Abstract: This article describes how a multidisciplinary problem-based learning (PBL) curriculum was established at the School of Stomatology at Wuhan University (WHUSS) in China for preclinical education in a seven-year dental school program. Based on positive feedback from a modified PBL program implemented in one discipline, a multidisciplinary PBL curriculum was established. PBL training for facilitators and students, development of resource materials, curriculum design, and case writing were done in a manner that is consistent with the characteristics and learning style preferences of Chinese dental students. About 80 percent of the lectures were kept in the new PBL program. The multidisciplinary PBL curriculum has been successful in helping dental students mentally construct an understanding of the interrelationship between dental knowledge and basic science concepts. The experience at WHUSS indicates that there are clear benefits for students in the PBL format. A benefit to faculty is that PBL tutorial facilitators were partly liberated from their traditional roles and developed additional skills for facilitating. However, conflict arises when PBL-trained students encounter the traditional exam-centered education system.

In 1994, the World Health Organization (WHO) recommended that dental education should be problem-based, socially and culturally relevant, and community-oriented. These recommendations, among many other factors such as changed patterns in oral health and application of molecular and genetic research in dentistry, prompted a significant curriculum re-evaluation in dental education in many nations of the world. In response, many dental schools around the world set about constructing new curricula that were more responsive to student learning and more sensitive to evaluation mechanisms. These new curricula have employed a more contemporary student-centered approach, utilizing flexible methods of teaching and learning that enable development of dental clinical skills enhanced by self-assessment and criterion-referencing. Teamwork and competency-based systems also characterize these curricula.

Problem-based learning (PBL) is a curriculum method that has frequently been advocated as a way to provide a better learning environment for health professions students and as a way to achieve the WHO recommendations. PBL originated in medical education at McMaster University in Canada in the 1960s. Since that time, many versions of PBL have arisen worldwide in a variety of fields and at different levels of education. Now, the role and advantages of PBL as an innovative approach in health professions education have been well documented; these include the structuring of knowledge for use in clinical contexts, the development of an effective reasoning process, the development of effective self-directed learning skills, and stimulating students’ motivation for learning. There has been an emerging trend of incorporating PBL into all aspects of the dental curriculum in many nations.

The School of Stomatology at Wuhan University (WHUSS) was founded in 1960 and became affiliated with a key university, directly under the administration of the Education Ministry of the People’s Republic of...
China. During the forty-five years since the founding of the school, the academic programs within the institution have undergone a series of changes, focusing on producing leaders in both clinical dentistry and biomedical research. All dental students are trained in the Medical School at Wuhan University for three years before they come to the dental school. This means that the students who enter dental education are the fourth- or fifth-year students.

Over the past four years, the undergraduate curriculum for the D.D.S. degree at WHUSS has evolved from an undergraduate curriculum based upon didactic teaching and clinical and laboratory sessions to the undergraduate and graduate curriculum for an M.D.S. degree that now emphasizes the ability to solve problems in the clinical environment. Simultaneously, the program length for dental school was changed from a five-year to the current seven-year track. A modified PBL in just one single discipline, pedodontics, has been ongoing in the undergraduate curriculum since 2000. Positive feedback about the modified PBL was voiced by some of the five-year program students and teachers, which included the ability of students to more effectively communicate ideas in a group setting, the enhancement of a practical approach in solving dental treatment-related problems, the development of critical thinking and problem-solving skills, and improved enthusiasm for learning. As a result of this positive feedback, a multidisciplinary PBL curriculum at WHUSS was established for the clinical education of the seven-year program students.

Preparation for the Multidisciplinary PBL Project

This section describes several factors that influenced the design of the new PBL curriculum at WHUSS, with an emphasis on the characteristics of Chinese students under the traditional education system.

Traditional Chinese culture is unique in the world. Confucian culture is deeply rooted in the minds of people, who strictly adhere to the doctrine of the golden mean. “Courtesy, Loyalty, Benevolence, and Credit” are often required during the communication between people. The students in China have independent personalities and are traditionally hesitant to communicate with others voluntarily. Students ask few questions in class and offer objections even less. They worship their teachers or parents as gods and treat their textbooks with the same reverence. They usually accept their fate passively.

The Chinese education system is also very different from that of other countries. Almost all the students in the dental school have graduated from high schools that use very traditional teacher-centered instructional methods. As a consequence, entering dental students are used to gaining information from didactic lectures. Numerical scores from the highly competitive entrance examination, especially in scientific subjects, represent practically the sole yardstick for admission into professional health institutes, although many dental and medical educators in China now think that it is inappropriate to select medical or dental students who will become physicians or dentists in the future based only on their examination scores while neglecting their people skills and career interests.

Once accepted, dental students enter a three-year training program in the medical school. Therefore, the academic background of dental students is almost the same as medical students. The dental school curriculum is initiated in the fourth year, except for a brief introduction to dentistry that is provided to students in the third year. Students have only one year to learn dental knowledge and complete their preclinical training because they spend the entire fifth year in the clinic. Because of this short fourth-year training period prior to entering the clinic, students usually feel a large amount of stress when they begin treating patients.

