Models of PBL in Japanese medical universities

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医科チュートリアル教育（PBL）のモデル

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English

Abstract

This research examines how the teaching methodology called Problem-based Learning (PBL) has evolved in various Japanese medical universities since its first introduction into the curriculum of a Japanese medical university twenty years ago. The author has visited several Japanese medical universities to observe PBL tutorials and collected both quantitative and qualitative data. Presented here is a summary of the PBL models observed, the unique features that each offers, and some criticisms that need to be addressed.

Key words: medical education, PBL, tutorial education, PBL models, Japan

Introduction

The introduction of Problem-based Learning (PBL) in Japan in 1990, now commonly referred to as tutorial learning, was initially spurred on to match the globalization of medical education that had been developing in foreign medical universities, in particular McMasters in Canada, Harvard and John A. Burns School of Medicine in the United States of America, and Maastricht in Europe, since the 1970's. Further impetus for implementation came from the subsequent 2001 revision of the Japanese government's Japan Model Core Curriculum[1)] for medical universities that recommended the adoption of a PBL model as desirable (but not compulsory). By 2004, Kozu[2)] reported approximately 80% of Japanese medical schools had adopted some model of PBL tutorials and by 2007 Oda[3)] reported it was 94%. However, the adoption and evolution of tutorial learning has followed a particularly Japanese path, best categorized as "galapagosization", that is, each university/area has developed its own unique way of

tutorial learning with scant regard to what has been occurring in other universities/areas. This has resulted in the development of various models of tutorial learning, not all of which have benefited from following what could be regarded as "best practice" in other universities. What has brought this situation more closely into focus is the current establishment in medical education of the Global Minimum Essential Requirements (GMER) developed by the Core Committee of the Institute for International Medical Education (IIME)[4]. This committee has developed a set of minimum common learning outcomes that would enable a high standard of medical competencies for all medical school graduates to produce "global physicians". Although the World Federation of Medical Education (WFME)[5] has set itself the adoption goal of 2020, Japanese medical universities are aiming for 2023 for an entirely new round of globalization to meet these standards. The evaluation criteria set by WFME include many items closely related to the process of medical education, including PBL, set standard requirements for all participating medical universities to follow.

Problem-based Learning (PBL) was first developed in Canada at McMasters University in response to mounting criticism that traditional medical education, i.e. teacher-centered, lecture-based, rote-learning, exam-centered education, was failing to prepare doctors for the rigors of actual medical practice. Their innovation was a new instructional model, PBL, that would strive to develop students' critical thinking abilities and team-building skills as they acquired needed content knowledge. Rather than large-sized lectures, it would be a small group tutorial approach that was student-centered and requiring students to engage in collaboration and self-directed learning to take on greater responsibility for their own progress. Working through crafted problems that would reflect examples from real life, PBL would present an ever-changing variety of contexts, contents, and unknowns to challenge each student to develop the knowledge and skills need for their future careers. Of course, this is quite apart from the usual educational experiences of Japanese medical students who enter university directly from high schools and *jukus* (cram schools) where teachers direct students to learn specific content (e.g. from exam preparation books) which is subsequently tested in examinations, as illustrated by Figure 1.

