's taxonomy: knowledge, understanding and application. The test is given in the form of multiple choice with a total of 40 questions.

The self-evaluation instrument as well as motivation and awareness in the form of a 5-point Likert-type scale is an instrument developed by Aalborg University[12]. The results of the instrument trial showed very high validity and reliability, except for the self-evaluation of knowledge applications with Cronbach Alpha = 0.350 (Table 1).

The questionnaire was administered independently by students at the end of the Biochemistry lecture in the experimental class and the control class.

Table 1. A summary of the variance calculation of the questionnaire items (N = 30)

Scale	Number of Items	Cronbach Alpha (Aalborg)	Cronbach Alpha (researchers)
Awareness and Motivation	10	0,82	0,881
Self-evaluation			
Knowledge Application	2	0,59	0,350
Self-directed learning	4	0,63	0,873
Problem Solving and Critical Thinking	9	0,78	0,802
Team Work	10	0,82	0,919

Qualitative Research Components: Ethnographic methodology with interview strategy is used to determine the culture being studied[13]. Group interviews are used to evaluate students' motivation about PBL and its benefits in helping them gain generic skills.

PBL Universitas Aalborg: The Aalborg University PBL model used is the lecture and case modules (Figure 1). This module is designed to increase knowledge and skills of generic methodology with one mini project[14].

Students form a work team consisting of 7-8 people to solve problems at each lecture meeting and the main task is to complete a mini project[14,15]. In both the lecture and case modules as well as the lecture modules, learning is carried out following the flow of problem solving starting from problem submission, independent search for information and solutions, group discussions, online group presentations, question and answer sessions, lecturer feedback, and group and individual reflection.

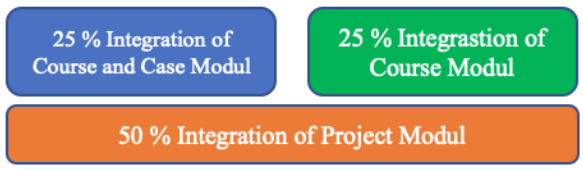

Figure 1. Combined course model and case modules (adapted from[13])

Each group determines their own video project topic with a duration of 2-5 minutes that provides explanation, data, information and behavior related to Covid-19. Project appraisal is carried out individually by looking at the project work reports they submit.

Meanwhile, for the control group, the LBL model was implemented. At the first meeting, the lecturer gave an overview of the lecture material and divided them into 7 groups. Each group was given the task of finding different lecture materials to be presented to the class.

Results

Demographic information of participants: PBL was applied to students with a total of 72 people, most of them were 19 years old (43.06%) and dominated by women (76.39%). The total number of participants in the control class was 28, all of whom were women, mostly aged 19-20 years (85.72%), only 14.29% were 18 years.

Pre-test and Post-test Results: The Post-test was only followed by 69 students (Table 2). In general, there was a significant increase from the pre-test and post-test in the experimental class, from 55.47 to 84.02 with a difference of 28.55 points. The average post-test obtained by the experimental class students was higher than the D3 Nursing students with a difference of 4.73. Thus, PBL is very effective in improving the knowledge or cognitive aspects of nursing students in Biochemistry courses.

Table 2. Statistic of Post-test

	Experimental class (N=69)		Control class (N=28)
	Pre-test	Post-test	Post-test
Mean	55.47	84.02	79.29
SD	8.695	8.747	10.338

Sig value. Levene's test for Equality of Variances is 0.345>0.05, it means that the data variance between the experimental class and the control class is homogeneous or the same. Value Equal variance assumed Sig. (2-tailed) of 0.005<0.05 (Table 3), it can be concluded that there is a significant difference between the post-test average of the experimental class and the control class.

Table 3. Summary of the independent sample t-test of post-test

	Levene's test		t-test
	F	Sig.	Sig. (2-tailed)
Equal variances assumed	0.901	0.345	0.005
Equal variances not assumed			0.011

Self-Evaluation Results:

Motivational awareness: Data analysis shows that the implementation of lectures, both PBL and LBL, is followed by students with high motivation and awareness. The T test for independent samples t-test shows that p> 0.05, except for item numbers 4, 5, 7 and 8 (Table 4). This means that students are more motivated to learn through discussion in small groups, and are more challenged to learn so that they become active learners and practice critical thinking than in the LBL.

