

Original article

Comparative study between evidence-based or problem-based learning and conventional method to improve the clinical problem solving of the medical students

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ABSTRACT The purpose of this study was to compare learning methods between the conventional and educational technology with evidence-based medicine and problem based learning methods, which is in accordance with the ability of clinical problem solving of medical students. This quasi-experimental study involed medical students at ninth semester, index of achievement ranging between 2.5–3 and worked at the Child Health Department of Dr Soetomo Hospital from January until December 2000. Data included performance of history taking, physical examination, summary, diagnosis, planning examination, therapy, complication, prognosis, pathophysiology and total score. All of variables were analyzed by using t test with $p < 0.05$ was considered to be significant. We found significant difference between the two groups in terms of history taking, building the summary; establishing diagnosis, planning further investigations, planning treatment, predicting complication, and describing the pathophysiology, and total scores, but did not see any difference physical examination $t = 0.3$ $p > 0.05$ and in predicting prognosis. We concluded that the use of educational technology with problem-based learning and evidence-based medicine methods significantly improve the problem clinic solving of the medical students. [**Paediatr Indones 2001; 41:268-272**]

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DEVELOPMENT OF ANY COUNTRIES NEEDS A NATURAL AND human resources as primary asset. Human resources are more important, include, quantity and quality. The quality is more important and educational effort and training should be given to increase this quality.^{1,2} According to the governmental regulation, No 60/1999, section 2, the purpose of higher education is preparing the learners to have academic and professional abilities that enable them to apply, develop and or to enrich the sciences, technology and or art. In fact, the learning system in most of the Indonesian universities is still lecturer-centered, the

students tend to learn passively and to be incapable in self developing so, the result is not as expected.^{3,4} On the other hand, improvement of educational level and socioeconomy will cause increased demand for health services. Learning module is more efficient and relevant educational system, the students are able to study without dependence on the quality of the lecturers, learn in their capacity, will have high motivation to reach instructional purposes. Evidence-based medicine (EBM) is the integration between the doctor's professional competency and the evidences of the valid researches.⁵ Doctors must have sufficient critical appraisal skill to judge the validity and importance of research report that can be implemented to their patients.⁶ The purpose of problem-based learning is that the students should be able to obtain

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efficient, integrated, and achievable knowledge structures and could solve the problem easier.⁷

The purpose of the study was to compare the conventional learning method and EBM/PBL methods to improve of the clinical problem solving skill and capacity.

Methods

This quasi-experimental study compared the medical students at ninth semester with the index of achievement ranging between 2.5-3.0 and worked at the Department of Child Health, Dr Soetomo Hospital, Surabaya, Indonesia. The students were randomized into two groups to either given the conventional method or EBM/PB learning methods. The dependent variables were scores in history taking, physical examination, summary, diagnosis, planning examination, therapy, complication, prognosis, pathophysiology, and total performance. The independent variables were learning methods, the confounding variables were gender, index of achievement, parent's education background, parent's occupation, parent's income and student's residence. Outcome were analyzed by using independent t test with $p < 0.05$ were considered to be significant.

Results

From January to December 2000, there were 128 students eligible for the study but only 72 students agreed to participate. Several external and internal factors influenced the learning process are summarized in **Table 1**.

To solve the clinical problems, we measured several variables that indicated the development of academic and professional competence, i.e. ability of doing history taking, physical examination, summary, supporting diagnosis through clinic data, planning investigations, treatment, complication, prognosis, understanding pathophysiology, and the total score of test. The results are depicted in **Table 2**.

