

Comprehensive Research

Self-efficacy achieved through problem-based learning tutorial

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Positive self-esteem helps students build and maintain self-efficacies to affect later clinical practice. We examined the outcome of problem-based-learning (PBL) curriculum by evaluating self-efficacy in terms of sustained learning and clinical competencies among medical school graduates.

- 1) We compared practicing doctors who either had PBL tutorial experience or who had not by a questionnaire survey.
- 2) The subjects self-evaluated whether they had achieved expected abilities (1) at the end of undergraduate years, (2) during 2-year internship, and (3) at present.
- 3) Among 1,502 doctors surveyed (response rate = 36.0%), doctors with PBL tutorial experience had higher self-efficacy (odds ratio > 2.1) in their clinical abilities than doctors without it, especially during the school years.
- 4) In the later 2 periods, doctors with PBL experience had higher self-efficacy in communication skills.
- 5) PBL tutorial foster self-efficacy in clinical abilities, especially in communication skills, during earlier clinical career.

Key words: PBL, self-efficacy, learning ability, communication skill

INTRODUCTION

Many medical schools adopted PBL tutorial as a medical education strategy¹⁾. The educational outcome of PBL has been discussed in the variety of settings yielding different results^{2,3)}. How-

ever, students generally prefer and accept PBL because of its learner-directed component^{4, 5)}. Our medical school introduced PBL to enhance self-directed learning and problem-solving skills in 1990^{6, 7)}. Upon implementation of PBL, curriculum on "attitudes toward active communication" and "expression of own view" was also included^{8~10)}. In PBL, students are also expected to pursuit knowledge of basic science, facilitate active self-directed learning, and promote ability to integrate psychosocial and humanistic concepts in patient care. These competencies are expected to remain in the postgraduate careers.

Some studies have compared behaviors or motivations between students who had been exposed to PBL tutorials^{3,6,11)}. PBL tutorial is student-centered, however, little studies have examined learners' confidence in terms of their

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learning ability, practice, and behavior through PBL, or self-efficacy¹²⁾. In other words, the outcomes of PBL from the learners' perspective are rarely evaluated. The objective of this study is to quantify self-efficacies in doctors who had PBL tutorial experience. Our medical school had about 700 graduates with 4 year PBL/lecture hybrid curriculum at the time of study. Our study was performed on these graduates and on 700 graduates who graduated immediately before the implementation of PBL curricula.

METHODS

Subjects

There were 1,502 students who graduated from Tokyo Women's Medical University (TWMU) before and after the implementation of PBL tutorial (from 1989 to 2003). Both groups finished their 6-year medical school curriculum which contained 4 years of preclinical and 2 years of clinical studies. The first-year medical school students were mostly high school graduates and a few college graduates. Among these subjects, 783 subjects had 4-year PBL tutorial experience (PBL+) and graduated from TWMU between 1996 and 2003. Other than that, 615 subjects had no PBL tutorial experience (PBL-) and graduated between 1989 and 1994. The remaining 104 students who graduated in 1995 experienced a tutorial trial. Questionnaires were sent to all these graduates.

A detail of the PBL curriculum has been given elsewhere⁷⁾. Briefly, the medical school curriculum is a 4-year organ-based lecture/PBL/lab hybrid curriculum followed by a 2-year clinical clerkship. During the 4 years of preclinical studies, PBL sessions are conducted twice a week for 105 minutes by a group of 6 to 7 students with a non-content expert tutor, followed by a 170-minute self learning time (also twice a week). In the self-learning time, students studied common learning issues that were adopted

through group discussions. One case is studied in 4 PBL sessions (group discussion with a tutor). A total of 49 cases are studied during the preclinical years.

The PBL- group underwent a didactic lecture-based curriculum for the preclinical years which consisted of different discipline-based lectures in a large lecture room. Thus, lectures were given in an order of premedical, basic medical and clinical medical disciplines. Laboratory works were combined into the course. The preclinical years were followed by 2 years of clinical clerkship as in the PBL+ group.

