Original Article

Teaching Reform of Pharmaceutical Chemistry with PBL Method

Xiangling Gu, Xinfeng Song, Hanwen Sun, Maojiang Dong, Jing Li, Guiyun Liu, Zhiqin Zhang, and Jiwei Wu

College of Medicine and Nursing, Dezhou University, No. 566, Daxuexi Road, Dezhou-253023, CHINA.

ABSTRACT

Objective: Pharmaceutical chemistry plays a key role in pharmaceutical speciality, which is aiming at making students master basic concepts, basic theory and basic skills of pharmaceutical chemistry. The teachers, however, often encounter some challenges in their teaching process, such as insufficient learning motivation for students, lack of effective means to achieve teaching goals, non-uniformity of program outcomes and ability to satisfy industry needs. It is necessary to seek for an efficient way to improve teaching level by applying new mode. **Methods:** In view of the great success of Problem Based Learning (PBL) mode in medical courses, this mode is also attempted in pharmaceutical chemistry. We applied PBL method in teaching of pharmaceutical chemistry with the procedure as follows: Under the guidance of teachers, students carry out an active learning around the core knowledge or problem in each module, undergoing a logic process of "asking questions, establishing hypothesis, self-study to disambiguation, demonstrating hypothesis" to acquire knowledge. **Results:** Well-design of curriculum program and reasonable setting up of assessment system are both emphasized in teaching reform. Through teaching reform of PBL mode in pharmaceutical chemistry, complicated materials are easily to understand and basic knowledge is easily connected to practice. In addition, students' enthusiasm of autonomous learning is inspired and good teaching effects are found. **Conclusion:** Only more efforts in teaching practice in pharmaceutical chemistry are unceasingly made, will the goal of teaching reform with PBL method be achieved.

Key words: PBL, Pharmaceutical chemistry, Teaching mode, Teaching reform, Evaluation system, Pharmaceutical speciality.

INTRODUCTION

Pharmaceutical chemistry is one of the basic courses of pharmaceutical speciality, which lays a foundation for further study of follow-up pharmaceutical courses and future application in pharmaceutical industry.[1] The teachers, however, often encounter some challenges in their teaching process, such as insufficient learning motivation for students, lack of effective means to achieve teaching goals, non-uniformity of program outcomes and ability to satisfy industry needs. Though many efforts have been made to solve these problems and to improve teaching efficiency of pharmaceutical chemistry, no obvious effects has been formed up to now. Therefore, some new teaching modes that have been successfully applied in other area are gradually entered the field of pharmaceutical chemistry teaching.

Problem Based Learning (PBL) is a student-centered teaching mode in which students learn about a subject through the experience of creating a problem. Students learn thinking strategies as well as domain knowledge. The PBL format stemmed from the medical school of thought, and is now expanded to other schools of thought too. The goals of PBL are to help the students to develop flexible knowledge, effective problem solving skills, self-directed learning, effective collaboration skills and intrinsic motivation.[2]

With a group work, students identify what they already know or need to

Submission Date : 24-05-2016
Revision Date : 19-07-2016
Accepted Date : 24-08-2016

DOI: 10.5530/ijper.50.4.4

Correspondence Address
Dr. Xiangling Gu
College of Medicine and Nursing, Dezhou University, No. 566, Daxuexi Road, Dezhou-253023, China.
Email: guxiangling2004@163.com

www.ijper.org

know, and how and where to achieve new information that may lead to the resolution of the problem. The role of the teacher in PBL is to facilitate learning by supporting, guiding, and monitoring the learning process.[3] The tutor must give students' confidence to face the challenge, while also extending their understanding. PBL addresses the need to promote lifelong learning through the process of inquiry and constructive learning. PBL can be considered a constructive approach to instruction, emphasizing collaborative and self-directed learning and being supported by flexible teacher scaffolding.[4]

Based on the above understanding of PBL mode reform in medical courses, this method is also integrate into pharmaceutical chemistry. Some basic problems and their countermeasures in the teaching reform are discussed.

METHODS

Aiming at the existing problems in teaching of pharmaceutical chemistry, the goal of teaching reform with PBL method is designed, that is, to develop self-directed learning skills. As pointed out the skills refer to a process in which individuals take the initiative in diagnosing their learning needs, formulating goals, identifying human and material resources, choosing and implementing appropriate learning strategies, and evaluating learning outcomes. In classroom teaching of pharmaceutical chemistry, students are also invited not only to participate in the learning process, but also to take responsibility for their learning, which result in an increase in self-directed learning skills. Severiens et al reported that PBL focused on self-directed learning which formed motivation of students to maintain study pace, resulted in social and academic integration, encouraged development of cognitive skills, and turned out more study progress than students in a conventional learning paradigm.[6] In this sense, PBL fosters learners to locate in the academic world through inquiring and discovery that is central to PBL.

