# Discussion on Research-based Teaching in Computer Network Management course

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*Abstract*—**Computer Network Management course is a subject where theory and practice are combined closer, aimed at improving students' ability to analyze and solve problems. But with the increasing demand for network management and new network management technology, there exits some problems for example content of computer network management course is updated relatively slowly, decline in student learning appears positive initiative, teaching cannot meet requirements of the in-depth study and understanding of the nature of network management, it is more difficult to cultivate independent ability of students to grasp the leading edge of technology and innovate. Therefore, combining the experience of network management undergraduate teaching, the article integrated research-based teaching into the teaching of computer network management curriculum, aiming to inspire the initiative of students to learn and improve quality of teaching. Practice has proved that research-based teaching model have good effect, and effectively exercise the students' scientific research and technological innovation.**

*Keywords- Research-based teaching, computer network management course, innovation, teaching*

## I. INTRODUCTION

Teaching of computer network management should pay attention to the combination of theory and practice, to improve practical ability of students[1] 。 However, the presence of program instruction to the questions: 1) Recently with the rapid development of the network, the diversity and complexity of network are increased, many the new network management techniques have been proposed. But update of the content of textbooks is far behind of update rate of the technological; 2) the learning of a lot of knowledge easily lowers learning enthusiasm of students, decreases capacity of initiation and innovation, the in-depth study and understanding of the nature of the requirements of network management cannot be met [2].3) The differences in student performance scoring system is so smaller that the true master of students cannot be reflect fully, research-based teaching mode cannot be met [3]. Therefore, the content and teaching methods of computer network management programs need to make adjustments , research-based teaching is integrated into courses in computer network management, paying attention to the combination of theory and practice, improving self-learning and innovation students.

## II. INTRODUCTION RESEARCH TEACHING

Research-based teaching is an open teaching, teachers should be teaching student-centered, teacher-guided approach [4].Research-based teaching is based on the real problems from practice, allowing students to learn in a realistic context, it is to train the students learning ability, problem-solving skills, teamwork skills and ability to innovate , enhance the students' adaptation to future work capacity. Research-based teaching method has the following characteristics:

1) creation and reality is similar for teaching situations, stimulating interest of students in learning and enhancing ability to adapt and work. When students can look at things from a different perspective, the situation of problem can attract and maintain their interest so that they actively seek solutions to problems. In the process of problem-solving, organizational meetings, report writing and preaching make organizational skills of students, communication skills, teamwork skills training is closer to the actual work situation, it lays a good foundation for students to adapt to the working environment for their future more quickly.

2) By solving open-ended questions, learning ability and creativity of students are trained. Since there is no standard answer, the answer based on each person's accumulated knowledge and experience is personalized and creative. Measurements of the job quality standards for the students to complete is a reasonable degree of design. Therefore, the key of research-based teaching is to learn how to learn, students master the knowledge hidden behind the question, so that students learn more active and meaningful construct in nature.

3) Behaviors of the teachers and students in the classroom is transferred. In the methods of research-based teaching, teachers' main job is to design the problems, then teachers stimulate students to think, design, summarize and report ,and work is completed by the conscious of students. Therefore, in class teachers are not manipulator or controller, but a facilitator/promote/mentor of student learning. This change resulted in the migration on status of teachers and students in the classroom - from traditional teacher-centered to student-centered migrate. Relations of teachers and students reflected in more cooperation and communication.

Therefore, the article will integrate research-based teaching into computer network management courses, introduces teaching content, implementation process of research-based teaching, and made a scoring criteria.

## III. THE COMPUTER NETWORK CURRICULUM

According to the design curriculum system, needs of teaching and current major network management curriculum materials [5-8], the main content of the course as shown in Table 1:

