

# Experiment Design for a Course Series of Computer Network Based on Problem-based Learning

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## Abstract (use "Abstract" Style)

This paper systematically designed all the experiments of a course series of computer network through linking of the related problems based on the relationship among the courses' contents. The design of the experiments made fully use of the existing advanced experiment equipment to enrich experiment contents and increase their difficulty levels. According to the newly designed experiments, we attempted to further enhance students' practice ability and therefore achieve the expected teaching objective.

**Keywords:** problem-based learning; computer network; experiment;

## 1. Introduction

A course series of computer network plays a pivotal role for undergraduates whose major is computer science or related. So there are many investments to the projects of course teaching and practice teaching through Project 211 and provincial Ministry of Education. In addition, all the universities have carried out a fully construction from teaching team to the experiment environment for this course series. Some universities have even implemented systematical preparation and planning through undergraduate's teaching team construction and fine course construction<sup>[1]</sup>. But how to accomplish

teaching tasks effectively and achieve the corresponding results is really worthy of further exploration.

Problem-based learning is an instructional method that challenges students to "learn to learn," working cooperatively in groups to seek solutions to real world problems. The principal idea behind problem-based learning is that the starting point for learning should be a problem, a query or a puzzle that the learner wishes to solve<sup>[2]</sup>. These problems are used to engage students' curiosity and initiate learning the subject matter. Problem-based learning prepares students to think critically and analytically, and to find and use appropriate learning resources. The method advocates active, self-guided learning and support lifelong learning skills<sup>[3]</sup>.

## 2. Computer Network Course Series

In Inner Mongolia University, the computer network course series is composed of four courses including Computer network, Network engineering, Information network security, Web programming. These courses are coherent in the teaching content, gradual in the teaching process and hierarchical in the teaching structure. The teaching order is shown in Fig.1; each edge represents example section linking course contents represented by nodes. To teach these four courses more efficient we make use of the prob-

lem-based learning in designing teaching process.

### 3. A feasible method of experiment design

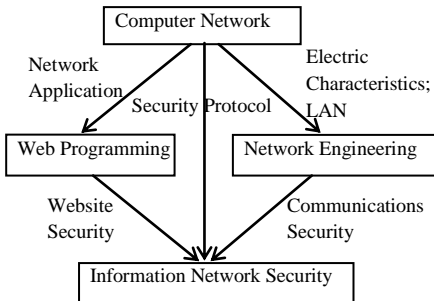


Fig.1 A sequence sketch of computer network course series

In order to combine present requirements and teaching conditions and make full use of the existing resources to train students' learning ability, we explore experiment contents' design of computer network course series.

#### 3.1. Experiment course mode

In the implementation of experiment course, there are two modes in general: separated experiment and auxiliary experiment associated with theory teaching<sup>[4]</sup>. The former is that the experiment is not taught in the same semester with its corresponding theory course. Credits of the latter are included in theory courses. The survey show the second mode is more widely used. This means that class hours of experiment of the latter is less than the former, but the depth of the knowledge is deeper than before.

#### 3.2. Existing experiment conditions

According to strong support of Ministry of Education and the third phase of the 211 Project in recent years, the school now has three network related laboratory, including advanced heterogeneous network laboratory, computer network la-

boratory (including network security) and network engineering laboratory<sup>[5,6]</sup>. All of them should be fully utilized.

### 3.3. Design of experimental contents

The majority of experiments in early network courses are validating experiment and configuration experiment<sup>[7]</sup>. In these types of experiments, students copy the contents and steps of the experiment assigned mechanically by teacher. The experiment mode is simple and dull, only to train the students' basic skills. So it is difficult to fully arouse the students' enthusiasm for studying and really improve the students' practical innovation ability. The new experimental environment, equipment and tools, which have been built up under vigorous promotion of Project 211 and Ministry of Education, have created perfect material conditions for reforming experiment contents and raising the difficulty of experiment. In the meantime, the learning method based on problem provides an effective guidance for setting of experimental contents. Through the proposed unceasingly problems, teachers can promote the students' abilities of independent thinking and innovation in practice following the experiment links.

#### 3.3.1. Design of experiment contents for computer network

Computer network is a first theory course in the network series, which is mainly to provide students with understandings of network protocol, its working principle and some basic quantitative calculation. Considering it is a professional course, the depth and breadth of theory study for this course is more than that of follow-up courses. So we designed the experiment content combining with present condition of computer network laboratory, as shown in Fig. 2. The experiment contents can help student to understand how information is transmitted from source host to destination host on network, and then

attract students to consider what main problems are when designing a network protocol.