We applied PBL method in classroom teaching of pharmaceutical chemistry with the procedure described as follows: Under the guidance of teachers, students carry out an active learning around the core knowledge or problem in each module, undergoing a logic process of "asking questions, establishing hypothesis, self-study to disambiguation, demonstrating hypothesis" to acquire knowledge. The concrete steps include: (1) Dividing into some groups; (2) Posing questions according to the clinical scenario; (3) Summarizing problems; (4) Putting forward assumptions; (5) Discussion; (6) Feedback; (7) Seeking solutions; (8) Putting forward new questions. As for the part of Introduction of pharmaceutical chemistry, in light of the fact that the structure diagrams of many drugs were often found in the description of medicine molecules, a question should be put forward as what groups can be observed from the sketches shown here. In addition, to study the section of the amino acid and the protein, one question could be posed like "How to identify whether the protein denatured or not in daily life". Students of different groups, collect relative materials separately combined with their own knowledge, form a preliminary answer after group discussions and make feedbacks to unclear compound or functional groups as new questions. On the premise of ensuring the quality of teaching plan, the method obviously cultivates the students' learning interest and innovation ability, at the same time it can improve the students' ability to analyze and solve problems. In the process of implementing PBL teaching method, we focus on the design of four steps, including problem, learning, discussion, and summary.[7]

The core of the PBL is just around problems, that is to put forward problems, to analyze problems and to solve problems. Through an elaborate design of the problem, teaching activity can be achieved in a preinstalled situation. The design of the problem is based on the teaching outline, and closely related to the teaching content, students' study level, knowledge structure, emotional attitude and so on. Question design should be carried out based on the principle of the zone of proximal development, namely, jumping to pick the peach, in order to inspire the students' interest and desire to explore terra incognita. Questions should be of realistic significance and highlight connections of theory and practice, which can not only attract students to actively take part in the teaching activity, but also develop the ability of creative thinking.

After teachers give questions, students fully exert their subjective initiative under the teachers' guidance to explore and to imagine. Teachers encourage students to conduct autonomous learning in the process of mutual cooperation and team communication. Based on the voluntary principle, the teacher should take into account the following factors, including age, gender, personality, way of thinking, learning conditions and knowledge structure, for the optimal combination, to form a team of 6-10 students, in which a more responsible student should be selected

as group leader, with the responsibility of organization, supervision and urging. Each team may fully mobilize the members' ability of social activities, to collect first-hand information by practice, also gather data through internet, newspapers and books. They should communicate within the group around proposed problems to achieve the common learning goals.

Hereafter, teachers organize the discussion, in which the host who is selected by the team explain how they understand the problem, and lists the rest unsolved problems. They should encourage other one mutually so as to ensure improving together. Students should explore the methods to solve these problems, meanwhile forming good habits to try bravly.

For the problems those are easily confused, some relative information, which is absent in textbooks, should be supplemented, especially for the development of research methods and latest progress in pharmaceutical chemistry, to enrich the teaching content of pharmaceutical chemistry. On this basis, teachers should carry out evaluations on students' learning level and help students build knowledge structure so as to form an integrated knowledge system.

RESULTS AND DISCUSSIONS

No doubt, teaching reform of PBL mode is a complicated system engineering, which will inevitably encounter many difficulties. In the teaching process of pharmaceutical chemistry, we have paid more attention to the design of teaching plan and evaluation system, face up to the existing problems, and try to find solutions to these problems, in order to ensure the success in teaching reform with PBL method.[8]

It is widely accepted that the design of teaching plan is the core of such a teaching reform. Therefore, we have defined the writing principles, the audit procedures and evaluation criteria of teaching plan. A complete teaching plan must include two sections: the first section is for the student and the second one for the teacher. Each piece of teaching plan should be set up based on the instance of the students and become a formula upon the approval of experts who are familiar with PBL mode. For the teacher, careful preparation of teaching plan plays a key role in the teaching reform, which requires not only the overall grasp of pharmaceutical chemistry, but also the deep understanding of related disciplines. So the reform needs more inputs of teachers. For the students, the transformation from telling students directly what it is to studying around the core of questions, needs a self-study process that students carry out via internet or in library. The level of teaching plan will directly effect on students' ability to achieve teaching goals. A case should not be ignored, that if we could not control the overall arrangement to give students enough time for self-study, it will become a mere formality and difficult to achieve teaching goals.

