

# Implementation of teaching strategies in a medical physiology curriculum: A shift to student-centred learning

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## Abstract

The traditional view of higher education is that student learning should be teacher-centred, and that assessment of students, teacher, or both, is unimportant. The paper outlines teaching strategies used in medical physiology in China, and suggests ways to improve it. A brief expository description of learning processes and outcomes follows, based on a comparison of short-term and long-term memory. So, reasonable modifications of teaching methods should be implemented in China tertiary science, and educators may well eventually come to accept this challenge. This process might well have a long way to go, however, finally it is hoped that a more student-centred learning approach will occur.

## Introduction

Most of higher education in China uses teacher-centred strategies, only a few universities encourage student-centred teaching. The same situation occurs in my discipline, medical physiology. The lecturer is a story-teller and student learning is essentially passive. Few professional resources are offered on the Web. Teaching and learning activities are rarely evaluated, and monotonous assessments of student outcomes are employed. Instructors are seldom aware of the effect of their teaching activities on the students themselves.

More versatile teaching strategies could be used in order to cater for students of different backgrounds. Approaches include problem-based learning (PBL), use of case studies, seminars, mini-lectures, and virtual learning environments (VLEs). Students should work in teams so that interpersonal skills are incubated via their learning activities. Teaching and learning outcomes are evaluated. Hence, the teaching may become more student-centred, and students more active participants in the learning process.

## Description of curriculum

### *Introduction to medical physiology*

The discipline includes 9 units in undergraduate teaching:

- cellular physiology;
- vasocardiac physiology;
- respiratory physiology;
- sensory physiology;
- digestive physiology;
- energy balance and body temperature;
- urinary physiology;
- neuronal physiology;
- endocrine physiology; and
- reproductive physiology.

for postgraduates:

- vasocardiac physiology;
- sensory physiology; and
- neuronal physiology.

Over the last few years, the amount of time for teaching has declined dramatically.

Year	Lecture		Tutorial		Laboratory work	
	Bachelor	Master	Bachelor	Master	Bachelor	Master
<1996	108	20-36	9	0	52	9
97-99	76	20-36	9	0	39	9
2000+	60	20-36	9	0	30	6-9

**Table 1.** The distribution of time (hours) teaching human physiology

### **Teaching activities in my discipline**

Nowadays, I use three strategies in my teaching: lectures; tutorials; and laboratory work. In the lecture course, 180-200 students are present. We all usually deliver content according to the syllabus. The instructor narrates, the learner listens, and records the information. I also use teaching charts, teaching models, acoustic materials, and visual materials (slide, film, tape and disk). Sometimes, we link multimedia demonstrations (computer aided instruction CAI). The tutorial has 20-25 students. The tutor reinforces newly acquired information. The tutor helps the students to probe typical cases. Finally, the tutor asks each group to present their comments or viewpoints. In their laboratory work, 3-4 students work in a peer group to receive critical training in animal surgery, specimen preparation and instrument operation. They perform experiments, observe aspects of life, collate data and analyse their information. The laboratory practicals are presented as written reports.

### **Biological mechanism of the learning process**

Learning is the acquisition of knowledge or skills as a consequence of experience, instruction, or both. To a psychologist, learning is an issue of individual potential motivation and a performance of personal intent. It is crucially important for an organism to survive using experience acquired from their surroundings. To an educator, good learning ought to evoke the learner's imaginative power, foster intellectual development, develop interpersonal skills, promote creative skills, enhance the ability to solve problems and boost capacity to perceive and explore the real world. However, to a biologist, learning results from information delivery to the brain via the sensory organs or receptors scattered over the body. Synapses involving in the learning process are modified in the CNS (central nervous system) and the outcome of learning is retained by memory. So, any learning activity involves synapse plasticity resulting in a new circuit being built, due to potential propagation and protein synthesis. Memories (Table 2), short term (STM) and long term (LTM), are stored (Sherwood 2002).

Characteristic	Short term memory	Long term memory
Time of storage	immediate	later; STM→LTM (by consolidation)
Capacity of storage	limited	very large
Retrieval time	rapid	slower
Inability to retrieve	permanently forgotten	relatively stable memory trace
Mechanism	involves transient modifications in functions of pre-existing synapses, such as altering amount of neurotransmitter released.	involves relatively permanent functional or structural changes between neurons such as by synthesis of new proteins.

