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Evaluation of a Problem Based Learning Curriculum Using Content Analysis

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ABSTRACT

Faculty of Medicine UGM has implemented Problem Based Learning (PBL) since 1985. Seven jump tutorial discussions are applied. A scenario is used as a trigger to stimulate students to identify learning objectives (LOs) in step five which are used as the basis for self study in step six. For each scenario, the Block Team formulates the LOs which are informed to tutors. Tutors have to facilitate the discussion that the correct LOs are identified. This study checked the allignment of LOs formulated by the Faculty and LOs by the students. Cardiorespiratory system block is used. A content analysis is applied for this purpose. Sixteen discussion notes (DNs) written by 16 groups from one scenarios were analysed. The LOs from the tutor book and DNs were coded separately. There were eight Faculty LOs for scenario Blood Donation. None DNs were mentioned correctly. Many DNs mentioned LOs which are not in the prescribed LOs. It was clear that 16 groups of student failed to identify LOs correctly. This might affect their performance in their block exams, and also their preparedness for the subsequent blocks as they lack relevant prior knowledge.

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1. INTRODUCTION

Problem-based learning (PBL) is a very famous innovation in medical education and was started in 1950s by Case Western University in USA and was followed by McMaster University in Canada in 1960s. In the following four decades, PBL spread out to five continents and implemented by hundreds medical school [1]. PBL is designed to apply knowledge instead of just acquiring knowledge and recommended as a promising approach for long-term retention of knowledge and skills development needed in global workplace such as critical thinking, problem-solving, communication, collaboration, and self-regulation [2],[3].

PBL curriculum is designed by integration of knowledge which is needed for the students in order to get a deep understanding of knowlegde, to have proper schemas and retrieve them in order to understand presented problems and to solve the similar problems later in their professional life. The more students are exposed to different kinds of problems, the more schemas will be created in the students' mind, and students will become more prepared to work in their professional life. Continues exposures of problems are encountered during small group discussions. In these discussions, students are challenged to apply their prior knowledge in problem analyses and generate their own learning objectives. In between the discussions, students apply self-directed learning using various available learning resources guided by their own learning objectives. Students have the opportunities to apply elaboration of their gained knowledge and understanding in the problems in the subsequent tutorial discussion. By enganging in tutorial discussions using a problem as

a trigger, it has been proved that new information is better procesessed and retained; students' motivation and problem solving skills are strengthened; and self-directed learning readiness is enhanced [4].

In a PBL curriculum, learning outcomes at the end of the education programme are broken down into more specific learning objectives (LOs) that are distributed in logical sequences throughout the blocks. Hence, each block has LOs to be achieved by students at the end of each block. The block team develops instructional design of each block based on block LOs which will be achieved through various learning activities. Some LOs are to be achieved through tutorial discussions and are hidden in the scenario (case/problem). The distinctive characteristic of PBL as learning strategy is the focus on problem as a vehicle to engage in learning. Students are challenged to activate their prior knowledge, to identify their own learning objectives, and to contextualize their acquired knowledge.

Two features of a PBL case are essential, namely content and format [5]. In terms of content, PBL cases should be prototypic. It should be an example of a routine problem encountered in a practice which has key features (for example, signs, symptoms and causes) in common with other examples of that type of problem. PBL cases should be challenging and sufficiently complex, so that they have a high degree of fidelity and create sufficient cognitive dissonance to motivate learners [6]. Dolman proposes several aspects to be taken into account when constructing problems, as follows: connections with prior knowledge, clear connection with the block objective, complexity of problem, degree of structure, concrete wording and connection with professional life, length of the problem, time availble for independent study, and time available at reporting phase [4].

In small group discussion, a faculty tutor was present during all group activities to monitor and assess the discussion [7]. Tutor is a learning facilitator and not a source of information [3]. The most important task of a tutor is to ensure that the LOs identified by the students match with the LOs designed by the faculty. If this occurs, students' self-directed learning will be rightly guided [6],[8]. Tutor's training is very important to train tutor how to stimulate active and self directed learning [3]. Several research were conducted to compare tutor's background for effective tutorial discussion, i.e between student-tutored and tutorless, facilitative and non-facilitative tutor, expert and non-expert tutor, student tutor and faculty tutor. Tutor was able to modify their role and influence group processes depend on students experience in PBL. Increasing students experience in PBL need a higher level of independence and autonomy [7]-[11].