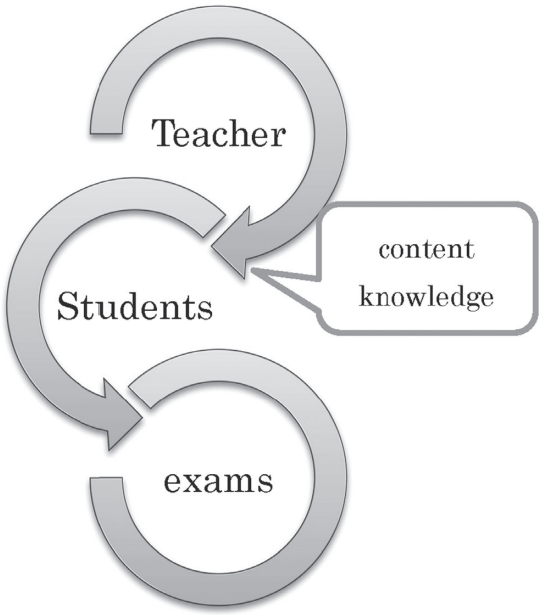


Figure 1. Traditional education model

Indeed, O'Dowd[6] reported that both students and teachers have commented that the narrow concentration on test preparation guides rather than textbooks has left students without the basic foundation knowledge that their professors in the hospital expect them (5th and 6th year medical students) to have acquired by that stage of their education. In order to present how different PBL is in nature, the following table details the various characteristics of PBL verses the more traditional model of didactic teaching.

Table 1. Comparison of Traditional teaching vs. PBL (tutorial education)

Traditional	PBL
Large class (60-120)	Small group (7-10)
Teacher-centered	Learner-centered
Teacher directed	Tutor / facilitator assisted
Passive attention	Active participation
Information spoon-fed by teacher	Self-directed learning
Information transfer from textbook	A problem needs unpacking
Receiving content	Exploring
Rote learning	Critical thinking
Memorization	Skills & knowledge acquisition
Solo, teacher-directed study	Collaborative learning
Silence	Discussion of Learning Issues
Narrow focus on examinations	Wide scope of learning

As can be seen by the disparity of these characteristics, a tutorial learning environment is far outside the usual experience that students have been accustomed to in the normal Japanese educational system, also described by O'Dowd[7,8]. As a result, many of the problems arising after the implementation of PBL tutorial programs in Japanese universities have stemmed from students' unfamiliarity with such a methodology. This is not to suggest that Japanese students are incapable of performing well in tutorial education, but rather that the majority of students need careful, explicit preparation at the very beginning of the process as well as continual guidance by trained facilitators to achieve the successes promised by this educational approach. Indeed, the implementation of this new mode of knowledge delivery requires students to become more self-reliant in defining learning objectives by themselves and to learn how to work and collaborate as an equal member of a team.

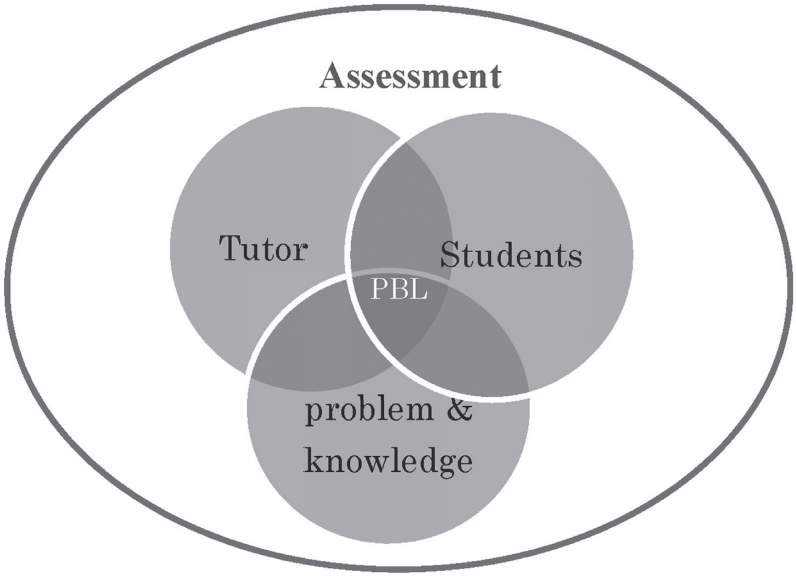


Figure 2. PBL overview

Figure 2 illustrates how PBL brings together students, their tutor and the problem that will lead them to acquire new knowledge as how overall assessment of students, tutors and group presentations in PBL necessitates interactive student participation throughout the duration of each tutorial. The next section will give an overview of the processes of PBL that are common to most models.