**Table 2.** Comparison of short term and long term memory

### **Modifications to my teaching**

Students retain 10% of what they read, 26% of what they hear, 70% of what they say, but 90% of what they say as they do something (Lagowski 1990). So, students play a passive role in the teacher-centred activities, but they can become active participants in student-centred strategies. When I return to China, I will attempt to change my teaching inasmuch as reform of China Higher Education and circumstances allow.

### **Problem-based learning**

Problem-based learning (PBL) is a strategy that develops critical thinking and disciplinary knowledge bases and skills by placing students in the active role of practitioners confronted with situations that reflect the real world. The reasons for using PBL are clear. The amount of knowledge is exploding. The world is increasingly complex. Students also require self-directed and lifelong learning skills. Use of PBL will allow students to practice solving problems, and encourage skills in analytical and critical thinking. PBL integrates knowledge across disciplines, and encourages teamwork and interpersonal skills.

We will put forward one or two PBL sessions each semester. Each will consist of 2-3 weeks preparation, after which students will present a poster or talk on topics such as 'energy balance and obesity'. Some students are eager to resolve this imbalance, so the topic has relevance. After the students have resolved the 'problem', they will have identified a problem, collected materials probably from various sources, resolved the issues, and presented their resolution to a critical audience.

### **Establish a virtual learning environment (VLE)**

Lectures deliver limited information. Students need access to more information, and modern methods to access that information. A virtual learning environment might encourage student learning. Students can access these learning resources at any time and from anywhere.

VLE might include 5 sections:

1. problems from real world;
2. quizzes, theory, concepts;
3. e-library;
4. administration; and
5. a student discussion forum.

For a teacher, his/her roles might just be to put forward problems, quizzes, theory, and concepts. The University of Sydney, *WebCT* (web course tool) provides basic information to students, such as: a handbook (orientation, accommodation, financial information, safety, awards, etc.); syllabus and timetable information; news (scientific news, views, letter, alumni); and research projects (for specific groups of students). It provides links to an e-library, lecturers' notes, multimedia, online feedback, forum for discussion, and assessment (web self-quiz).

### **Re-equipment of teaching facilities**

Although many instruments are used in our laboratory and lecture rooms, some of them are old, some are new and

modern. As we renew some old instruments with computer-controlled ones, the student might pay more attention to observation of the subject matter and not simply the operation of the instruments.

**Exhibition of notes from lecturer**

Good teacher’s notes can influence student learning. In the lecture, the teacher gives information, and students attempt to record the content. Students usually cannot keep up with

the teacher. However, when notes are provided on the Web, students can focus on the teaching and spend less time writing. They can get lecture notes from the Web when they are out of class.

The lecture notes must contain well-constructed content, possibly including pictures and graphs. The notes must be clear, and they offer an opportunity to present themes in several different ways (see below for an example).