Success or failure in teaching reform of pharmaceutical chemistry with PBL method depends largely on evaluation system, especially about the examination. The evaluation system should change flexibly with teaching method, otherwise it is difficult to guarantee the sustainable development of teaching reform. To this end, we have set up the evaluation standards on learning effect, in which the key points of evaluation system are stipulated clearly, including the performance in brainstorming, the ability to search for information and to solve problems, the ability to share what they have achieved with classmates and the skills of communication with group members and so on. The way to implement the evaluation includes various types, for example, teachers to students, students to students, students to teachers, self-evaluation of students, and so on. Even though the teaching method has been changed to PBL mode, the evaluation method is unlikely to make students realize the difference between traditional teaching mode and PBL mode in a short duration, and the advantage of PBL is impossible to be revealed rapidly. One misunderstanding that PBL will increase the students' burden may from to some students, so that they can enjoy little happiness from PBL and thus are not willing to cooperate with teachers, which will result in an abortion of teaching reform of PBL mode. It suggests increasing the examination amounts of judgment and comprehension and to cut down the type of memory.

CONCLUSION

Pharmaceutical chemistry is an important course of pharmaceutical speciality, which is aiming at making students master basic concepts, basic theory and basic skills of pharmaceutical chemistry. Through the implementation of PBL mode in teaching process of pharmaceutical chemistry, complicated materials are easily to understand and basic knowledge is easily connected to practice. In addition, students'

enthusiasm of autonomous learning is inspired and good teaching effects are found. Teaching reform of PBL mode in pharmaceutical chemistry is a continuous progress. Only further efforts in teaching practice are unceasingly made, will the goals of teaching reform of PBL mode in pharmaceutical chemistry be achieved.

ACKNOWLEDGEMENTS

This work was supported by Shandong Provincial Development Project of Science and Technology (No. 2014GGX102037) and The National College Students' Innovative Entrepreneurial Training Plan (No. 201410448012).

CONFILCT OF INTEREST

There is no conflict of interests regarding the publication of this paper.

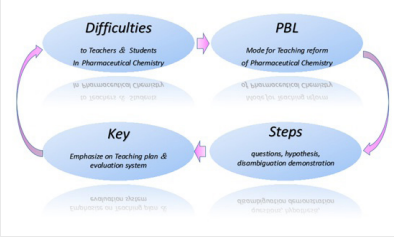
ABBREVIATIONS USED

PBL: Problem Based Learning.

REFERENCES

1. Louisa WD. Careers for 2003 and beyond: Medicinal Chemistry. Chemical and Engineering News. 2003;81(25):53-6.
2. Hmelo-Silver CE. Problem-Based Learning: What and how do students learn?. Educational Psychology Review. 2004;16(3):235-66.
3. Schmidt HG, Rotgans JI, Yew EHJ. The process of problem-based learning: What works and why. Medical Education. 2011;45(8):792-806.
4. Hung W. Theory to reality: A few issues in implementing problem-based learning. Educational Technology Research and Development. 2011;59(4):529-52.
5. Loyens SMM, Magda J, Rikers RMJP. Self-directed learning in problem-based learning and its relationships with self-regulated learning. Educational Psychology Review. 2008;20(4):411-27.
6. Severiens SE, Schmidt HG. Academic and social integration and study progress in problem based learning. Higher Education. 2008;58(1):59-69.
7. Schmidt HG, Loyens SMM, Van Gog T, Paas Fred. Problem-based learning is compatible with human cognitive architecture: Commentary on Kirschner, Sweller, and Clark. Educational Psychologist. 2007;42(2):91-7.
8. Yew EHJ, Schmidt HG. What students learn in problem-based learning: A process analysis. Instructional Science. 2011;40(2):371-95.

PICTORIAL ABSTRACT



SUMMARY

- PBL mode is firstly attempted in pharmaceutical chemistry.
- The steps are set as follows: asking questions, establishing hypothesis, self-study to disambiguation and demonstrating hypothesis.
- Well-designed curriculum program and reasonable setting up of assessment system are both emphasized in PBL mode.
- Students' enthusiasm of autonomous learning is inspired and good teaching effects are achieved within PBL mode.

About Author

Xiangling Gu: Dr. XianglingGu is an associate professor at College of Medicine and Nursing,Dezhou University. He received his Ph.D.from College of Chemisty and Chemical Engineering, Shandong University in 2010. Dr. Gu is one of the key members in Shandong Provincial Engineering Laboratory of NovelPharmaceutical Excipients, Sustained and Controlled Release Preparations. Also, he serves as the member of Chinese Chemical Society. He specializes in research on higher pharmaceutical education and preparation of biomedical polymer.