PBL process

PBL has an established framework and its implementation is easily recognizable, although O'Dowd[9] describes how some tinkering has occurred as it has evolved both in different counties and at the local level in Japan. Here is a basic outline of the stages of PBL common in virtually all models:

* Each class is divided into small tutorial groups of approximately 5-10 students each.
* Each tutorial group has a tutor/facilitator who oversees their discussions and interactions and guides the students through each phase of the paper-patient problem being studied.
* In each tutorial, students must in turn each play a role, e.g. discussion leader, scribe, resource person, time-keeper, etc., to develop team skills as well as to move the tutorial forward in a structured manner.
* Students are presented with a series of tailored problems, based on course materials and goals, to engage the students' interest and stimulate learning of the target subject matter.
* Students pool their current knowledge of the topic and list it as "What do we know?"
* Discussion and analysis then enables them to construct a problem statement/hypothesis. This is a starting point and may be revised as assumptions are questioned and new information is added.
* The group then identifies the "Learning Issues" (LI) to clarify the essence that each new problem presents under the heading, "What do we need to know?" (NTK). Here, students develop questions that must be answered to address missing knowledge or to illuminate the problem.
* Under a third heading, "What should we do", each student resolves to independently investigate a LI to resolve these questions and then records matters such as what specific actions must be performed by the next tutorial. Students then gather information from all available sources, such as the school's library, Internet, and from experts on the subject.
* In the following tutorial, students share their findings and new information and analyze it within the group for its application to the problem statement and usefulness in refining their initial working hypotheses. This process continues until the target topics have been covered.
* Each member of the group then presents their accumulated work and members discuss its application to the problem.
* In the final stage, students reflect on the process they have carried out and on the content knowledge they have now studied through the module's problem.

  As can be seen by the various stages of this process, modeled in Figure 3, such a learning environment requires active participation, critical thinking skills, voicing ideas and opinions, time management and collaborative skills that some Japanese medical students find difficult to engage in. Nevertheless, the adoption of PBL has become de rigueur in modern medical curriculums, thus making it an essential part of medical education both abroad and in Japan. It is the unfamiliar

processes of PBL tutorials (described in O'Dowd[10]) that are initially somewhat befuddling to both students and their facilitators.

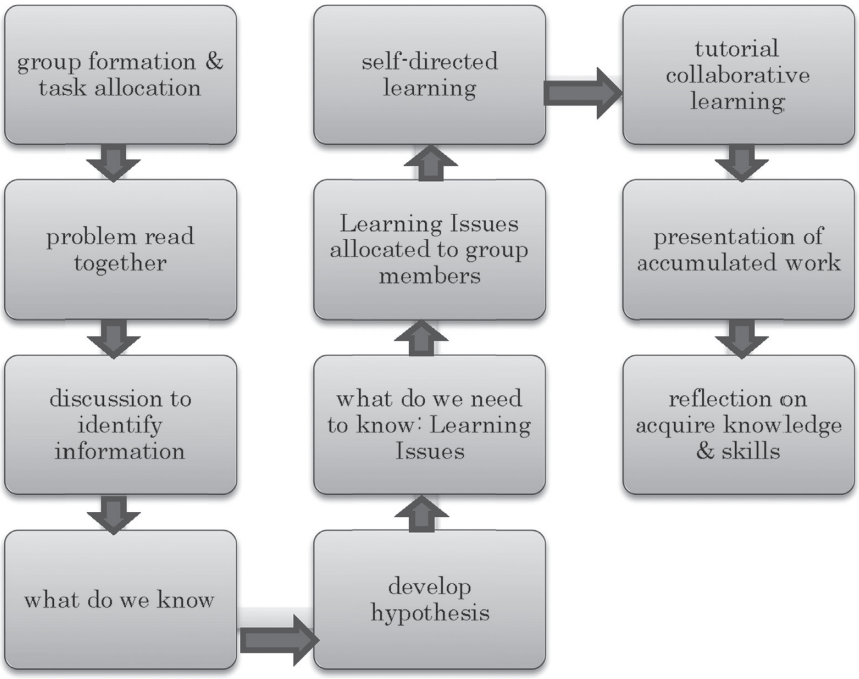


Figure 3. PBL process

Even so, most students engaging in this model quickly understand the basics and, if proficiently guided by their tutor, can perform at an adequate level. In the following section, various adaptations of this generic model will be described.