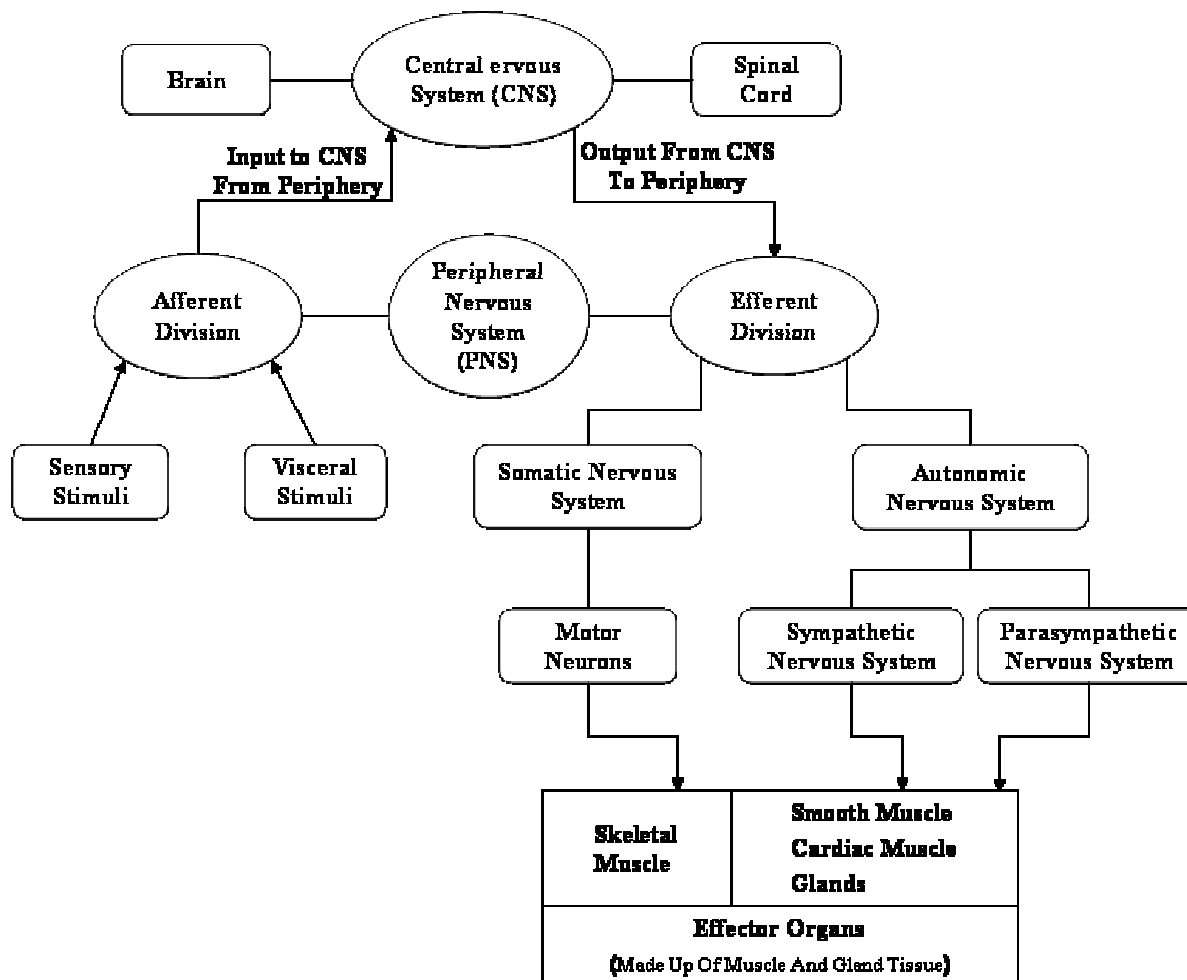


Figure 1. Organization of the nervous system

**Incubation of teamwork**

Students may explore the real world more readily if they collaborate with each other. By posing challenging problems to students, PBL teachers encourage students to work together to find potential solutions to the problem. Often the practice of PBL involves student groups determining their own work in order to resolve a question. Skills in interdependence and communication are enhanced.

**Using scientific evaluation of student learning**

In the past, we have been unaware of assessment of outcomes of teaching strategies. Few teachers, and only some supervisors, investigated the impact of teaching strategies. Scientific investigation of teaching strategies, such as through questionnaire, student comments on the Web, typical case probes, and evaluation of assessment outcomes, will enable improved methods of enhancing student learning to be identified and adopted.

**Summary**

Learning is a complicated activity. Students aim to master knowledge and skills for their career. Teachers aim to pass on knowledge and enhance student learning. The most effective approach is to encourage the student to become an active participant in their own learning process and to take more responsibility for it.

Several strategies have been shown to aide student learning. PBL is good teaching strategy, because it offers a very challenging opportunity for student learning. By using PBL, students become more self-directed, more creative, more independent and more collaborative in their learning strategies.

With progress in the scientific and technological fields, teachers have an obligation to offer students alternative

learning environments such as through the Web. For this reason, it is important for us to establish a web course tool, and renew our teaching facilities. Finally, some scientific investigation of outcomes of teaching and learning should be carried out in order to place future developments on a sounder basis which is underpinned by learning outcomes data.

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