Questionnaire:

A questionnaire that contained 85 questions was constructed. The questionnaire was composed of 5 sections. The first section contained 14 questions asking about issues in the undergraduate years. The second section contained 15 questions asking about PBL tutorials (limited to those who had PBL tutorial experience). The third section contained 17 questions asking about issues related to the 2-year internship. The fourth section contained 29 questions asking about present issues and the last section contained 10 questions asking about other information. The items that asked about the 2-year internship and the present issues were the same, and they were more clinically focused. Subjects were asked to evaluate their self-efficacy using a 5-point-scale, ranging from -2 to +2, where -2 = not achieved, -1 = little achieved, 0 = neutral, +1 = fairly achieved, and +2 = achieved.

Subjects were asked to retrospectively evaluate themselves on whether they had achieved the abilities expected of them as doctors during the 3 different defined periods. Questionnaires were sent to all of the subjects by post in April, 2004.

Data analysis:

Self efficacy was compared between the 2 groups (PBL + and PBL -) during the 3 defined periods (at the end of undergraduate years, 2-year internship, and at present). The 5- point-scale response was further reduced into 2 main groups for subsequent analyses. Mainly, subjects who responded 1 or 2 were grouped as "achieved" and the others were grouped as 'not achieved'. The difference between PBL+ and PBL- were compared by the "n" values in terms of odds ratio. Statistical analysis was performed using JMP IN for Windows (Version 5.0.1a, SAS Institute Inc.).

RESULTS

A total of 121 posted mail were returned for reasons such as unknown address. A total of 541 subjects responded to the questionnaire (total response rate = 36.0%). The response rate excluding subjects with unknown address was

39.1%. Out of these subjects, PBL+ group (n = 239, response rate = 30.5%) and PBL- group (n = 211, response rate = 34.3%) were almost equivalent in number. The remaining 91 subjects included students who experienced the tutorial trial or whose graduation year could not be decided according to their responses. (Table 1) The PBL- was older than the PBL+ because their graduation years were earlier than that of PBL+. The age distribution was wide in both groups.

Table 2 shows the doctors' self-efficacy at the

Table 1 Characteristics of the subjects in the Study Groups

		PBL	
		+	-
		(N = 239)	(N = 210)
Graduation Year		1996 ~ 2003	1989 ~ 1994
Present Age	Median	29.8	37.5
	Range	47 ~ 25	53 ~ 33
	SD	2.6	2.6

PBL = problem-based learning.

Table 2 Proportions of subjects who achieved the expected ability "at the end of undergraduate years"

abilities expected to be achieved in PBL	PBL(+)	PBL(-)	OR	95% CI
Attitudes in learning				
self-studying	195 (81.6%)	125 (59.5%)	3.05	1.99, 4.67
collecting information	190 (79.5%)	86 (41.0%)	5.75	3.78, 8.75
multi-phasic thinking	175 (73.2 %)	106 (50.5%)	2.80	1.88, 4.15
logical thinking	154 (64.4%)	97 (46.2%)	2.15	1.47, 3.15
Problem-solving				
setting up and considering a hypothesis	172 (72.0%)	58 (27.6%)	6.87	4.54, 10.41
finding and solving patients' problems	176 (73.6%)	95 (45.2%)	3.41	2.30, 5.07
connecting a knowledge to each case	171 (71.5%)	96 (45.7%)	3.00	2.03, 4.45
Communications				
communication with doctors	148 (61.9%)	84 (40.0%)	2.46	1.68, 3.59
communication with nurses	79 (33.1 %)	44 (21.0%)	1.87	1.22, 2.87
Group discussion				
discussion with students	203 (84.9%)	83 (39.5%)	8.80	5.60, 13.85
cooperative attribution to group	203 (84.9%)	157 (74.8%)	1.94	1.21, 3.10
Knowledge				
Knowledge on subject matters	155 (64.9%)	135 (64.3%)	1.03	0.70, 1.51

PBL(+): subjects with problem-based learning experience; PBL(-): subjects without problem-based learning experience;