Models of PBL

Currently, three main models of PBL can be identified in medical universities around the world. First, a pure PBL model that uses PBL tutorial formats exclusively, as found in Maastricht University in Holland. Second, a hybrid PBL model that developed from Harvard Medical that retains a lecture component to support problem-solving tutorials. The third is a modified PBL model that includes lectures and tutorials as well as a research skill development component introduced in the students' free period of learning, exemplified in the Middle East by Husain[11]. The adoption of PBL in Japan, starting in 1990 at Tokyo Women's Medical University, can be characterized as a nuanced approach to instituting educational change via a new educational model. Numerous difficulties arose during the early adoption of a PBL methodology that drew heavily from American models, such as those outlined later in this paper. And although this novel approach weighed heavily on all stakeholders, persistence has resulted in the evolution of a tutorial education methodology with a Japanese face. Now, the prevailing model of PBL in

Japanese medical universities is a hybrid; elements of a conventional PBL tutorial system overlaid on the more traditional didactic approach so it works in tandem, with tutorials usually in a minor supporting role rather than as the main mode of education. In some cases, the result is that students may only being able to complete a minimal number of problem cases being studied in each unit (sometimes only one) with the bulk of assessment remaining embedded in the final formal examinations at the end of each unit or semester. Japanese medical institutions have individually developed their tutorial programs to suit their immediate needs that include a number of institutional factors that impact on the quantity and quality of the education provided. In the following section, various Japanese PBL models will be described.

Hybrid models in Japan

The author has visited several Japanese medical universities to observe PBL tutorials and collected both quantitative and qualitative data, i.e. PBL samples and documents, surveys of students and tutors, and interviews. Presented here is a summary of the hybrid models observed and the unique features that each offers (Table 2); the names of the universities will not be used to identify them, rather, each model will be labeled with a letter of the alphabet so that the distinctions between the models may be focused on. A brief description of the distinctive features of each will follow.

Table 2. Models of PBL in Japanese medical universities

Model	PBL model	Students	Students per group	Tutors	Hours per tutorial	Tutorials per week	Tutorials per semester	% of final exam	Assessment
A	hybrid	3rd year	7-10	Doctors: clinical & basic science	3	3	3rd = 9 4th = 15	N.A.#	tutor assessment peer assessment self-evaluation paper test
B	hybrid	1st year 2nd year 3rd year	6-8	Doctors: clinical & basic science	1.75	2	24-28	N.A.#	tutor assessment† portfolio presentation
C	hybrid	3rd year 4th year	7-8	Doctors	3	2	29	0%*	tutor assessment
D	hybrid	4th year	8	Doctors & 6th years	3	3	15	15%	presentation paper test
E	hybrid	3rd year 4th year	8-9	Doctors & 5th years	1	2	3rd =11+8 4th =11+12	N.A.#	tutor assessment presentation

(# PBL assessment is independent of final examinations;
* 100% attendance and good tutor assessment is required to take the final examination)

Model A

In this unique hybrid model, audio-video technology plays a large part in facilitating student-doctor communication. Each tutorial room has a two-way video monitoring system linked to a central control room where a panel of doctors responsible for the problem design and the unit observe and monitor all groups. After each group is formed, students must begin the process by themselves as a single tutor is assigned to oversee three tutorial groups, that is, the tutor visits each group in turn throughout the assigned time. All groups are observed via the video link and their progress monitored. When the students reach the stage of forming hypothesis and developing Learning Issues, the students create a poster of their work that is then brought by each tutor to the central control room where the panel of doctors reviews each of them and makes suggestions and comments which are then returned to the students to make necessary changes; this allows all the groups to know that they are keeping pace with each other. Towards the end of the tutorial time, each group is allowed to send their questions regarding the problem to the panel in the control room and these questions are addressed to all the students via the two-way video link so each group can now participate with the panel.