Faculty of Medicine Universitas Gadjah Mada (FM UGM) has applied PBL since 1985 in gradual phases. The seven jump tutorial discussion developed by Maastricht Medical School is adopted. The first step is to identify unfamiliar terms and try to define them using the students' prior knowledge. The second step is to identify problems in the scenario. The third step is brainstorming where using their prior knowledge the students attempt to explain the mechanism underlying the problems. During the third step, each student is allowed to think aloud and activated their prior knowledge. In the fourth step, students analyse and synthesize their preliminary explanation using their prior knowledge in step three. In this step, students are encouraged to create a mind mapping or concept mapping in order to easily visualize their thinking and to identify the gaps they have to complete. In step five, these gaps are converted into LOs. In step six students conduct independent learning through various kinds of learning activities directed by LOs. In step seven students report the results of their self-study to the group. It is encouraged that in this step, each student has the opportunity to present to the group what they have learnt in step six.

Starting in 2002 until now, FM UGM has implemented PBL as a curriculum; therefore the structure of the curriculum is changed into block system. In each year there are six blocks to be completed. The competences to be achieved at the end of the study are broken down into specific learning objectives and distributed to each block sequentially. LOs in each block (Faculty learning objectives) are hidden in the problem scenario and have to be identified by the students (students learning objectives) as the basis for self-study. The critical point is to what extent Faculty LO and student LO are alligned. Ideally, Faculty LO and student LO are congruent. This means the learning process is effective. The purpose of this study is to evaluate the allignment of LOs formulated by the block teams and LOs identified by the students.

2. RESEARCH METHOD

A qualitative content analysis was used in this study. Qualitative content analysis was done by extracting systematically qualitative material-in this case is the discussion notes (DNs)-in order to create evidence about the content that builds or support an argument through identifying themes and patterns as well as describing situations.

In this study, a second year cardiorespiratory system block was used, 16 discussion notes (DNs) for scenario "Blood Donation" written by 16 groups of which each group comprsies of 10-12 students are analysed. The common themes were identifed and number coded differently for each theme. The learning objectives (LOs) from the tutor book and the discussion notes (DNs) are coded separately.

3. RESULTS AND ANALYSIS

There were 14 discussion notes (DNs) applicable and two DNs were not applicable (NA). The eight faculty learning objectives (LOs) were written in number 1 to 8 and dark color coded. There were 18 other themes (number 9 to 26) that were not included in faculty LOs. The resume of the congruence of LOs from faculty and 16 groups of student can be seen in the Table 1.

Table1. Congruence of learning objectives (LOs) from tutor book and discussion notes (DNs) of 16 groups of student

LOs from tutor book	LOs from DNs of the 16 Groups															
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI
1	4	6	1	3	16	5	NA	3	8	1	6	1	1	1	2	NA
2	8	8	6	5	17	8		4	10	2	8	2	2	2	6	
3	9	12	13	14	18	9		5	20	4	18	3	3	3	25	
4	10			15		17		6		6	21	4	5	5	26	
5	11					19		8		8		5	6	6		
6								9				6	8	8		
7												8	11	24		
8												22	27			

Notes:

A. No. 1-8: LOs from tutor book

1. Topography of the heart, chambers, valves and the heart's wall
2. Structure of the cardiac muscle cells
3. Cardiac conduction system and the normal ECG
4. Mechanism of contraction and relaxation of cardiac muscle
5. Cardiac cycle and cardiac output
6. Structure and function of the vessels (aorta, arteries, arterioles capillaries, venules, veins, vena cava) as a resistance and capacitance vessels and the dynamic of bood flow in the vessels. Autoregulation mechanism of blood flow to fulfill demand of the tissue and cells
7. Startling equilibrium at capillaries
8. Definition of blood presure, factors affecting blood presure (age, sex, gravitation, dehydration, drugs, etc) mechanism of baroreceptor to maintain blood pressure, mechanism of blood pressure alteration as physiological consequences

B. No. 9-26: LOs from the students

9. Heart sound auscultation
10. Benefit, blood donation requirement, and condition post bood donation
11. Biochemical regulation in blood vessel
12. Reciprocal relation between pressure, resistency, and capacity of the blood vessel
13. Wiger graph electrically and mechanically
14. General principle of cardio haemostasis
15. Formula which influence blood pressure and heart rate
16. Complete process of nerve regulation and substance
17. Relation of heart rate and blood pressure
18. Blood donation, arteri or vena, why?
19. Hypertension standart, JNC
20. Effect of aspirin in the blood
21. Blood donation, hipovolemic
22. Starling equilibrium
23. Effect of hydrostatic and osmotic pressure in plasma
24. Vascularization in general
25. Vascular and lymphatic system
26. Heart enzyme

NA: Not applicable

There were eight Faculty learning objectives (LOs) for scenario Blood Donation. However, no discussion notes (DNs) mentioned Faculty learning objectives correctly. All DNs mentioned LOs which were not included in the Faculty LOs, such as requirements and condition of blood donation, lymphatic system, and heart sounds.