Discussion

The system of the higher education in Indonesia still unable to reach the optimal result. This view is based on the reports obtained from the doctors in some

TABLE 1. INTERNAL AND EXTERNAL FACTORS, WHICH MAY INFLUENCE THE RESULTS OF STUDENT'S LEARNING

Factors	Conventional group (%)	PBL Group (%)
I. Internal		
- Gender: Male	20	17
Female	16	19
- Achievement Index	26.8 (SD 2.2)	26.4 (SD 1.8)
II. External		
Parent's educational background		
- high school or less	12	16
- university	24	20
- Parent's income		
Average	16	18
Above average	20	18
- Parent's occupation		
Civil servants	15	15
Private sectors	18	20
Army	3	1
- Residence		
Own house	24	22
Boarding house	12	14

regency. Those doctors stated that the doctors who just had been graduated recently, were less capable to work in the medical field both professionally in terms of medical science, and professionally in terms of problem solving. Most of the systems of the higher education in Indonesia, learning process emphasized more on the lecturers' role and the students tend to act passively and unable to make self-improvement.³ The lecturers usually give the instructional materials that have been stated explicitly on the syllabus, by using the instructional method and its timing, that only applies face-to-face instruction or lecturing without considering the individual differences among the students, such as learning ability, ways of learning, intelligence, motivation, interest, difficulties in learning and so on.^{8,9} In this system, the students do

TABLE 2. COMPARISON ON THE ABILITY TO SOLVE THE CLINIC PROBLEMS BETWEEN THE CONVENTIONAL AND LEARNING MODULE GROUPS

Skill domain	Conventional Group	PBL Group	p
History taking	5.9 (SD 0.7)	7.0 (SD 0.4)	$p < 0.05$
Physical examination	6.1 (SD 0.7)	6.1 (SD 0.7)	$p > 0.05$
Summary	6.1 (SD 0.7)	7.1 (SD 0.5)	$p < 0.05$
Diagnosis	6.1 (SD 0.7)	7.3 (SD 0.5)	$p < 0.05$
Planning examination	6.1 (SD 0.7)	7.3 (SD 0.5)	$p < 0.05$
Therapy	6.1 (SD 0.6)	7.0 (SD 0.4)	$p < 0.05$
Complication	6.1 (SD 0.7)	6.6 (SD 0.9)	$p < 0.05$
Prognosis	6.8 (SD 0.8)	6.8 (SD 0.9)	$p > 0.05$
Pathophysiology	5.9 (SD 0.7)	7.3 (SD 0.4)	$p < 0.05$
Total score	5.9 (SD 0.1)	6.8 (SD 0.1)	$p < 0.05$

not participate in deciding the instructional method that they would get, the students must adapt their ways in learning with the available method. The result of learning is measured by the certain tests, and the students do not have to know how the measurement is being conducted.¹⁰ The weaknesses of the system are: (1) the success of the teaching and learning process depends on the lecturers' ability profoundly, (2) the syllabi is spelt out unclear and not in details, (3) the instruction is emphasizing more on how giving the instructional material as much as possible based on the available time.^{11,12} Concerning with the fact stated previously, the department of the National Education assigned the curriculum developer to arrange and to plan a better instructional system, called the instructional by using modules.

Instructional system by modules is an efficient and relevant educational system. Modules are expected to be able to change the situation in which the modules will create an interesting situation for learning, and activate the students to read and solve their problems under the lecturers' guidance and supervision.^{12,13} By using modules, students enable to study without depending on the lecturers' quality, enable to conduct the independent study with the available directions on the modules, and by using module, the education is closer to the mass education.¹¹ Furthermore, using module will encourage the students to be more active and dynamic, since they have to work harder to solve problems, and to create inventories.^{14,15}

The researcher used a variety of tests, that can be used as tools in measured the students' ability ranging from C1 up to C6, i.e., acknowledgement, comprehension, application, analysis, synthesis, and evaluation. Those tests were used to acknowledge the success of the application of the PBL and EBM instructional modules in relation with the students' ability in clinic problem solving.

The students' ability in doing history taking must be supported by abilities in identifying the complaints of the patients, abilities in explaining and categorizing the other complaints from other patients, so, the complaints can be categorized into a diagnose of work. And these abilities need knowledge, comprehension, and analysis. Our study shows that the result of testing the history taking as reflected on the sheet of oral tests, found that in the conventional group, the skill

in history taking as the most important parts in making diagnosis was complete and correct. However, the documentation was less systematic and less detailed. On the contrary, in PBL group the history taking was done properly, in which important things were questioned and noted in details. The difference of the two groups was statistically significant.