The qualitative findings suggest that students are aware of PBL and are motivated to study harder. Students realize that PBL is able to develop self-directed learning, critical thinking, and solve problems through lectures. The unstructured contextual problems introduced by the researcher at the beginning of the lecture were stated by students as a trigger to gain knowledge, think critically, and solve problems as medical personnel. PBL is able to provide meaningful learning experiences for them.

Knowledge Application: Students apply their initial and latest knowledge in lectures with high categories both in PBL and in the LBL. The T test for independent samples t-test shows that p <0.05 for item no. 1(Table 4). PBL makes students use their previous knowledge to solve new problems rather than by LBL.

The results of the interview stated that the experimental class students used existing knowledge and tried to find new knowledge to solve the root of the problem at hand. They strive to dig deeper and obtain broader information that can increase their understanding.

Self-directed learning: The data analysis shows that the implementation of lectures, both PBL and the LBL, is experienced by students with experience of applying highlyself-directed learning skills. The T test for independent samples t-test shows that p <0.05 for items no. 1 and 4(Table 4). PBL makes students independently seek more relevant information from various learning sources to solve new problems and identify any opportunities for improvement in learning rather than through LBL.

The above findings are supported by qualitative results which reveal that Aalborg PBL allows them to gain the ability to search for relevant sources and information to solve problems. They are also used to providing critical ideas and ideas in accordance with the topic of the problem at hand. Problems are considered as clinical cases experienced by nurses in the field, so they must be resolved methodologically and carefully. They want to make the most informed decisions to help others.

Critical Thinking and Problem Solving: Data analysis shows that students attend lectures by applying

critical thinking skills and high levels of problem solving in PBL and the LBL. The T test for independent samples t-test shows that p <0.05 for item number 3(Table 4). PBL encourages students to propose one or more solutions to solve problems rather than LBL.

The quantitative findings above are in line with the qualitative findings from the interview results. PBL stimulates the ability to solve problems through increased thinking power, quickly responds to problems, looks at problems and digs deeper into relevant information. Sharing information with friends is one way to improve problem-solving skills.

Team Work: Data analysis shows that the implementation of lectures, both PBL and LBL, is followed by students with experience in applying high team work skills. The T test for independent samples t-test shows that p <0.05 for item numbers 1, 4, 7, and 9 (Table 4). This means that PBL makes students more committed to completing tasks in teams and helping friends who are left behind, compared to the LBL.

The qualitative findings support the quantitative research results. They want to complete assignments on time and be successful in teamwork. Teams are the best place to share assignments, find information, share knowledge, offer best feedback and help to stay connected to recovery. They also want to contribute to their group by giving different views on the problems at hand, as well as helping their friends who are left behind.

Table 4. Resume Statistic of Motivational Awareness and Self-evaluation

	N	Mean	SD	Levene's test Sig	t-test Sig (2-tailed)
Awareness and Motivation					
1. Realizing the rational implementation of lectures in Biochemistry courses	72	4.22	0.42	0.463	0.115
	28	4.04	0.69		
2. Be aware of the competencies that will be obtained from the lecture approach	72	4.22	0.42	0.08	0.407
	28	4.14	0.36		
3. Recognizing to practice self-directed learning from the lecture approach	72	4.25	0.44	0.895	0.251
	28	4.11	0.74		
4. Recognizing the importance of small discussion groups in the lecture approach	72	4.33	0.50	0.145	0.001
	28	4.18	0.39		
5. Be aware that the lecture approach can stimulate student learning	72	4.24	0.54	0.428	0.027
	28	4.14	0.36		
6. Recognizing the lecture approach can improve communication skills.	72	4.21	0.47	0.079	0.008
	28	4	0.47		
7. Being aware of the lecture approach can shape into an active learner	72	4.28	0.48	0.066	0.031
	28	4.11	0.31		
8. Recognizing the lecture approach can train to think critically	72	4.31	0.55	0.09	0.025
	28	4.07	0.26		
9. Recognizing the lecture approach can shape problem solving skills	72	4.26	0.53	0.328	0.001
	28	3.75	0.89		
10. Recognizing the lecture approach can increase students' intrinsic motivation	72	4.24	0.43	0.08	0.407
	28	4.14	0.36		
Knowledge application					
1. Using previous knowledge to solve new problems	72	4.29	0.49	0.325	0.029
	28	4.11	0.32		
2. Adapt and apply the concepts associated with the new problem situation	72	4.1	0.54	0.955	0.69
	28	4.14	0.45		

