

Future changes to the teaching style from teacher-centred to learner-centred in a Biochemistry course

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Introduction

The discipline of Biology has experienced a significant revolution, particularly since the 1950s. Biology, especially biotechnology, plays an important role in our economy and society as well as our daily lives. It requires our students to have the abilities to function well in their work place: abilities such as acquiring life-long learning skills, cooperating with others, grasping many new concepts and mastering the techniques and skills in their subject area. Biochemistry is a base of biology. How can we help our students improve these abilities? Can it be achieved through a teacher-centred learning environment?

In teacher-centred learning, teachers are the source of knowledge, students look like “ducks waiting to be fed”. However this is a typical in a time of knowledge explosion. Teachers are never able to keep enough information nor to convey it to the students, they must change their roles. Similarly, students also have to learn in new ways to adapt to the new world. Life is too short and knowledge is too broad. Learning must be relevant to learners’ objectives in order to be effective and efficient (Kwan 2000) According to the characteristics of learning, teachers must change their traditional teaching style. Learner-centered education is a promising model.

Course description

In our university many courses, including the Biochemistry course, are given by lectures. The Biochemistry course is designed in two parts for the second year students: lectures (64 hours, 4 hours each week), Practical work (36 hours, 3 hours each week). About 1000 students attend this course per semester per year. There are more than 120 students in each classroom. Teaching in a teacher-centered way has been the norm in our classroom. Sometimes we try to use case studies hoping they will stimulate students’ interests’ in studying. But we still have big problems. We find many students learn shallowly, only a few students can do deep learning. What’s wrong with my teaching? I have done plenty of pre-work before I go to a classroom. After my study of education theories in the University of Sydney, I suddenly realise the problem. The key problem is that I always play an “actress” in my classroom, not considering my students’ feelings nor their learning situations. This does not give them a good studying environment where they can learn actively. If I teach in a learner-centered way, my problems will be solved to some extent.

What is Learner-centred?

Learner-centered education is the perspective that couples a focus on individual learners (their heredity, experiences, perspectives, backgrounds, talents, interests, capacities, and needs) with a focus on learning (the best available knowledge about learning and how it occurs and about teaching practices that are most effective in promoting the highest levels of motivation, learning, and achievement for all learners). (McCombs and Whisler, 1997)

Learner-centered education advocates a student-focused teaching and learning environment. Teaching in a learner-centered style requires the teacher to serve as the presenter or facilitator of knowledge rather than “a spoon-feeder of ducks” and also requires the teacher to foster a learning environment that will be helpful for students (Yeary, 1998).

What is a good teaching and learning environment? Students learn more effectively if they are active rather than passive during the learning process. Learning by doing is generally more effective than learning by listening or

reading. (Wood, 2004). Therefore as a teacher, it is our task to supply students learning environment where students can learn actively.

In contemporary society, there are a lot of educational theories and a lot of education strategies to help us to create learning environments for students. These include development theory, constructive theory, problem-based learning and case studies. I would like to focus on some of them.

Problem-based learning in a biochemistry course

Problem-based learning (PBL) is a curriculum design and teaching/learning strategy that simultaneously develops higher order thinking and disciplinary knowledge bases and skills by placing students in the active role of problem solvers confronted with a problem that reflects the real world. PBL is a very effective method to develop learners' critical thinking, self-directed and lifelong learning, problem-solving and teamwork skills (Woods, 1994).

It is problem-based learning strategies that enable us to design our course and to foster a good student-learning environment and help our students to build and improve their abilities of critical thinking, self-directed and lifelong

learning and problem solving and so on.

I would like to design a biochemistry course syllabus based on problem-based learning and start from a problem.

Overweight conditions and obesity are associated with heart disease, certain types of cancer, type 2 diabetes, stroke, arthritis, breathing problems, and psychological disorders, such as depression. Approximately 300,000 deaths each year in the United States may be attributable to obesity. 61% of adults in the United States were overweight or obese in 1999. (United state Department of health and Human Service web site). How can this be changed by diets, and why?