OR: odds ratio; CI: confidence interval

Table 3 Proportions of subjects who achieved the expected ability "at the end of 2-year internship" and "at present"

Abilities expected of doctors	the end of 2-year internship				at present			
	PBL(+)	PBL(-)	OR	CI	PBL(+)	PBL(-)	OR	CI
Clinical problem-solving								
finding the key to problem-solving for yourself	185(77.4%)	153(72.9%)	1.33	0.86, 2.06	199(83.3%)	197(93.8%)	0.32	0.12, 0.82
finding appropriate literature	178(74.5%)	158(64.0%)	0.99	0.64, 1.53	196(82.0%)	186(88.6%)	0.81	0.42, 1.58
checking the reliability of information	121(50.6%)	114(46.2%)	0.88	0.60, 1.27	175(73.2%)	186(88.6%)	0.37	0.20, 0.68
Writing medical record based on POS	192(80.3%)	156(63.2%)	1.46	0.92, 2.31	197(82.4%)	169(80.5%)	1.98	1.10, 3.57
Communication with patients								
communication at clinical interview	218(91.2%)	189(76.5%)	1.22	0.61, 2.44	212(88.7%)	201(95.7%)	0.21	0.02, 1.82
listening to patients well	219(91.6%)	188(76.1%)	1.38	0.69, 2.77	209(87.4%)	200(95.2%)	0.26	0.05, 1.25
explaining to patients of their diseases	186(77.8%)	161(65.2%)	1.11	0.70, 1.75	208(87.0%)	198(94.3%)	0.47	0.14, 1.54
answering to patients' questions clearly	181(75.7%)	152(61.5%)	1.21	0.79, 1.87	202(84.5%)	200(95.2%)	0.13	0.03, 0.60
Communication with doctors								
with colleagues	221(92.5%)	194(78.5%)	1.06	0.49, 2.31	216(90.4%)	197(93.8%)	5.48	0.63, 47.34
with doctors of different specialties	189(79.1%)	154(62.3%)	1.41	0.90, 2.21	207(86.6%)	195(92.9%)	0.74	0.28, 1.99
with doctors of different hospitals	163(68.2%)	125(50.6%)	1.49	1.00, 2.20	198(82.8%)	188(89.5%)	0.72	0.35, 1.50
Communication with co-medicals								
with nurses	201(84.1%)	180(72.9%)	0.89	0.51, 1.53	204(85.4%)	199(94.8%)	0.34	0.11, 1.08
with medical-engineers	189(79.1%)	176(71.3%)	0.72	0.44, 1.19	204(85.4%)	200(95.2%)	0.26	0.07, 0.92
Group discussion								
promoting the others' understanding	176(73.6%)	143(57.9%)	1.36	0.89, 2.06	201(84.1%)	191(91.0%)	0.66	0.29, 1.49
considering the others' thoughts and logics	186(77.8%)	132(53.4%)	2.19	1.43, 3.34	201(84.1%)	186(88.6%)	1.01	0.49, 2.11
giving your opinion	81(33.9%)	57(23.1%)	1.40	0.93, 2.11	138(57.7%)	133(63.3%)	0.89	0.60, 1.34
Others								
making full use of internet or e-mail for collection of information or communication	147(61.5%)	46(18.6%)	5.88	3.86, 8.96	178(74.5%)	178(84.8%)	0.59	0.34, 1.03

Note: PBL(+) = subjects with problem-based learning experience; PBL(-) = subjects without problem-based learning experience; OR = odds ratio; CI = confidence interval for the OR, POS = problem oriented system.

end of undergraduate years. Most items showed high odds ratios, which were statistically significant (OR = 1.03–8.80). All the items of problem-solving showed higher odds ratios (OR = 3.00–6.87). The abilities of group discussion showed the highest proportion of PBL+ doctors who achieved those abilities (84.9%).

