Multiple Solutions Interactive Learning

Recipient of the Certificate of Merit
Mr CHEUNG Yu–pang (Years of teaching: 20 years)
School
Hong Kong Chinese Women´s Club College
Teaching Targets
Secondary 1 to 7 (Mathematics)
The Beliefs of Teaching

"Teachers and students solve problems together; students practise more and construct multiple solutions". This is effective in developing students´ problem solving skills and their appreciation of the wonders of mathematics.

◄ Mr Cheung often provides opportunities for students to learn outside the classrooms. For example, outdoor observations enable students to understand the close relationship between mathematics and daily life.

Interview with the Teacher

"When students cause trouble during lessons it is often because they are unable to catch up with the progress of the class and to master what is being taught. They eventually lose interest in learning. To help these students, I have to be firm and fair to establish my authority and maintain discipline in class." Mr Cheung Yu-pang points out that logical thinking is very important in mathematics. Besides, a person has to discipline oneself and work diligently. Both beliefs are closely related in the study of mathematics. In order to get twice the result with half the effort in teaching, we should maintain students´ discipline first and then establish a good rapport with students.

Mr Cheung Yu–pang points out that each student is an independent individual. There are usually 40 students in a class and it is inevitable that there are learner differences. Therefore, it is important to teach students in accordance with their aptitude, using both hard and soft tactics. First of all, we need to take care of the interests of the majority of the students. We should not let the minority of students who are not so interested in the subject affect the progress of other students. To do this, discipline in class has to be maintained. Secondly, we need to enhance students´ desire to learn in order to reap twice the result with half the effort. This means teaching has to be interactive and interesting.

Never teach according to the books

How can we make learning interactive? Mr Cheung Yu–pang likes to work with students to solve mathematical problems. Mathematics is on the one hand abstract but practical on the other. Mr Cheung does not teach according to the books. He thinks if students understand the principles, they will be able to read and understand the examples in the textbooks. Mr Cheung makes use of daily life examples to explain mathematical concepts and principles. Tang Shu–man, who finished Secondary Seven last year and is now studying Physics in the Chinese University of Hong Kong, commends Mr Cheung´s work. When Tang was in matriculation class, Mr Cheung Yu–pang taught him Applied Mathematics. Tang recalled and said, "When we learnt about probability, Mr Cheung used playing cards to explain the concepts. The content was very clearly presented and the concepts can be applied to numerous situations. I often quote the examples Mr Cheung used when I give private tuition to students. I am benefited for my whole life."

Although the community in general does not want schools to conduct too many tests, Mr Cheung Yu–pang does not agree. He thinks that regular quizzes can help students master the basic concepts of the subject. If a test is conducted long after a topic has been taught, the relatively less motivated students may have lost what they once gained during the lessons. If they are unable to catch up with the progress, they would lose interest and the atmosphere in class would be adversely affected. Other students would be affected too. As a result, Mr Cheung generally conducts a quiz for his students every two weeks.

Learning from games

In relation to the frequent quizzes, Mr Cheung Yu–pang says, "The first few tests are usually quite easy. So long as students have paid attention in class, they can pass." They are deliberately arranged so as to build up student's confidence and let them know that they are able to do well. After having built students' confidence, Mr Cheung would then adjust the level of difficulties of the quizzes.

The keen interest in studying mathematics is contagious in Hong Kong Chinese Women's Club College. The Mathematics Society of the College has established the Mathematics Corner to help students learn about mathematics through games. Mr Cheung says, "The Mathematics Corner has a stock of many mathematical games, like tangram and Hung Ming Lock, and it may be the best equipped in terms of

mathematical games found in Hong Kong secondary schools. Student members of the Mathematics Society have put much effort in developing the Corner."

Reading to learn

Reading is a vital part in learning a language, but not many people realize that it is also applicable to the study of mathematics. Mr Cheung advocates "reading to learn mathematics". He does not require students to write any reports on their reading, so as not to put pressure on them. Students are only required to find articles about mathematics in the newspapers, books, magazines or on the internet, read the articles and give each a grading. At first, Mr Cheung was worried that it would be very difficult to find articles about mathematics in the newspapers. However, as "sudoku" has become very popular over the world in recent years, articles on related topics are often published. Many students are thus able to finish their task.

