

Improving learning result: Problem based learning for Chemistry

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Introduction

The Problem-based Learning (PBL) course design is different from regular chemistry laboratory class in early years. For regular laboratory teaching classes in year 1 and year 2, instructions and procedures for the experiments are given by teachers or instructors. Students in the class follow the instructions from the laboratory manual provided to carry out experiments. The results from each experiment are usually known. In PBL classes, students are required to manage their own project. They have to collect information from the literature and plan their experiments to solve problems encountered. The projects are usually research oriented. Each group of students in each project has to work independently in the laboratory monitored by a group leader (usually a teaching assistant). Students are required to take a full record of their work in progress and find the direction through the project. They are required to report their progress and results orally in seminars and in the written thesis. Students need to apply the chemistry knowledge and laboratory skills learnt to solve the problems in the project. Teachers are taking the role as consultants; they provide advices and supports to students in individual projects.

Started from 2008, PBL course was introduced to replace the final year laboratory classes. Final year Chemistry Major Students are required to take their Final Year Projects (FYP) under the PBL approach with the purpose of allowing students to integrate and put to use various concepts and theories in the discipline to solve some research problems. In solving the problems, students have to carry out different tasks independently: such as project planning, laboratory works, literature research, oral presentations, and scientific writings. The problem-based learning (PBL) design should enable students to acquire the practical skills together with their knowledge in chemistry to use in research work. The inquiry-based and problem-solving experience also assists students in their future career.

One of the challenges in this project is students have to manage the project with a budget including some available resources, such as consumables and equipment usage, throughout the project. Each project is allocated a fixed sum of budget to cover the expenses on consumables and equipment usage. Students have to complete their projects using the allocated budget and time. An essential strategy is students are advised to divide their projects into small components and evaluate the feasibility of the pilot components first. At the beginning, the results may deviate greatly from what are expected from the original plan, and students need to make adjustments to their plan. Also, they need to be aware of the delivery time of the chemicals and consumables ordered. With good planning, students can avoid ordering excessive and wasting chemicals. These practices are close to the real working environment, if students get used to handle these kinds of problems, they will be easier adapting to the real working environments.

Other than that, students can learn more chemistry knowledge beyond their textbooks. When students carry out the work, they need to search the literature to support their investigation. Therefore, students are trained to be independent learners, and they will get used to the professional chemistry literature and databases. Also, they can acquire the knowledge in the related research field. As a result, they gain research experience to continue their academic career in the future.

Advantages of this learning activity

There would be several advantages for students who finished the Problem-based Learning as their final year project. Below are some illustrations:

- increase scientific research skills
- enrich the ability in conducting scientific investigations
- gain advanced chemistry knowledge and skills on the investigated topic
- acquire professional presentation skills
- improve the skills in writing professional scientific paper
- obtain communication and team-work skills
- enhance problem-solving skills

After finished this final year project, students are better equipped for their career paths or study paths.

Feedback from teachers and students

Department of Chemistry has distributed a questionnaire to students in 2009-2010 to collect their feedbacks on the Problem-based learning Final Year Project courses. The aim of this questionnaire is to compare the effectiveness between PBL and regular chemistry laboratory classes. The statistics show that: over 80% of students think PBL can better appreciating the complexity of actual chemistry problems; nearly 90% of students agree PBL is better acquiring chemistry literature search skills; over 90% of students feel PBL is better developing presentation skills and project planning and management skills. PBL in the rest of the comparisons are also show the positive response.

Here shows some of the responders' opinions on the web:

“Better than teaching lab that PBL can be more flexible.”

“PBL is just like the real research, but it is much easier of course.”

“Better preparation if working in lab in the future.”

“I really gain experience in this PBL by actual practice.”

“The PBL is the process of collaborating with team members and exploring the world of science.”