TABLE I.    NETWORK MANAGEMENT CURRICULUM

| No. | Teaching content | Teaching requirements |
|-----|------------------|------------------------|
| 1 | Development, type and operational characteristics of network technology, especially in the modern mobile communications network,AD HOC network , sensor network, Vehicular ad hoc network. Show the necessity and significance of network management. | 1) be familiar with the historical development of network technology. 2)understand the characteristics of revolutionary technology to produce, understand the field of science and technology innovation networks. 3)master technologies and business characteristics of a variety of network, as well as important differences between the classical Internet and network technologies and services |
| 2 | Hierarchical network management system, system components and key technologies, network management explain in detail the five key features: performance management, fault management, configuration management, accounting management, and security management. | 1) familiar hierarchical network management system, in-depth understanding of the composition and role of the internal network management system. 2) master five important of network management : concept, purpose, parameters and content. |
| 3 | OSI concepts and OSI network architecture, target and the theoretical system of the OSI network management, OSI network model, structure and basic functions, more information about Public Management Service of OSI. | 1) in-depth understanding of the content and objectives of the OSI network architecture for the future Internet network architecture and understand the differences between them, lay the foundation. 2) master OSI network model and structure, understanding the basic functions of OSI network management. 3) master public administration of OSI network management information services. |
| 4 | 1)Concepts and models network management MIB of SNMP. 2)Relationships between groups. 3)Objectives and business characters of Internet network architecture, 4)Analyze weaknesses in the Internet architecture, then realize the importance and urgency of SNMP. 5)Understand the difference between SNMP and OSI network management. | 1) grasp the concept of model and SNMP community. 2) master the content of SNMP content repository, further understand architecture and technical characteristics of the Internet. 3) understand the importance of the difference between SNMP and the OSI network management. |
| 5 | 1)Limitations of SNMP network management. 2)Introduction of remote nettwork monitoring RM-ON and content repository of RMON . | 1) grasp the concept of the model as well as groups of RMON. 2) master repository content of RMON . 3) grasp the difference between RMON and SNMP. |
| 6 | According to information furnished by the students, have a class discussion, including Management of AD HOC networks, sensor networks and Vehicular Ad Hoc Networks | 1) master models/content/key technologies about AD HOC networks, sensor networks, the Internet of things. 2) master links and differences between AD HOC networks, sensor networks, networked and classic Internet. |

| NO. | Hours | Teaching methods | Corresponding target |
|-----|-------|------------------|----------------------|
| 1 | 4 | Teaching | 1 |
| 2 | 4 | Teaching | 2 |
| 3 | 4 | Teaching | 2 |
| 4 | 8 | Teaching/Discussion | 2 |
| 5 | 4 | Teaching | 2 |
| 6 | 8 | Teaching/Discussion | 3 |

This course is one of the specialized courses in computer science and technology direction. The task of this course is to enable students to master the OSI, Internet, network architecture, the five important functions of network management(performance management, fault management, configuration management, billing management, safety management) and the key theory and technology characteristics; the OSI network management protocol (CMIP, Internet network management protocol SNMP and MIB2 function group; the remote network monitoring RMON1 and RMON2; and from a management perspective, to understand the demand of the network key technology and challenges further, especially the new requirements which are put forward by the Internet of Things and Vehicle Ad-hoc Network for network management.

## IV.    SPECIFIC IMPLEMENTATION AND SCORING CRITERIA OF RESEARCH-BASED TEACHING

### A.  *Specific implementation of research-based teaching*

Innovation not only depend on the acquisition of knowledge, but also dependent on the accumulation and ability of direct experience of undergraduate training largely, so in order to strengthen the implementation of the research-based teaching, implementation of research-based teaching is very important. Process and goal of research-based teaching as shown Figure 1.

1) The combination of theory and practice: development of innovation capability, active learning and practical ability of a student should be emphasized during the learning, so when undergraduate is in classes, they should not be merely passive recipients of knowledge and ideas from the teachers, but should take the initiative to pay attention requirements of companies for students. To enable students to better understand the required standards of corporate personnel, some companies should be allowed to come to school, talk to students about their company against this course of study requirements, which can stimulate students' interest in school and this course attention.
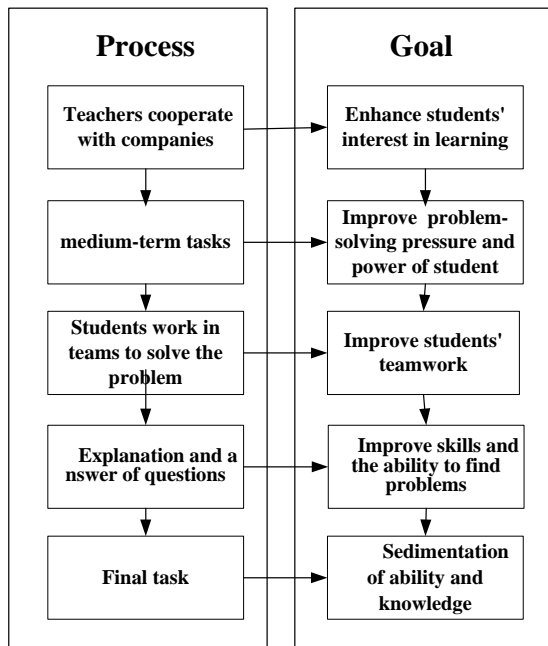
| Process | Goal |
|---|---|
| Teachers cooperate with companies | Enhance students' interest in learning |
| medium-term tasks | Improve problem-solving pressure and power of student |
| Students work in teams to solve the problem | Improve students' teamwork |
| Explanation and answer of questions | Improve skills and the ability to find problems |
| Final task | Sedimentation of ability and knowledge |