For ‘Blood Donation‘scenario, it was clear that 16 groups of student failed to identify Faculty LOs correctly. If during step five the students fail to identify correct learning objectives, eventually during step six when students do their self study, student will learn different materials which might not be what they should have learnt. This might affect their performance in their block exams, but also their preparedness for the subsequent blocks as they lack relevant prior knowledge.

Many factors might contribute to the differences between faculty and student learning objectives. Some could be mentioned as follows: (1) tutors are unable to facilitate the discussions due to cognitive incongruence and lack of tutoring skills, (2) design of the block is inappropriate - either the LOs are too many for two hours discussion or the scenario diverts students' attention.

Cognitive congruence and tutoring skills are very important to facilitate PBL tutorial discussions. The PBL tutorial discussion is a method for students learning to master knowledge acquisition and knowledge utilization (from application, analysis, and synthesis). Cognitive congruence means tutor's understanding of the subject matter being discussed. Without this, tutors are unable to facilitate discussions, to provide appropriate questions and timely probing. Although tutor training in FM UGM has been conducted regularly covering both beginner, intermediate and advanced courses, and refreshing tutor before the beginning of the block, tutors are still having difficulties to exercise their tutoring skills. Therefore tutor PBL preparation needs to focus on subject matter knowledge and facilitating skills to encourage effective group functioning and to stimulate students learning process. Any feedback from the students regarding tutor performance could be important sources for tutor's evaluation [8]-[11].

Design of the problem is very critical for the success of a PBL curriculum which is affected by the design of the macro and micro curriculum. This includes sequence of instructions – what integrated themes and learning materials to be included in which blocks. Design of block – in terms of contents and sequence of instructions – and tutors' competence are very important to have the advantages of PBL strategy materialized.

Khoo identifies that in many Asian medical schools, the Learning objectives of the PBL problems are often unclear. He also finds that the trigger problems should be designed carefully to make them more relevant and more challenging for the students. Writing a problem scenario needs a special ability, not only about the case, and the underlying theory, but also about the structure of the whole curriculum and how to hide learning objectives in the problem [12]. If we can not produce good trigger problems, and tutor's ability to facilitate students learning process is less, then students usually take too narrow a view of the problem and focus too soon on potential solutions rather than understanding the many implications of the problem [13].

Espey *et.al* in New Mexico Medical School has modified the seven jump tutorial discussions to include home review of the case prior to the first meeting where students are allowed to learn first about the case. By doing this, students are better prepared. Two more steps are added, namely oral case presentation and corner stone presentation where students are given opportunities to present particular topics about the case. Students are also allowed to identify learning issues during their home review. These efforsts are to avoid students' formulating incorrect learning issues [14].

Oda, *et.al* conducted the study on 234 tutors and 191 students participated in the PBL sessions and tutors were changed after each full session was completed. Every group received equivalent tutors, either from student tutor or faculty tutor. This study found that student gender, quality of case scenarios and tutor backgrounds were correlated with 'excellent scores' in tutor performances [9]. This finding is in line with the previous researches by Dolmans, *et.al*. that good problems improve tutor performances [15].

Couto, *et.al* found that 'subject matter expert' is very good at building knowledge (confirmed by 95% out of 252 students and assisting in generating self-study learning goals (confirmed by 87% of the subject). It shows that tutors with subject-matter expertise are very instrumental in making sure that students identify the correct learning goals [16]. The role of tutors, including how various styles of tutoring affect the success of PBL tutorial have been researched. Gerhardt-Szep, *et.al* evaluated PBL tutorial groups with facilitative and non-facilitative tutors. The finding shows that in initial years facilitative tutors are more demanded and non facilitative tutors are better for the later year when students already mastered sufficient grasp of knowledge [17].

A number of factors related to tutors' performance and designs of problem scenarios might contribute to the failure of students' identifying the correct learning goals that will bu used to lead them during self-study. A high degree of congruence between students' characteristics with tutors' style is very important. Tutors need to be trained on how to change their style to suit students' characteristics. The allignment of problem scenario with Faculty learning objectives for each blok also affects the tutorial's results.

4. CONCLUSION

Sixteen groups of student failed to identify eight Faculty Learning Objectives (LOs) for scenario 'Blood Donation'correctly. Many DNs mentioned LOs which are not in the prescribed LOs. Two main factors might explain why this occurs, namely tutors' performance and the design of problem scenario. Tutors' performance vary according to their facilitation styles and expertise; whilst the design might be

inconsistent with the Faculty learning objectives. The results of this study is limitedly applicable to the research setting.

