Preliminary Research of Biochemistry Experiment Reform in Medical College

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Abstract. In medical college experiments is a very important part during the biochemistry teaching. According to problems arising from the previous biochemistry experiments, the author has carried on the teaching model reform: the students designing experiments independently, case teaching method and problem-based teaching method. The final questionnaire feedback shows that the reform improved the students' interest in learning and self-study ability. And good results have been achieved.

Introduction
Biochemistry is one of the basic medical courses offered by the five-year medical specialty in the second grade. Biochemistry mainly studies the chemical molecules and chemical reactions in the organism, and probes into the essence of life from the molecular level. Its knowledge and experimental technology are widely used in various fields of life science. And it is also a bridge connecting basic medicine and clinical medicine. Experimental teaching is an important part of the subject teaching. It can broaden students' horizon, cultivate students' scientific thinking and scientific research consciousness. It can make students master common experimental technology, and know the hot spot of science. Compared with theoretical teaching, it is more intuitive, practical and comprehensive. In order to help students mastering the knowledge more quickly, thinking and solving problems independently, experimental teaching and theoretical teaching must be combined organically during the whole students’ learning process. Experimental teaching is regarded as a supplement to theoretical teaching, so it often been despised. In the previous experiment teaching, the author found that some students only paid attention to the theory course and thought that the experiment class was useless. Some students just follow the instructions in the notes, but they don't know exactly why they did it. [1]Aiming at these phenomena, the author tries to improve the teaching mode, aiming at stimulating students' interest in learning and cultivating their independent learning ability, thus improving their learning efficiency.

1. Students' designing experiment independently
In the past, the author used the traditional infusion teaching method. First, the experimental principles, operation steps and matters needing attentions were explained clearly to students. And then the students began to operate. The author finds many problems in this teaching method. First, some students were distracted during the class, so they made mistakes in the operation. Even the teacher emphasized the problem, and the students still made mistakes. Second, students tend to do the experiment without thinking, although the experiment is done, they have no idea why they should do it. Therefore, in some experiments, the author adopted the method of students designing experiments independently, which can engage students' initiative. Then students can participate fully in the experiment. For example, in the experiment of “human serum γ-globulin extraction, purification and identification”, the author assigned the week homework to the students, and let the students to design the experiments and prepared PPT in group. There were four students in a group, and a class is divided into 7-8 groups. Then the students designed the experiment independently by using the
theoretical knowledge and internet. [2] In the experimental class after each group presented its own experiment design through PPT, the author then guided the students to discuss the rationality and feasibility of the experimental design. For example, in purification stage, the students proposed several purification techniques such as dialysis, ultrafiltration, organic solvent precipitation and gel filtration chromatography. Then the techniques were analyzed by discussion. Dialysis and ultrafiltration utilize the principle of selective permeability of semi-permeable membrane. Small molecules can freely through a semipermeable membrane, while large proteins can't. So the macromolecules are separated from the small molecules. This method is easy to operate and have a high recovery rate. In organic solvent precipitation acetone and ethanol were used commonly to precipitate protein carefully at low temperature, and precipitate should be quickly separated to prevent protein denaturation. Finally, the most feasible method was selected, and the students did the experiment according to the chosen method. The author found that these students were more efficient, also they had less error and better experimental results than using the traditional teaching methods. Students designed experiment independently before class, discussed and compared various methods in class, and then verified the design through experiments. This learning method not only can enable students to deepen their understanding of theoretical knowledge, but also can change the situation of students' mechanical operation with the experimental procedures. And in the process of solving practical problems, students' learning ability and cooperative spirit were cultivated.

2. Case teaching method

The case teaching method is usually used in the theory teaching. But the author added clinical cases in the experiment teaching, and found that it can improve the interest of the experimental class and the enthusiasm of student.[3] Such as the experiment of “serum glutamate transaminase activity determination” is just a mixture of some reagents if students only follow the steps of the experiment to do. And finally a numerical value is obtained. The experiment is not very interesting. Glutamate transaminase is the most abundant in human liver tissue. And it is often used as an auxiliary diagnosis of liver disease, which is a sensitive index. So the author designed a clinical case of early hepatitis. The students had a preliminary assessment by knowing the patient's clinical performance and other examination indicators. Many students had suggested that the patient has a liver problem. The author then guided the students to observe whether the laboratory tests were enough according to what they have learned. Because in theory class the students had just studied the activity of in different tissues of the human body, so they found the absence of the GPT activity immediately. In order to get the accurate diagnosis, the students determined the activity of GPT seriously, and the students' interest and enthusiasm would be aroused. When correcting student's experiment report, the author found that the error rate of students’ experimental results was significantly lower than tradition teaching method.

3. Problem-based teaching method

The traditional experimental teaching is that students often do not use their mind and seldom come up with some innovative ideas, which is not conducive to the exertion of students' subjective initiative. So the author proposed some questions for the experimental content of this lesson (and gives some inspirations) to students. [4] The questions included many of the "why" in experimental principles, design and the notes. The time to ask questions could be during or before the experiment. The answer could be specified, free or even preemptive. The questions could be discussed only. Then the students did the experiment with the questions. Then teacher gave the answer to students after the experiment. For example, in the experiment “the inhibition effect of malonic acid on the dehydrogenase of succinic acid”, question could be raised before the experiment: the liver was one of the most abundant organs known to contain succinic dehydrogenase, and why did the liver not be used in this experiment? In the experiment, students were asked to predict the order in which the tubes were fading, and asked the students: why can't the tubes be shaken after adding liquid paraffin? After the experiment, the
students discussed the concept of oxidase and dehydrogenase, aerobic dehydrogenase and non-aerobic dehydrogenase. As the teaching ideas “raise the questions- hypothesis- verification- summary”, the new teaching method deepened the students understanding of experimental principle and basic theoretical knowledge. The more importance was that the students knew the practical scientific spirit.

4. Student feedback and effect

The author also carried out a student questionnaire survey about the new teaching methods. In the feedback data, 80-90% of the students thought that the biochemistry experiment course was very important, which was closely related to the follow-up medical courses. More than 90% of students believed that the reform of experimental teaching methods had improved their interest in learning. 80-90% of students believed that experimental reform had improved their ability to teach themselves and solve problems themselves. Students reflected a preference for teaching methods combined with discussion. This enabled them to make efficient use of the experimental class time so that they could carefully observe and actively solve the unexpected experimental phenomena and problems during the experiment. The students felt that they benefited greatly from the experiment class.

Summary

Through the above reform practice, students had gained a new understanding of the purpose of biochemical experiment, and their ability to participate in the experiment had been significantly improved with their interest, initiative and self-solving problems. The reform cultivated the spirit of solidarity and cooperation among the members of the group and enhanced the experimental teaching effect. It provided an important guarantee for students to better learn, master and apply biochemical knowledge and laid a solid foundation for their future work and scientific research.

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References