Model B

In this hybrid model, considerable focus is placed on the students' skills development in learning to be able to communicate better, express their own views, and to work progressively as team members. The students' orientation for PBL starts in their first week on campus with a full day of presentations by coordinators, tutors and video examples, followed by a full dress rehearsal and discussion. Each student is required to contribute to all discussions in turn; no passive attention is allowed. An interesting feature is the initial inclusion of ice-breaking exercises to activate the students and focus their attention on the communication process. Another feature was the period of reflection at the end of each tutorial where students evaluated their own contribution to the group and what they have learned through the tutorial processes. This vital preparation in the first semester enables students to undertake more ambitious problems and skills development well into their third year of medical studies.

Although the tutorial period is listed as 105 minutes, it is important to note that prior to the formal tutorial, students meet in their tutorial groups and engage in 30 minutes of preparation so that the tutorial begins with a flying start. And after the tutorial ends, the students continue to engage for almost another hour to concentrate on their Learning Issues (LI).

Model C

This hybrid model is based on the PBL models practiced in Hawaii (John A. Burns School of Medicine) and Canada (McMaster). Integrated into their Phase III program for 3rd and 4th year students, the tutorial

groups meet for three hours with their tutor twice each week. Their PBL process is divided into three stages. In the first stage, students read the problem together, identify the important information that needs unpacking, and develop a list of Learning Issues (LI) for further investigation that is then allocated to individual members. In the second stage, students engage in independent study and research their assigned LI, preparing summaries to be distributed to classmates in the following tutorial. In the third stage, each student presents to their group what they have learned about their LI and then discusses the relevance to the problem. Students then apply their new knowledge to the problem and discuss options and outcomes. Between these tutorials, clinical medicine lectures are given as in a traditional curriculum, but may not always be related or relevant to the problem being studied at that time. Nevertheless, it is incumbent on the students to do their own study to broaden their knowledge base regarding the problem.

Model D

This hybrid model is very similar to Model C in process and structure. However, in this model, 6th year students are utilized as tutors in conjunction with clinical doctors as tutors. The idea of utilizing senior students as tutors has been trailed at several universities in Japan, but not always continued. The initial concept was developed to reduce the dependence solely on clinical doctors as tutors as it was considerably adding to their workload. In this model, 6th year student were asked to volunteer to become tutors, and as long as they had a good academic record they were given tutor training. These senior student-tutors have been on the whole well received and indeed show energetic enthusiasm in tutorials. Students have reported finding the student-tutors easier to talk with and to ask questions of and the atmosphere of the tutorial is less tense.