Children born singly into a family have been coddled since childhood because of the control that the Chinese family exerts on its offspring. As a result, many educators in China believe that our dental students have poor abilities to live independently, to think independently, and to study independently. They lack the propensity and skill of self-directed study and may be less mature in dealing with people or may even have become spoiled in the historically passive academic culture. The traditional examination-driven teaching system of the past has encouraged them to focus on the retention of factual knowledge without concern for the process of reasoning out situations.

The Chinese education system mostly inherited the Soviet education system, and consequently, there is a big conflict between that system and the contemporary Western system. Therefore, introducing comprehensive PBL will be a big challenge for the Chinese education system.
Preparation of Facilitators and Students for PBL

Changing the concept of teaching and learning to support the facilitator’s role in PBL has been a big challenge at our dental school. Although all faculty who were assigned as facilitators were experienced in leading clinical conferences, most of them did not have any experience as PBL facilitators. Thus, their preparation focused on developing the proper behaviors of a facilitator within student-centered group discussions, such as encouraging students to comment on scenarios, sharpening their awareness of interests and skills, and using insight and problem-solving to reach goals and avoid blocks. Central to the facilitator’s role was the ability of the faculty member to break away from teacher-dominated discussions to those that are truly student-centered. If commitment to PBL is to be maintained, every facilitator must appreciate its advantages, such as the encouragement of greater student participation and responsibility and the development of group ownership and leadership skills.

Every year, three or four young faculty members whose teaching experiences ranged from teaching large classes to small groups in clinical settings are assigned as facilitators in PBL. One of the current faculty at WHUSS received training as a PBL facilitator at universities with established PBL programs. The new faculty members being introduced to PBL take part in a tutor training workshop, which is led by the two faculty members who were trained for half a year in Canada and the United States to learn comprehensive PBL.

In preparation for the workshop, a PBL manual incorporating ideas from established PBL programs was used. The trainer used questioning while taking participants through the PBL steps. Participants then worked in small groups to formulate the two parts of a problem situation (main problem statement and additional data). Each of the developed problem situations was examined by the large group for appropriateness and completeness, with the guidance of the trained PBL facilitator. After an additional two-hour session with the new PBL facilitators, all aspects of PBL such as facilitator role behaviors and problem situations were practiced in a small group. The goal was that all new facilitators should master three concepts: first, learn about PBL; second, develop an understanding of the facilitator’s role; and third, acquire facilitator skills.

Further PBL training is ongoing. Three experts from McMaster Medical University of Canada, Zhongshan Medical University of Taiwan, and Otago Medical University of New Zealand, for example, provided lectures on PBL concepts in the early part of 2005. All the facilitators are asked to attend a periodic training project during the year. They are assigned a temporary full-time teacher to cover their responsibilities during the training. Other faculty members are encouraged to audit some training workshops or PBL courses, so that they can develop an understanding of PBL concepts and also write some PBL cases for teaching.

Students received a three-hour program that introduced them to PBL basic concepts before they started the PBL curriculum. A one-hour discussion followed the lecture. A demonstration was given by the trained facilitator and several upperclassmen who have had experience in the modified PBL curriculum. As students have to be proficient at accessing informational resources to gather relevant, credible information to solve PBL problems, they were also given a special orientation to the library. At this time, it was hoped that the curriculum change would allow students to explore their academic interests more freely and would encourage the pursuit of basic and patient-oriented research during the preclinical and clinical years.

Resource Preparation

Three laptops were bought for the facilitators of PBL, who used the laptops to prepare the cases and search for information using the Internet. Three electric whiteboards were prepared for PBL groups. Students could write out what they were thinking or diagram their strategies for how to deduce the learning issues and print it out after the discussion.

Library resources are critical to PBL. The educational resources and facilitator’s effectiveness are limited without sufficient books in library. Therefore, a large number of new textbooks and references were bought recently. Wide-band communication was built up for students, so they are able to utilize the resources of the Internet more freely. The library hours were also extended, so that students are now able to research information needed to analyze cases on the weekends.
Design of the PBL Project at WHUSS

As previously described, all WHUSS students are enrolled in the medical school curricula during the first three years of education for both five-year program students and seven-year program students. The difference is that the students enrolled in the seven-year master’s program have two additional years of study. In the preclinical period, a multidisciplinary PBL curriculum was created just for the seven-year program students. Teaching modalities used in large classes, which were bilingual lectures, were mainly didactic, while PBL was student-centered. The total lecture hours for the seven-year programs were reduced from 416 to 366 hours. About 20 percent of the lecture schedule was converted to the PBL curriculum.

PBL was planned for groups of nine or ten, to address content areas, group process, and conflict resolution. In addition, students explore elements of professional practice such as ethical decision making, legal implications, collaborative practice, and the role of professional organizations. Three teachers were responsible for course design and implementation. The PBL evaluation tools developed by Woods were adopted. This includes the knowledge base, reasoning process, communication skill, assessment skill, and professionalism. These tools evaluated students’ competency in problem-based learning, students’ performance as a group member, and students’ task and role performance as related to group morale. The last ten minutes of each class are set aside for reflection and evaluation of group performance.