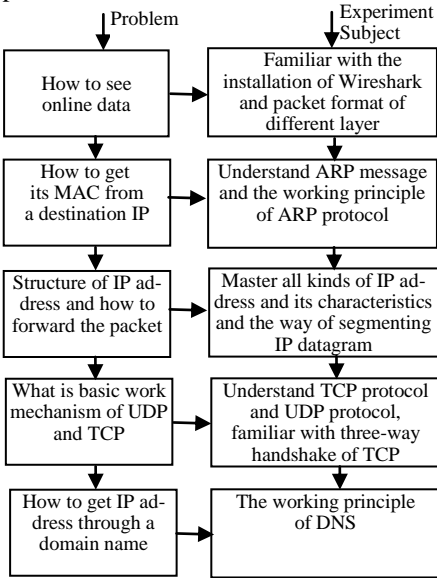


Fig.2 Design of experiment contents for computer network

### 3.3.2. Design of experiment contents for network engineering

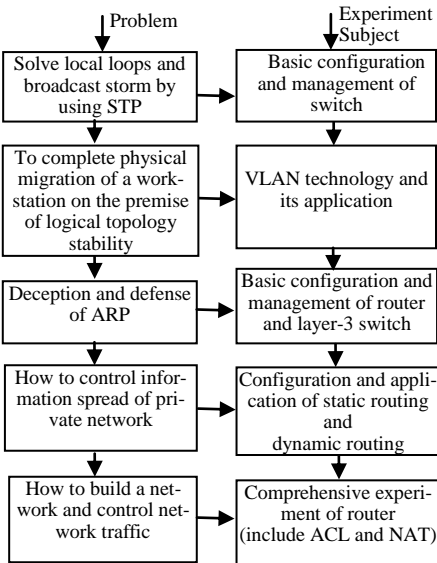


Fig.3 Design of experiment contents for network engineering

After the new lab is put into use, each experiment project of network engineering were designed in Fig.3.

Each experiment is related to network engineering's common problem in reality.

### 3.3.3. Design of experiment contents for information network security

The experiments of traditional information network security were more likely to belong to configuration type or validation type and lack of innovation and challenges on contents. On the other hand, all the parts of knowledge have not been work in the best way possible to form some comprehensive experiments because of relatively independent arrangement of experimental contents. Therefore, we took into account the relations among depth, breadth and difficulty of experimental contents, designed experiment subject under the guidelines the learning method based on problem. For several experiments, we appropriately adjusted them according to existing experimental environment and improve their difficulty

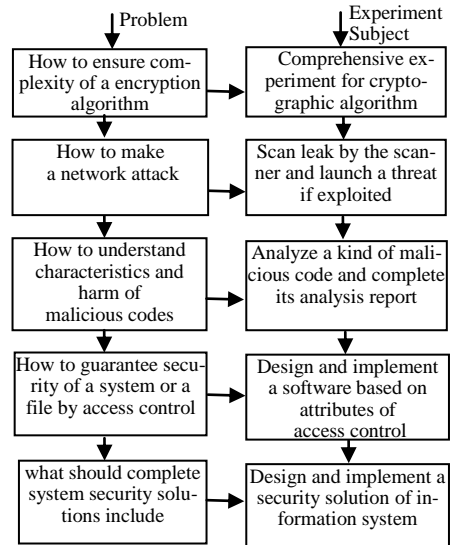


Fig.4 Design of experiment contents for information network security

and innovative. The design of experimental contents for information network security is shown as Fig.4.

### 3.3.4. Design of experiment contents for Web programming

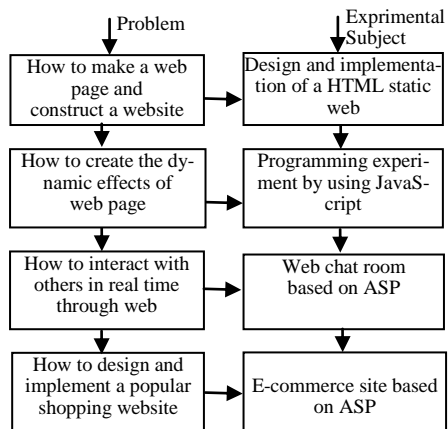


Fig.5 Design of experimental contents for Web programming

Web programming is a practical course; its purpose is to develop students' comprehensive practice ability. We start with the most popular network application - creation process of website, guide the students step-by-step to design and implement their e-commerce sites. The improved design of experimental contents is shown as Fig.5.

## 4. Conclusions

The contents of computer network course series have both deep theoretical background and urgent requirement of application-oriented qualified personnel who possesses practical skills. Therefore, we should design related experimental contents of computer network course series by putting theory into practice and further

combining region demand of Inner Mongolia. In the future, we will strengthen the contact and coordination between teachers and external units as well as departments. All this makes course teaching and social requirement produce linkage effects, so that the part of experimental contents design for the series is more reasonable.

## 5. References

- [1] Computer network. [http://curricula.imu.edu.cn/jpk/apply/teacher/course\\_previewindex.jsp?from=manager&curid=370&coursename=computernetwork&engname=&curstyle=default](http://curricula.imu.edu.cn/jpk/apply/teacher/course_previewindex.jsp?from=manager&curid=370&coursename=computernetwork&engname=&curstyle=default).
- [2] R. James, "Problem-based learning: an introduction," *The National Teaching & Learning Forum*, pp. 1-4, 1998.
- [3] L. Hua, "Implementation of Problem-Based and Hybrid X Learning in Computer Science," *Proc. Of Information Technology in Education*, pp.1230-1232. 2008.
- [4] W. Chun-xia, "Explorations on computer network experiment teaching course," *Journal of ShangQiu Normal University*, pp. 123-125, 27(3), 2011.
- [5] C. Ai-hui, G. Mei-rong, W. Heng etc, "Exploration on cultivating innovative engineering talents," *Laboratory Science*, pp. 10-14, 13(6): 2010.
- [6] Z. yi, L. Li-xie, Y. Liu, "Advocate teaching mode base on research experiment, improve quality of engineering construction of higher education," *Jilin Business and Technology College*, pp. 94-97, 25(3), 2009.
- [7] Inner Mongolia University's homepage. <http://www.imu.edu.cn>.