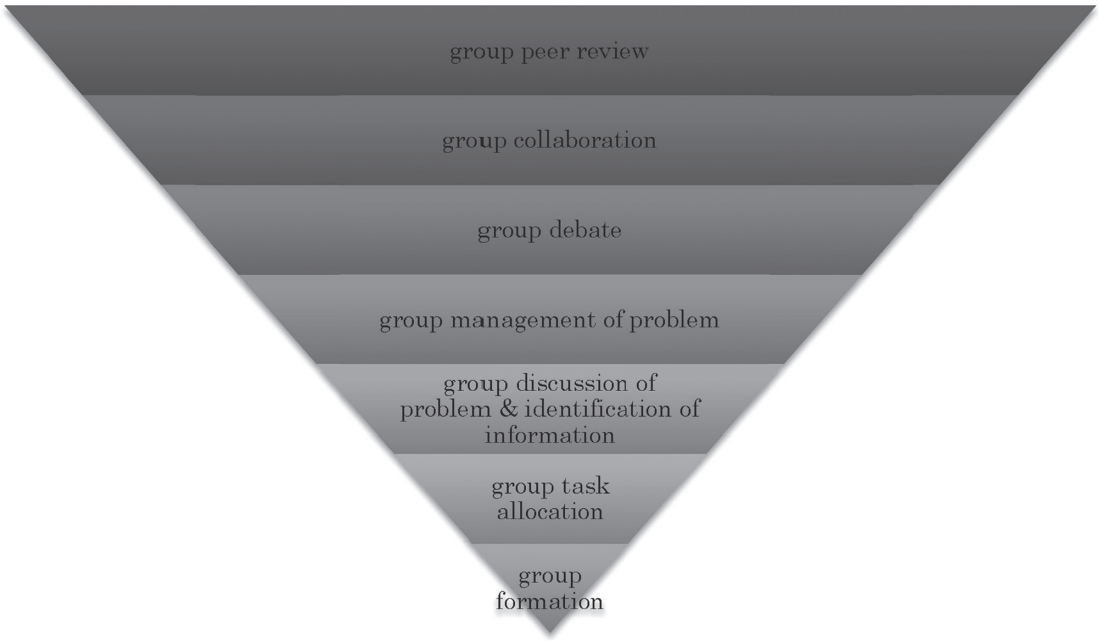
Model E

This hybrid model, again similar in process and structure to Models C and D, utilizes both technologies to support the tutors and students as well as student-tutors to reduce the burden on clinical doctors. Similar to Model A, an audio-video system links each tutorial room to a central control room where three workstations are monitor by clinical doctors. This system also records all tutorials for later review. In this model, 5th year students are utilized as student-tutors; all 5th year students are required to participate in two tutorials. In addition, the formal tutorial meetings are only one hour long; the set time slot is 8:30 – 9:30 a.m. on Monday-Thursdays for 3rd years and Tuesday-Fridays for 4th years. Time is also provided after tutorials for students to collaborate together on their Learning Issues and final presentations. Individual group presentations (3-5 minutes each) are given in a joint class after the tutorial set is complete. Assessment is formative, including tutor assessment and presentation assessment.

Group skills development

One of the basic requirements of these models is that students should actively participate in developing group communication and teamwork skills. Indeed, many students report this is one of the most difficult aspects of PBL tutorials. Identifying these needed skills is the first step towards achieving them; Figure 4 models the type of group skills that need to be practiced and acquired through participation in tutorials.

Figure 4. Group skills development model



Usually, academic staff determines the formation of groups for PBL tutorials at the beginning of each semester. Students must then learn how to cope with random groups that can sometimes be dysfunctional from the beginning due to personality clashes or cultural factors. To complete the required tasks, moving up through the inverted pyramid, students will have to find ways to communicate and cooperate. Skills acquired in one semester are carried forward and built upon in following semesters and beyond graduation. PBL provides the best process model for learning those skills that medical students will most likely experience in the future in real-world medical practice.

Special aspects

Apart from the above-described features of these PBL models, the author has noted the following additional special aspects and innovations to some programs that may be beneficial for inclusion in other program models either to enhance their effectiveness or to further appeal to students and increase their motivation.

Technology

Various technologies are being employed to support the PBL learning environment in two of the above models. One of the common technologies used is a video monitoring system for all tutorial rooms/groups. This allows unit supervisors to view how all groups are handling the problem under study and to give advice or assistance when required. Recording of individual tutorials provides data for later review and study and can assist with both student and tutor training.

Inter-professional workshops (IPW)

One of the distinctive tutorial programs the author observed at the Kobe University Faculty of Medicine was the Inter-professional workshop that combined students from the medical, nursing and pharmacological departments. This type of project was first instituted by Tokyo Women's Medical University and its value recognized in its subsequent support by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) as a Support Program for Distinctive University Education. Inter-professional workshops are PBL tutorials where students from different disciplines come together to discuss and learn how each can contribute to solving a common problem. It teaches cross-discipline communication, teamwork skills and broadens the students understanding of how each discipline supports the other and how pieces of a larger medical puzzle fit together. Indeed, it is rare for undergraduate students to work and study with students outside their discipline, making this opportunity both novel and advantageous.