Following this map (Figure 1), we can design our problem-driven syllabus as description in Table 1.

Not all the information needed by learners can be obtained from the lectures. According to Table 1, only limited information can be covered by the Biochemistry curriculum. In order to solve real life problems, the students must look for every piece of information they need from many sources and learn how to use these sources to solve the problems. As teachers, in this way, we will change our role to be guiders to help the students finish their tours. We can start our activities as shown in Table 2.

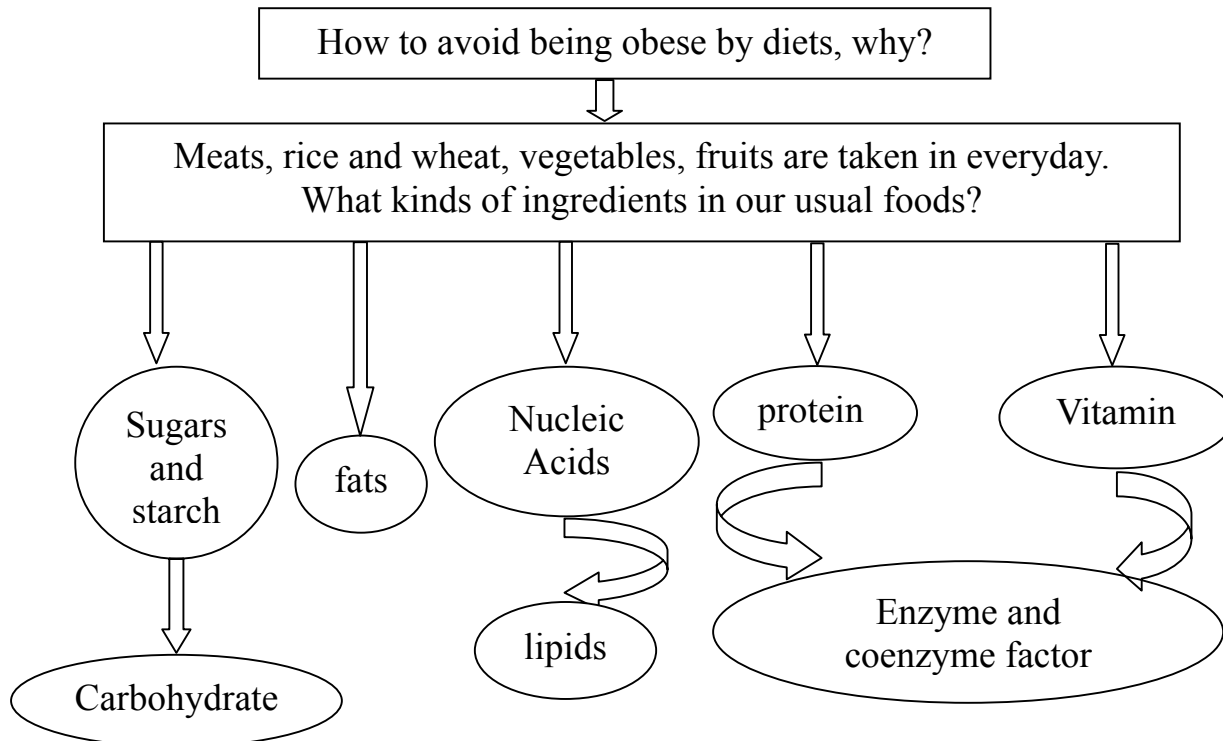


Figure 1 Problem-driven syllabus

Table 1. Problem-driven syllabus

Course Topic	Guided problems (Maybe students will address these issues)	Covered Contents
Amino Acids and proteins	Do we need to eat protein everyday? Why?	Types of amino acids, characteristics of amino acids and proteins, structures of proteins, purification of amino acids and proteins
Nucleic Acids	Do you think RNA and DNA nutritional supplements are necessary?	Types of nucleic acids, structures of nucleic acids, characteristics of nucleic acids, purification of nucleic acids
Enzymes	When a patient has Beri-beri, what is the deficiency in the diet?	Functions of enzymes, characteristics of enzymes, dynamics of enzymes
Energy	Everyone knows we can get energy from food? How do different foods give us energy? Is energy from different foods the same?	Sources of energy, production of ATP, electron transport chains, oxidative phosphorylation
Carbohydrates	It is said that eating more sugar will make you get more fats? Do you think so?	Type of carbohydrates, metabolism of glucose (glycolysis, TCA, HMP)
Lipids		Type of lipids, metabolism of lipids and fatty acids and phospholipid
Nucleic Acids metabolism	It is said a High-protein Diet will help patients with diabetes (American survey 2003). Does it make sense? What is the relationship between nucleic acids metabolism and diabetes?	Metabolism of nucleic acids and nucleic acids replications, transcription
Protein metabolism		Nitrogen fixation, metabolism of amino acids, translation, synthesis of proteins
Metabolism Regulation		Different level regulations of metabolisms

Table 2 Organization of problem-based learning progress

Procedure	Aim	Practice
The big problem is to put forward to the learners (How to avoid being obese by dieting, and why?)	Start the progress of problem-based learning	
10 students are set up in one group	Ask students to attend	Learning is learners responsibilities (for students)
To collect the outline of how to solve this problem from each group after the first week	Students must do team work to give outline how to get the answer of the question	How to collect information, communication skills, critical thinking skills, self-guide study skills (for students)
To sort of the questions or problems in the outline of each group.	Teachers must to check and help students to return to the right track	To think how to organize their problem-based learning progresses according the students situations (for teachers)