The result of physical examination skill test obtained by the two groups were almost similar; students in both groups were able to do physical examination accurately. They were able to search the necessary things and noted them carefully. The t-test concluded that the difference was not significant. Indeed, PBL instructional modules did not include the direction of the physical examination explicitly, and this physical examination could be carried out well if the students got knowledge about 'bed side teaching' and they practice it continually.

To made chronological and systematic status, and to constructed of informative summary needs acknowledgment, comprehension, analysis, synthesis, and evaluation of the data obtained from anamnesis, physical examination, and additional examination. The ability to develop the summary in the conventional group was not bad, but the summary was made too short and less systematically. The PBL group was able to construct status well and completely, and construct summary briefly and systematically. The difference of the two groups was statistically significant.

In constructing a diagnose, students must be able to integrate their abilities, including the knowledge and comprehension about diseases, ability in analyzing, synthesizing, and evaluating the available data. In this domain, the conventional group was able to construct a diagnosis based on the available data, but they did not include or write two important information for completing the diagnosis. The learning module group was able to organize the obtained data systematically, analyze the data and construct a diagnosis well. There was a statistically significant difference between the two groups.

In planning the recommendation of the examination, the students were expected to be able to construct a diagnosis of work in advance, and able to identify the insufficient data needed in constructing an exact diagnose. This required knowledge and comprehension related with diseases, and abilities in ana-

lyzing, synthesizing, and evaluating the available data and the insufficient data. The result of planning examination, the conventional group was able to plan a specific laboratory investigation or consultation. They also were able to interpret the test results. The same was shown by the PBL group; in addition they were also able to plan an alternative diagnose strategy based on the result obtained. The t-test stated that there was a significant difference.

PBL group showed a significantly better skill in planning the treatment as compared to conventional group. In the learning module group was able to arrange a program of management and therapy, which was written accurately, and the result of the treatment was written in detail.

The test result of complication test, the conventional group was able to record complicated factors in detailed, but they forgot one or two of them. Meanwhile, the learning module group was able to record the count of the complicated factors and diseases carefully and in detailed with its follow up. In predicting the emergence of the complicated factors in a certain disease, the students must have sufficient knowledge and their comprehension toward the disease' concepts, enable to carry out analysis, synthesis, and evaluation from the available data, including the clinic, laboratories, and supporting data.

The test result of the prognosis test, the conventional group and the learning module group were able to determine a prognosis based on the complete and detailed data, and plan a follow up. The difference of the two groups was small, and the t-test resulted that the difference between the two groups was not significant. The statement of prognosis is in the form of good and bad. To determined prognoses required knowledge of disease and clinic experiences in order to be able to provide a variation of treatment for each disease. Experiences are very important, and these could not be obtained from the module instructions, but the students themselves must experience them.

The test result of the pathophysiology test, the conventional group was able to connect their basic knowledge to the clinical data of the related patients. And the learning module group was able to use of their basic and clinic knowledge related with the condition of the patients. The t-test resulted that there was a significant difference. Pathophysiology is

a science which studies changes occurred in the system of human body both relates with shapes and functions as the effect of the pathological process. The students' comprehension toward pathophysiology requires the students to have a lot of knowledge and deep comprehension about diseases, and to be able to analyse, synthesis, and evaluate any disorder process in the system of human body.

The test result of the ability in clinical problem solving, at the conventional group and the learning module group showed a significant difference from t test. Although there was not any significant difference between the two groups in relation with the variable of physical examination and the variable of prognosis, the research found a significant difference between the two groups concerning with the total value of ability in clinic problem solving. The variable of ability's total value in clinical problem solving is the total of overall variables used to measure the students' ability in clinical problems solving. As conclusions, ability in clinical problem solving proved significantly better at the group experiencing learning module method, but the ability on physical examination and prognosis at the 2 groups is not significantly different. As suggestion, for the lecturers to made learning contract, clear, and detail learning modules and also to begin to give lessons based on problems experienced at the clinics. A need on the preparation of serving available means of information, such as: CD-ROM, Internet, and library providing scientific papers, popular science book, and current studies. A need to contribute some knowledge dealing with clinic appraisal.

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