International exchanges

An important educational dimension can be added through exchange programs between universities, and this is particularly useful when it comes to tutorial education. Students meeting students from other campuses in other countries can share different experiences and add fresh aspects to their otherwise normal tutorials. For example, Saga Medical University has an exchange with students from Hawaii and Taiwan visiting the Saga campus to participate in tutorials where Japanese students benefit by learning more about how the visiting students approach problem solving and discussions. In particular, Japanese students are able to observe how foreign medical students approach tutorial learning and engage in discussions that lead to collaborative learning as well as practicing critical thinking and teamwork skills. In other exchanges, Japanese medical students visit overseas medical campuses, such as in Hawaii, to engage in PBL tutorials and learn from foreign students in a different cultural environment.

Criticisms of PBL in Japan

Of course, every educational innovation is subject to criticism and PBL is no different. Various stakeholders in each institution this innovation has been introduced into have raised criticisms of this methodology,

and while some criticisms are relevant, others are merely a reaction to or struggle against change. Here the author will address a few of the major criticisms.

Both students and tutors have argued that students do not fully understand what is required of them in tutorials in regards to process, assessment, and the knowledge (and skills) they need to acquire. This dilemma observed by the author led to an examination of how students were prepared to engage in tutorial learning and the need for better orientation before tutorials start. Typically, orientation at the beginning of the academic year includes a one hour or more introduction to tutorials; in those universities where PBL has made the most progress, the orientation has been expanded to several segments each addressing one of the major elements of tutorial learning, i.e. tutorial process, student learning, role of tutor, and skills development. Included in the orientation is usually a video showing what a successful tutorial looks like so students can see what is supposed to happen in each tutorial.

Tutorials have also been criticized for slowing down the students' acquisition of knowledge. Some teachers, and students, argue that a conventional lecture-based program covers more material than a problem-driven approach. Although some research also suggests this outcome, it is quite superficial and ignores the neglected factor of the depth of learning and the interconnectedness of needed knowledge. Conventional lecture-based programs are well known for the typical 90 minute lecture, usually a reading of the textbook by the teacher to the class, while students are passive and often not engaged, followed by exam tips that students cram for in order to pass the final exam with shallow learning and little real retention of knowledge. Tutorials, on the other hand, are adept at anchoring knowledge to problem examples and tutorial experiences, resulting in better overall retention.

In a similar vein, the hybrid model of tutorials overlaying lectures can be criticized as it reduces the importance of tutorials to that of a bit player while the main emphasis remains on the lecture programs. This is often reinforced by the heavy weighting given to final exams that remain based on the materials covered in lectures. Students have consistently reported their interest in covering materials that will be asked for in final exams, and if tutorial work is outside this area, it tends to be de-emphasized by students as peripheral to their focus.

Indeed, as is shown in Table 2, the various assessment policies concerning PBL indicate that it has not yet won the confidence of program administrators, who may not yet believe it can play a major part in determining students' success in knowledge and skills acquisition. There appears to be a considerable reluctance on the part of program administrators to discard traditional 100% examination-based assessment as an indicator of learning, or even to assign PBL a significant percentage of assessment as being too subjective, thus relegating PBL to token status. Facilitators that have been interviewed by the author have also made comments such as, "Tutorials (PBL) are interesting but the students don't seem to put a lot of effort into it, so it is difficult to assess them (on what they do)." If tutors don't seriously evaluate

students' efforts in tutorials, it becomes merely a child-minding exercise as students don't feel the need to make real efforts to be successful in the tutorial process. Assessment is an issue that is in urgent need of reform.

