Teaching Reforming Practice for Non-chemistry Major Students in GDUT

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Abstract. Guangdong University of Technology has been carrying out teaching reforming for more than 10 years. It is still challenging to make non-chemistry major students highly qualified in general chemistry and chemical education within very limited period. We are making attempts to improve the attractiveness of the teaching materials and continuously optimize the teaching process.

Introduction

Guangdong University of Technology (GDUT) has the largest amount of students in Guangdong province. More than 50,000 full-time students are distributed into 20 plus school/departments. Given that more than 80 percentages of the students are bachelor-degree students, it is always challenging to carry out the inter-discipline teaching practice effectively and efficiently over the past decades. The school of Chemical Engineering and Light Industry (CELI) has been assigned to provide whole students in the campus with professional chemistry courses, including the teaching courses and training practice. Some of the students outside the school of CELI, for instance, in the school of Electro-Mechanical Engineering (EME) and Civil and Transportation Engineering (CTE), are requested to take chemistry courses. Passing the exams and obtaining the credits (commonly 2~3) is prerequisite for their success in pursuing the bachelor degree. We called the students outside the school of CELI as non-chemistry major students. The school of CELI is responsible of providing the non-chemistry major students with its deliverable-a course entitled "Engineering Chemistry". As a result, more than 500 students from EME and CTE have been taught upon the basis of the course every year since 2000.

Courses Design

The first issue is how to make the non-chemistry major students being interested in the chemistry courses, particularly in the case that most participants are lack of systematical chemistry knowledge. Actually, it is not an easy job. Great efforts have been made to explore any possible solutions [1]. Besides the skills we exploited to enhance the communication efficiency and create a harmonious atmosphere in the teaching room, we think optimizing the teaching contents is one of the most important issues [2]. Fig. 1 schematically demonstrates the course contents design of engineering chemistry provided the non-chemistry students in GDUT. The contents design follows the below principles:

1. Avoiding over-difficulties, ensuing its absorption and attractiveness;
2. Covering wide ranges as much as possible, maximizing the practice usefulness.

Thus, the course contains 6 chapters:

1. The 1st chapter generally introduces the basic concepts, such as atoms, molecules, thermodynamic systems, energy, law of conservation of mass, and so on.
2. The 2nd chapter emphasize on the chemical compositions of matters, including solid, liquid (crystals) and gas.
(3) The 3rd chapter explores the relationship between the structure and properties, e.g. the periodic law of (chemical) elements.

(4) The 4th–6th chapters emphasize on the chemical reactions in the fields of energy, aqueous solution and materials protections respectively.

Additionally, the education background, interests and potential benefits of the students are fully considered. We are committed to optimizing the contents of the engineering chemistry courses, enabling the non-chemistry major students to lay the first stone in the application of the chemistry knowledge in the future.

Figure 1. Course Contents Design of Engineering Chemistry in GDUT.

Advanced Progress in Science and Engineering

Besides the above documental contents, we also try to introduce the latested progress in science and engineering fields to the students. Recently, flexible and stretchable electronics have been catching intensive academic and industrial interests [3,4]. Given that the exploration of the novel flexible electronics and devices widely utilized chemical engineering technologies, we prefer to add some related progress in the courses.

(1) The raw materials commonly involved various types of conductive nano particles, such as carbon nanotubes, graphene, semiconductor nanowires, nanofibers, silve nanowires. These materials are used by assembly of nanomaterials for large scale device and circuitry, flexible energy devices, solar cells and batteries.

(2) After through reviewing the cutting edge research, the key advantages and challenges of flexible electronics both from material and device perspectives, as well as identify future directions are discussed together.

(3) Electronic-skin or e-skin is currently a matter of intensive investigations due to its wider applicability in areas, ranging from robotics to digital health. The high density of multiple types of electronic components (e.g. sensors, actuators, electronics, etc.) required in e-skin.

Fig. 2 representatively demonstrates the sensing mechanism in the e-skin. The strain sensors could be attached onto different parts of the human body. The electrical signals are collected during the stretching/releasing process, which is further visibilized with computer. The usual parts include throat, face, brow and pulse. Comparatively speaking, the throat and pulse detection need highly sensitive sensing meanwhile the gesture recognition need stable sensing in wide working ranges. Thus, the scientists are exploiting sensors meeting different requirements with tailorable sensitivity, sensing range and signal-to-noise.
Summary
Both comprehensive general chemical contents and recent science progress together constructed the courses, which benefit the students to overcome the background loss and keep more interesting in the chemical engineering education.

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References