	N	Mean	SD	Levene's test Sig	t-test Sig (2-tailed)
Self-directed learning					
1. Set and achieve learning goals	72	4.36	0.64	0.439	0.036
	28	4.36	0.49		
2.Looking for relevant information from various learning sources independently to solve new problems	72	4.33	0.53	0.03	0.427
	28	4.25	0.44		
3. Pushing to the limit of students' knowledge and abilities	72	4.31	0.64	0.131	0.882
	28	4.29	0.46		
4. Identify any opportunities for improvement in learning	72	4.29	0.52	0.44	0.033
	28	4.21	0.42		
Critical thinking and problem solving					
1. Giving causes and synthesizing information	72	4.24	0.49	0.068	0.579
	28	4.18	0.39		
2. Identify several approaches to solving the problem	72	4.28	0.45	0.174	0.521
	28	4.21	0.42		
3. Propose one or more solutions to solve the problem	72	4.33	0.50	0.34	0.031
	28	4.07	0.54		
4. Identify the importance of the issues in the problem	72	4.25	0.47	0.564	1
	28	4.25	0.52		
5. Evaluate the results of the solution and determine appropriate action if needed	72	4.13	0.53	0.568	0.628
	28	4.18	0.39		
6. Having a different way of doing things to solve a problem	72	4.14	0.56	0.749	0.975
	28	4.14	0.59		
7. Think of better ways to do something or to solve a problem	72	4.26	0.44	0.089	0.898
	28	4.25	0.59		
8. Analyze the problem or goal, before beginning each action	72	4.22	0.42	0.212	0.509
	28	4.29	0.46		
9. Evaluating possible solutions, answers or plans for the problem	72	4.18	0.54	0.104	0.518
	28	4.11	0.42		
Team Work					
1. Submit work/assignments on time	72	4.38	0.54	0.029	0.411
	28	4.29	0.46		
2. Attend every group meeting and arrive on time	72	4.26	0.65	0.337	0.671
	28	4.32	0.48		
3. Strive towards achieving team learning goals	72	4.36	0.48	0.124	0.48
	28	4.29	0.46		
4. Interested to be actively involved in group discussions	72	4.35	0.61	0.049	0.266
	28	4.21	0.50		
5. Respect group members' opinions, ideas and contributions	72	4.4	0.49	0.855	0.928
	28	4.39	0.50		
6. Respect the opinions, ideas and contributions of others outside the group	72	4.29	0.46	0.098	0.335
	28	4.39	0.50		
7. Helping the members who are lagging behind the team	72	4.21	0.50	0.019	0.132
	28	4.04	0.51		

	N	Mean	SD	Levene's test Sig	t-test Sig (2-tailed)
8. Share information and literature sources with group members	72	4.26	0.44	0.501	0.4
	28	4.18	0.48		
9. Offer feedback to teammates in a constructive and friendly manner	72	4.28	0.54	0.034	0.533
	28	4.21	0.42		
10. Support group decisions even if they do not agree completely	72	3.9	0.65	0.146	0.21
	28	3.71	0.71		

Statistically, PBL increased students' awareness and motivation to learn better than in the LBL. Obviously, PBL makes students more intrinsically motivated to become active learners given the clinical problems their future profession has to solve[16,17] through small group discussion [18]. They are also more challenged to solve problems effectively which in turn spurs them to think critically[18,19,20].

PBL makes students generate prior knowledge relevant to the problem at hand [19]and be aware of the knowledge they do not have[18]. From this point, they know the direction to find the knowledge and ideas needed to solve problems[6,18]. They use metacognition strategies to plan, monitor, and evaluate the completion of mini project tasks[18]. This condition does not occur in the LBL. Working in small groups to solve clinical nursing problems is of the utmost importance in PBL. Student commitment to problem solving makes collaborators effective[18,19,20] and has the effect of increasing awareness and intrinsic motivation[18]. They discuss actively, and help their friends understand by providing logical, constructive and friendly explanations[18,19,20].

Finally, PBL succeeded in increasing test results to be higher than the LBL. Deep learning occurs when students understand content through problem solving. They want to fill in the knowledge gaps by looking for relevant information, ideas, doubting their knowledge, questioning and explaining opinions, evaluating problem solving processes, especially in mini projects[20,21,22], as well as tutoring their friends[18,19].

Conclusion

Aalborg's PBL model is more effective at improving test results and some generic skills in nursing education. Therefore, researchers suggest applying it widely in all nursing majors. Multi-year research needs to be done to see the academic and non-academic results of students. The instrument in this study can be used as a tool for quality assurance of education to monitor and evaluate learning management.

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