Tutors in Japan, and elsewhere, have criticized PBL as unsuitable as it requires a different mind-set from both students and tutors. Students used to passive engagement in classes have reported finding PBL tutorials "intimidating" because of the emphasis on participation and engagement in discussions of problems and active learning. In the past, many doctors who tutored PBL were not in favor of the implementation as it was different from the way they themselves had learned how to become doctors and therefore they distrusted the method as too soft. This belief, combined with a lack of understanding on the pro-active role of the tutor in tutorials, resulted in disengagement on a large scale, leaving students without the active support and guidance of tutors, resulting in lowered student motivation.

Difficulty in communication between students as well as with the tutor has been a major criticism of PBL. Cultural factors have been attributed to this problem, not only in Japan but in other cultural settings as well. The question has been proposed; is PBL suitable in all cultural settings? In response, academics from various countries have addressed this question, e.g. Frambach[12] and Al-Eraky[13], and describe how minor adjustments can be made to the PBL process to accommodate cultural differences without sacrificing the core values of the process itself, such as introducing a module to support self-directed learning.

The formation of groups for PBL tutorials is another problem area frequently cited by students. In some models, academic staff determines the tutorial groupings randomly and these groupings stay together for one semester. Students have complained that tutorial work is made all the more difficult when placed in a group that has a "bad" mix, that is, students who do not get along with one another; nevertheless this situation can reflect future work situations and enables students to discover conflict resolution skills as well.

Budgetary constraints have often been cited as a reason preventing Japanese universities from hiring extra tutors from outside their institutions, as opposed to the situation in overseas universities where hired tutors are the norm. Japanese universities are therefore restricted to use the staff resources already available, a mix of clinical, research or educational doctors. This practice has been criticized for the extra academic burden placed on Japanese doctors in addition to their clinical and research duties. In some universities, this has resulted in the development of a system utilizing senior medical students (usually 5th or 6th year medical students) to reduce the pressure on the working schedules of staff. The subsequent introduction of senior students as tutors, also unpaid, to relieve doctors of some of the burden was found by Oda[14] to have had a generally positive impact on tutorial learning. On the other hand, some students reported feeling shortchanged, believing that clinical doctors have more knowledge and insights into real-

world medical practice to offer their tutorial discussion than senior student who are only a year or two older than those they are tutoring. Of course, one solution to this issue is to have adequate tutor training for the supporting senior student tutors.

Each institution collects a large volume of data from each tutorial, i.e. student feedback, tutor feedback and evaluations, but the author has found it very difficult to be able to access any of it, with staff usually citing privacy concerns. However, much of this raw data remains unprocessed, although it is carefully filed away. If the data is important enough to collect and file then it is incumbent on each institution to distill the findings of the data and put it to good use. The author believes that reports should be regularly provided to coordinators at regular intervals throughout the year so that the success of the PBL programs can be gauged and changes adopted whenever necessary.

The future

PBL has evolved over the past 45 years since its inception and has proven its usefulness in achieving its goals. Even so, new models of small group learning that facilitate and enable better learning have developed and been incorporated alongside PBL; in particular, Case-based Learning (CBL) and Team-based Learning (TBL). These methodologies have added utility to medical students acquisition of both knowledge and skills and so are now common features of many overseas medical curriculum and in Japan as well. As future medical curricula move towards the inclusion of these methodologies as foundation programs, it will be necessary for Japanese universities to keep pace with their development and adopt and adapt these to ensure Japanese medical students are not left behind the rest of the world.

Conclusion

In this paper, a variety of Japanese PBL models have been presented. Medical universities with tutorial programs have continued to develop and strengthen while those who have lagged behind are now finding themselves with little choice but to bend to the winds of change and try to catch up. Indeed, it has become widely accepted that the change from passive didactic to active learning brought on by the increasingly rapid paradigm changes in modern medicine cannot be avoided to develop the multiple skills medical students will need after graduation. It is therefore incumbent upon Japanese medical universities that their curricula provide medical students with efficient pedagogical strategies, like PBL, to impart required knowledge and skills and optimize student development. In addition, medical universities should strive to be more transparent in the development of their model of PBL and engage in greater cooperation so the rising tide raises all boats.

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