Application of student-centred strategies in teaching a university Physics course in Sichuan University

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Abstract

This paper addresses the teaching of a university Physics courses after ten years of reform work in accordance with contemporary education theory. It is very important to progress from teaching-centred to learning-centred strategies. The combination of the traditional lectures and contemporary education strategies will be used to make Physics more exciting. A detailed description of how to use case studies, concept mapping, and problem-based learning (PBL) in *University Physics* teaching will be been discussed.

Introduction

I was glad to have the chance to participate in a cooperative program for *Teaching Science in English* supported by the China Scholarship Council and The University of Sydney. This program consists of two major components: intensive English language and a semester working with the Faculty of Science. We study much knowledge, including: PBL, case study, student-centred learning practices and online learning strategies. These theories and strategies were taught and many ways such as lecture-style presentations, seminars, group work, and peer presentation. We rarely use such techniques in the teaching of university Physics in China. During my study, I have to reconsider the current situation of our university Physics course and I want to use these methods to teach students when I go back.

Current courses and teaching strategies

As a teacher working in the Physics Department of Sichuan University, I teach the course *University Physics* for undergraduate students. There are about 150 students. The teaching process is currently teacher-centred. A student's score in the final examination is used as the assessment result. In order to increase student interest, I currently ask the students to answer questions and to submit a research paper on any topic in which they are interested.

How to execute the student-centred teaching method

Introduce PBL to lectures

PBL is a learning environment in which learning is driven by a posed problem in which the learner is interested in solving. The problems are based on real-life, open-ended situations because teaching and learning in science should be made more relevant to the life of the students and as close as possible to a real professional experience. Learning is active, integrated, cumulative and connected. PBL is a specific strategy for engaging students in collaborative learning, critical thinking, improving their problem solving skills and lifelong learning skills. It is helpful for students to combine the knowledge of different disciplines, which can open the students' minds. There are many questions about physics that are around us in everyday life. Most of them are suitable for the lecture. For example, why is the sky blue? If students find that the more answers they discover, the more questions they want to ask, then they are 'on the road' to becoming a physicist.

Introduce 'Workshop Tutorials' to Sichuan University (SCU)

The 'Workshop Tutorial' is a supplementing method that can promote a deeper-level processing of learning. As we know, the quality teaching should be aimed at promoting deep-level processing of information in the mind of the learner. It is a successful teaching and learning initiative. The 'Workshop Tutorials' are valuable. Firstly, they provide a learning environment with significantly more student control and choice. Secondly, they provide a variety in the available learning styles such that students with different learning styles can be accommodated. There are

computer aided instruction systems, demonstration equipment, references and tutors in this environment. The role of the tutor is to support by asking questions rather than by simply giving answers. The designed materials are used to promote discussion and conceptual understanding. Structured worksheets with a variety of activities are designed for students. Students have the freedom to choose activities and time for each activity but they are focused on teamwork through the use of team answer sheets. Students in the 'Workshop Tutorials' work in cooperative teams of three to five, reading, discussing with teammates or tutors, drawing, doing experiments, articulating and presenting logical arguments. Each member of a team is responsible for both learning what is discussed and helping other members learn, thus creating an atmosphere of group achievement. Students use different ways to get information. This helps students to open their minds. They obtain a deeper understanding of concepts in physics and develop the students' skill such as self-directed skills, research skills, communication skills, critical thinking skills and teamwork skills. What is more important is that students understand why the required 'skills' are important within the discipline, rather than just knowing how to use the skills.

Introduce the Personal Response System (PRS) to *University Physics*

Interaction in the lecture is very important. It dictates what the lecture focuses on and how to process the lecture. The easy interaction in physics is through demonstration but it is not very effective in informing the lecturer and students about what and how their classmates think. When the lecturer asks a question in the class, the students do not answer the question because some are shy and some do not like to show their stupidity if they make an incorrect answer. PRS is an effective and powerful interactive classroom communication system in large lecture classes for giving instant feedback to the students. With PRS, each student can answer the question by pressing a number on a keypad. The responses are collected by a receiver, processed by a central computer, and displayed to the class in the form of a histogram. The student finds the answer correct or incorrect by an identification number that is only known to them. Displaying the collective responses to the whole class helps improve students' confidence because they become aware that a fraction of the class thinks similarly to them. It also promotes student-student interaction and this is also important. Also, the lecturer can promote interactivity by assigning one keypad per three students and requesting group responses.

Conclusion

Although there are other teaching strategies, in this paper I have discussed my thoughts and reflections from my own experiences at The University of Sydney. These contemporary teaching strategies are very useful in improving teaching in physics. I will introduce these ideas in SCU. I hope my students will accept these and become real learners in the future.

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