RECOMMENDATION

Further researches are needed to identify which factors contributing to the students' failure in identifying learning objectives. Tutors' performance and design of problem scenario need to be further explored. To increase external validity, future research is advised to involve multiple research setting.

REFERENCES

[1] J. A. H. Caplow, J. F. Donaldson, C. A. Kardash, M. Hosokawa, "Learning in a problem-based medical curriculum: students' conceptions," *Medical Education,* vol. 31, pp. 440-447, 1997.

[2] S. Chakravarthi, H. S. Nagaraja, J. P. Judson, "An exploration of the strategic challenges of problem based learning (PBL) in medical education environment: A paradigm shift from traditional lectures," *Indian Journal of Science and Technology,* vol/issue: 3(2), 2010.

[3] R. Boelens, B. D. Wever, Y. Rosseel, A. G. Verstraete, A. Derese, "What are the most important tasks of tutors during the tutorials in hybrid problem-based learning curricula?," *BMC Medical Education*, vol. 15, pp. 84, 2015.

[4] D. Dolmans, Snellen, H. Balendong, "Problem-based Medical Education: Problems Construction," Maastricht, Department of Educational Development and Research, 2000.

[5] M. C. Lohman and M. Finkelstein, "Designing cases in problem-based learning to foster problem-solving skills," *Eur. J.Dent.Educ,* vol. 6, pp. 121-127, 2002.

[6] H. S. Barrows, "Practice-based learning: problem-based learning applied to medical education," Springfield, IL, USA, Souther Illinois University School of Medicine, 1994.

[7] S. Hayashi, K. Tsunekawa, *et al.*, "Comparison of tutored group with tutorless group in problem-based mixed learning sessions: a randomized cross-matched study," *BMC Medical Education,* vol. 13, pp. 158, 2013.

[8] M. Groves, P. Rego, P. O'Rourke, "Tutoring in problem based learning medical curricula: the influence of tutor background and style on effectiveness," *BMC Medical Education,* vol. 5, pp. 20, 2005.

[9] Y. Oda, H. Onishi, T. Sakemi, "Effectiveness of Student Tutors in PBL of Undergraduate Medical Education," *Tohoku J. Exp. Med*, vol. 232, pp. 223-227, 2014.

[10] S. Gerhardt-Szep, F. Kunkel, A. Moeltner, M. Hansen, A. Böckers, S. Rüttermann, F. Ochsendorf, "Evaluating differently tutored groups in problem-based learning in a German dental curriculum: a mixed methods study," *BMC Medical Education*, vol. 16, pp. 14, 2016.

[11] S. Turan, M. Elcin, O. Odabasi, K. Ward, I. Sayek, "Evaluating the role of tutors in problem-based learning sessions," *Procedia Social and Behavioral Sciences,* vol. 1, pp. 5-8, 2009.

[12] H. E. Khoo, "Implementation of problem-based learning in Asian Medical Schools and students' perceptions of their experience," *Medical Education,* vol. 37, pp. 401-409, 2003.

[13] W. Robert and M. McCracken, "Assessment and Evaluation in Problem-Based Learning," Georgia Institute of Technology, 2003. Available at http://wikifuse.pbworks.com/f/Waters+McCracken.pdf.

[14] E. Espey, T. Ogburn, S. Kalishman, M. Zsemlye, E. Cosgrove, "Revitalizing problem-based learning: students and tutor attitudes towards a structured tutorial," *Medical Teacher,* vol. 29, pp. 143-149, 2007.

[15] DHJM Dolmans, WH Gijselers, JHC Moust, WS De Grave, IHAP Wolfhagen, CPM Van Der Vlueten, "Trends in research on the tutor in problem-based learning: conclusions and implications for educational practice and research," *Med.Teach*, vol. 24, pp. 173-180, 2002.

[16] L. B. Couto, R. B. Bestetti, C. B. A. Restini, M. Faria-Jr, G. S. Romao, "Brazilian medical students' perceptions of experts versus non-experts facilitators in a (non) problem-based learning environment," *Med. Educ. On line,* vol. 20, pp. 26893, 2015. http://dx.doi.org/10.3402/meo.v20.26893.

[17] S. Gerhard-Szep, F. Kunkel, A. Moeltner, M. Hansen, A. Bockers, S. Ruttermann, F. Ochsendorf, "Evaluating differently tutored groups in problem-based learning in a German dental curriculum: a mixed method study," *BMC Medical Education,* vol. 16, pp. 14, 2016.

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