Case Preparation

PBL strategy is centered on a case, a facilitator, and a group. An effective case is essential for implementation and acceptance of PBL. It provides a focus for learning, whether it is used in a single course or used as the principal educational method in an entire course or curriculum. It is a framework for a discussion that allows students to recall what they already know, to quickly identify the limit of their knowledge, and to formulate a question to clarify a concept. A well-constructed case should function as a surrogate teacher. Therefore, case preparation is a very important step.

None of the facilitators at WHUSS have had any experience in writing PBL cases, so we have translated and changed one or two cases taken from established PBL programs and tried to imitate the concepts of these cases to write new ones. The purpose is to write cases as a focus for multidisciplinary learning, which is designed to foster mastery and understanding of particular skills, behaviors, and values that are identified as goals and objectives of the curriculum. The cases should match the logistic realities of the courses or curricula in all the disciplines. The case should not go beyond the content considerations of education outlined for undergraduate teaching.

The three facilitators wrote five cases for the PBL curriculum in each semester for the fourth-year students; thus, ten cases are currently ready for use. All the cases are deliberated and discussed by the faculty who attended the PBL tutor training workshop or other training in PBL. Of course, these cases will likely be changed after the PBL sessions, depending on feedback from the students and the facilitators.

Discussion

PBL at WHUSS is in an exploratory phase. Although a modified PBL in a single discipline has been in existence for years, we are still gaining experience with PBL in a multidisciplinary setting. The knowledge gained in the fourth year is quite important for all the students. No remediation is allowed by the students or their parents or the school. This places a heavy burden on all of our facilitators and students. To take into consideration the probable side effects of educational innovation, 80 percent of the existing lectures were retained to limit the influence of the new curriculum. Although the new curriculum was well received according to feedback from the students, there were conflicts between the traditional education system and PBL. For example, the traditional exam-centered education system restricted the application of PBL. The students complained they did not have enough time to prepare for the PBL curriculum during the period of the final exams. Students also wanted an evaluation that would provide clear and specific evidence of their competence. Because the students invested time and effort in PBL, a majority believed that their PBL grade should count towards their grade point average. But we could not give a multidisci-
Another concern is that some faculty members perceive PBL to be too time-consuming and too difficult to implement. Not all the teachers who are in charge of lectures took the time to become familiar with the concept of PBL. They gave their lectures employing the didactic format, including the concepts that were designed to be learned in the PBL curriculum. Students did state, however, that PBL was becoming a good method of review.

In regard to case innovation, the focus of the new cases was much more multidisciplinary in nature. Compared with the single disciplinary setting, the multidisciplinary PBL curriculum is much more successful in building a firm foundation for students that will help them understand complex dental knowledge and basic science. The PBL process helps students develop deeper understanding than possible in lectures and also stimulates the development of clinical reasoning and critical appraisal skills. It encourages students to think about social and environmental problems and to pay more attention to law, humanities, and ethics. For those who focus on knowledge from textbooks, knowledge of such fields is a very important reinforcement and improves their ability to acclimatize to work settings where dentists provide oral health care for patients. It should be said that the multidisciplinary setting is much enhanced by the spirit of PBL.

For a new problem-based curriculum that is just being established, it is essential that students, faculty facilitators, and administrators understand the basic concepts of PBL and receive training about how PBL works. Student preparation for PBL is not enough. Because our students were not previously exposed to PBL, allowing more time before starting the PBL curriculum would have made the process more effective. Increased preparation will also stimulate prior learning and provide guidance, feedback, and successful experiences with the method. Facilitators would be less anxious and more effective if they were given additional preparation in the form of workshops and team discussions. Students and facilitators have expressed their desire to continue the use of this method after experiencing the advantages of PBL. When the concepts and format of PBL become well accepted among the whole faculty, the application of PBL in subsequent years will promote their own and students’ self-efficacy in this teaching/learning method and enhance students’ ability to solve more complex problems in the future.

Future growth and success of a PBL curriculum at any dental school in any nation depends on investment in the future including the following: creating an adequate budget for PBL so that needed resources are available to conduct a high-quality program; inviting PBL experts to provide faculty development on this technique; enhancing financial reward and time available for the case writers; and building a substantial library of resource materials, including biomedical journals, to assist students in their exploration of the literature during the analysis of cases.

Conclusion

A multidisciplinary PBL program in the WHUSS is an innovation in our educational pursuits. It is a big challenge for Chinese students because of the traditional culture in this nation and the family-control policy. To take into consideration the probable side effect of education innovation, only 20 percent of the lectures were changed in the PBL curriculum. All the new cases have the characteristics of being multidisciplinary in nature and are related to some problems of society, environment, law, humanities, and ethics. There are clear benefits for the students from the use of the PBL format, including increased autonomous learning, critical thinking, and problem-solving.

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