To address some problems which are related to the lecture topic and to the beginning problem given to the students before some topic lectures	Teachers give some hints and give some background information to guide students to keep on track	
In each stage every group is required to give presentation on their report.	To check how much students learn and help the teacher decide what they should do next.	To improve their students motivations and to practice their organization of information.
Final report and presentation	Help teachers to know if problem-based learning does work	

In this way students have to learn how to solve problems that are related to their daily life. Therefore students are urged to participate and in this way self-guide their studying skills, ability to collect information, ability to organize information, cooperation abilities, and so on, will be improved.

Case study

As Herreid (1994) describes, the case method involves learning by doing, the development of analytical and decision-making skills, the internalization of learning, learning how to grapple with messy real-life problems, the development of skills in oral communications, and often team work. "It's a rehearsal for life". It has a lot of

characteristics such as interesting, motivating, relevant, professionally related, engaging, requiring the learner to be active in developing ideas further. All of the above characteristics of case studies will require teachers to supply a student-centered teaching-learning environment and help students improve their various abilities.

Biochemistry is the course which can readily be exemplified by case studies. Many human diseases are related to this course. We have plenty of cases that can be posted to students. Cases usually can be complicated and might not be understood by learners having only biochemistry background information. Students have to learn more, not only from biochemistry, but from other disciplines as well. So students need to learn how to learn

more and how to learn effectively. Case studies will stimulate the interests of students. "Interests are the teachers", students would like to do their best once they are interested in something. Case studies also let students understand how they can use what they have learnt and to assess what they need to learn that they have not known before. Sometimes they should work in teams and they may also need help from another discipline. After learning in this way, they will get more benefit from the process.

Summary

A big difference between teaching in China and in Sydney in some courses is teaching style. Student-centered teaching methods are more popular in the University of Sydney than in my university, in particular in Biochemistry courses. Therefore I do not hesitate to choose the topic of my paper on a shift in teaching style. Despite my provision of descriptions of a problem-based learning exercise and of a case study, which are two student-centered teaching strategies, I still need to investigate how to use them correctly and effectively. This is a hard job for me and it is also an example for me of life-long learning. I should do something that students need to do.

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