Comparing with the result “at the end of undergraduate years”, less items showed higher odds ratio than 1.0 “at the end of the 2-year internship”. However, the ability in “communications with patients” and in “group discussion” have higher overall odds ratio (OR = 1.11–2.19). Only the item of “considering others’ thoughts and logics” was statistically significant but this superiority in the PBL+ doctors was overcome by PBL– doctors “at present”. These odds ratios were overall under 1.0 “at present” (OR = 0.13–1.01).

DISCUSSION

Our study demonstrated self efficacy of medical graduates under PBL curriculum. Our results showed that at the end of the undergraduate years, doctors with PBL tutorial experience have strong self-efficacy in some dimensions which were also some of the objectives of PBL. At the end of the medical school years, PBL graduates showed higher confidence in most of the items listed as attitude of learning, problem-solving, communication and group discussion, compared with non-PBL graduates. This confidence was based on the subjective impression or recall memory of the graduates, yet, the comparison between PBL+ and PBL– showed a clear difference in most of the items. Thus, the PBL had implemented the learners’ confidence even after graduation from the PBL curriculum.

Similar findings have also been found among immediate graduates of PBL curriculum¹³⁾, but our results showed a longer lasting self-efficacy after graduation. Many studies investigated the

outcomes of PBL and had diverse conclusions²⁾. It is not surprising to observe a diversity because the outcomes are usually not the sole consequences of education in a medical school and the study effects are often influenced by many confounding factors after graduation. Our results showed that the learners maintained confidence in their learning attitude and skills even after graduation.

The average post graduation year of the PBL+ is shorter than the PBL– and may have affected our results. The answers on self-efficacy given “at the end of 2-year internship” and “at present” showed less or no difference. The results may be interpreted as that the postgraduate experiences are different between PBL+ and PBL–. In addition, the questionnaires addressed the competencies of skills and attitude for medical practice, which may not have directly related to self-efficacy acquired by PBL, showed no difference between PBL+ and PBL–.

Self-efficacy related to communication varied. At graduation, the PBL+ group showed high self-efficacy in communication with doctors but not with nurses. They also showed high odds in discussion with students. Communication with colleagues showed high odds “at present” while communications with co-medicals and with patients were not. PBL may have cultivated an atmosphere to “get along with colleagues”. Since clinical doctors usually join the PBL tutorial classes as facilitators, this encounter may have given students good opportunities to build self-efficacy in communicating with other doctors in their early clinical career. On the other hand, nurses scarcely join in any of the PBL tutorials, resulting in fewer chances to talk with nurses during undergraduate years. Similarly, rather low odds in PBL+ in self-efficacy in communication with patients were observed at present. Interviewing skills are not a major objective of

PBL in our university. However, our recent PBL includes role plays of medical interview and bad news telling in order to understand the patient-doctor relationship and the importance of medical communication. These experiences may indirectly promote doctors' communication skills. With regard to the communication ability, some studies showed gender difference¹⁴⁾. Our study did not address gender difference because our medical school comprises of all female students. Other competencies asked were low at present in PBL+. Again, these competencies are achieved through variable clinical experiences. Therefore it is difficult to interpret data in direct relation to PBL.

Our study showed a difference in self-efficacy in terms of some skills and attitudes learned through PBL between graduates of PBL curriculum and non-PBL curriculum. PBL curriculum can increase confidence among students, especially among those who just graduated from medical school. From the students' perspective, building such confidence is valuable because the students, especially those in preclinical years, have a lot of uncertainties about their future. Although PBL may not be a magical tool to solve all problems in medical education, it certainly is an enjoyable tool for learning and building self-efficacy at the end of medical school. Further study on PBL providing other dimensions of educational outcome should be performed.

The response rate for our study was 36.0% (40% when excluding subjects with unknown addresses) and the rates were not different between the two groups. We consider the response rate acceptable for a study as ours. Unlike in-class survey, a retrospective study on graduates tends to be low¹⁵⁾. Response rate, as well as difference in age at answer, which was about 8 years in median between PBL+ and PBL- may have affected the results, in addition to possible bias caused from low response rate.

In conclusion, implementation of PBL tutorial provides medical students the opportunities to foster self-efficacy in clinical abilities especially in communication skills in their earlier clinical career.

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