Mr Cheung Yu−pang has been teaching in Hong Kong Chinese Women's Club College for 15 years. He finds that students' academic results in mathematics are getting better. Students have outstanding performance in school and international mathematics competitions. Besides, there is frequent sharing and mutual support among the teachers. He says that the award should be shared by all the teachers of the school.

Teacher´s Sharing

Introduction

As a mathematics teacher, I certainly need to pass on mathematical knowledge but I also emphasize the following three teaching objectives: (1) making students like mathematics (2) making students like solving problems and (3) making students like thinking. If students do not like mathematics, they will be unwilling to spend time on learning mathematics. In learning mathematics, students need to solve many different mathematical problems. If students do not like facing the challenges of problem solving, they will give up easily. Solving mathematical problems is a thinking process. If students do not like thinking or do not know how to think properly, it will be very difficult for them to achieve anything in their study.

Teaching design

In order to achieve the above objectives, one important condition is that the teacher himself must like mathematics, solving problems and thinking. Teachers could exert great influence on students and students often imitate their teachers. For example, when I introduced "Hung Ming Lock" to students telling them that I had spent a lot of time assembling it, students immediately accepted the challenge. They were willing to spend time on finding the

solution. Certainly, the most important factor affecting motivation is students´ expectation of their learning outcomes. If they do not believe that they will be successful, they will not have any motivation to learn. The level of their expectation depends on their past successful or unsuccessful experiences. Hence, teachers must control properly the degree of difficulty of the questions. The solution should neither be too simple nor too difficult. Taking "Hung Ming Lock" as an example, I would give students "hints" at an appropriate time. Of course I would not tell them the final solution. I would share with them the difficulties I encountered and how I analyzed the possible ways to overcome the difficulties. Students would be required to try by themselves in order to get their way out. This is the only way to keep students thinking and looking for the answers. The pleasure in their later success could enhance their confidence and interest.

▼ **Students like outdoor activities very much and discussion is often very lively.**

▲ **Mr Cheung has prepared many mathematical games for students so as to develop their interest in mathematics.**

In the course of teaching, the role of a teacher is to guide students to think and to find the answer step by step. When I teach students to think and analyze problems, I often discuss with them during the lessons and guide them to the solution by various questioning techniques. For example, regarding teaching numerical solution of equations in Secondary Seven, I would ask students to tell me an equation they want to solve, and then we would spend the whole week trying to solve the same equation by different numerical methods. As the students apply different methods on the same equation, they can compare the merits and demerits of different methods and gradually master the skills. If the students understand the concepts and master the skills, they will be able to deal with any related problems.

Summary of Assessment

Effective teaching practices to achieve the target "students like mathematics, students like solving problems and students like thinking"

The learning target constructed by Mr Cheung is "students like mathematics, students like solving problems and students like thinking". Based on this target, Mr Cheung has developed the following teaching strategies: "teacher asks questions frequently in the lesson, teacher and students solve the problems together, students do more and teacher does less, solving one problem by several methods". These nurture effectively students´ problem solving ability and skills and promote the appreciation of the wonders of mathematics. The target and strategies are generic and worthwhile to be shared with colleagues.

In the lesson observed, Mr Cheung interpreted his concept of teaching successfully. He arranged a series of questions (e.g. How and where to set up a coordinate system? Which equations should be established to explore the flight path of the projector?). He also discussed with students the calculations involved (solve differential equations by integration, solve a number of equations by substitution). Students were happy to follow Mr Cheung´s instructions and to learn. His self-reflection shows that he understands the merits of the lesson and his teaching effectiveness has been enhanced.

Mr Cheung has designed an effective school-based mathematics curriculum for junior secondary mathematics. He promotes reading and considers it an activity for learning mathematics. He has also set up a mathematics corner to arouse students´ interest in mathematics. These strategies can enhance the academic results of the students in both internal and external examinations.

Way of Access to the Information of the above Teaching Practice

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Preferred Way of Dissemination

- Educational seminar
- Discussion forum on educational web site

Contact

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▼ **Mr Cheung is giving a lesson where discussion is very lively.**