Figure 1.  Process and goal of research-based teaching

2) medium-term tasks: teachers and company personnel interspersed with talk of this course , making students apply theory to practice. According to company personnel and their lessons to learn in this course, undergraduates learn the theory by conducting with their own points of interest. After learning courses of four weeks , teachers and company personnel discuss the tasks assigned to group of students, all tasks are the same. Through this mission, students accumulate  the knowledge, because the task requires a certain contact with the company, so the pressure for students complete tasks is to improved.

3) Problem Solving: Students assigned its own team to 3-5 persons as a unit, each group elected leader to complete assignments. For tasks assigned by the teacher, each person must post own views through constant exchanges between the team. According opinions idea of everyone, the leader makes decisions to develop a complete set of mission planning book, so that students' communication skills and teamwork are enhanced.

4) Solution Respondent: accordance to mission planning book, each member of the group collects data about research to make research reports. Members of the group handle the report together and then report to the teacher and other students. Students will ask some questions  from the value of the type, the report's research methods and content and reliability of data collection . According to the students' questions the respondents explain their task module. In this way we can improve the ability of students to identify problems, thinking skills, communication skills in other public places.

5 ) Final task : In order to achieve the goal of education to cultivate innovative talents, Graduation Thesis is an extremely important comprehensive training for professional practice so that the experience about research-based studying of students is reflected fully by a close professional and practical design or research project. So according to the Graduation Thesis, teachers assign the students of a big job about the course, and recommend some references to students. Students look for a point of interest from these references to open a topic. According to the topic, students first discuss and exchange their ideas with the other students, and start their own independent investigation data. Second students exchanges with teachers, teachers judge the topics, if the idea of the topic is good or right , the teachers should give some guidance about thesis writing. At the end of the semester, knowledge and learning skills students obtained throughout the semester is accumulated, improving ability of practice and problem-solving.

B.  Scoring criteria

Grading plays a guiding role for students. We change the traditional summative assessment model and combine assessment session adapted to research-based teaching.The total score of the course consists of two parts: 1) the score about practice , encouraging students to solve practical problems [9]; 2)Arrange students to read research papers related to network management，  the number of papers is 2 or 3 (e.g. paper about VANET). Students must write commentary of the book review according to format of the normal paper, and put forward their views. We will score the commentary by percentile score, the case of scoring criteria as shown table 2.

TABLE II.        SCORING CRITERIA

| Section | Detail Requirement | | Score |
|---|---|---|---|
| 1 | All author information of paper | Including the school where the author works, and his/her study field and home page. Note: Search content should be specific. | 5 |
| | Translation of abstract | Translation is correct. | 10 |
| | Paper Introduction | Including：<br>1) specific research issues<br>2) algorithm research<br>3)simulation tools and environment<br>4) conclusion<br>5) contribution of the paper<br>Note: Including above five parts certainly，summarizing each part(each part is 4 points). | 20 |
| 2 | Ideas about the research field of VANET | 1) The techniques of VANET interest you most | 5 |
| | | 2)The problems this technique solves, and the scene it is applied in. | 20 |
| | | 3)The framework of technology | 20 |
| 3 | Conclusion | Summarizing what you have learned in the network | 20 |

| | | management course. | |
|---|---|---|---|
| **Note**: Translation is correct. Ttypesetting is well organized. | | | |

| Section | Remark |
|---|---|
| 1 | 35 points in total， 4 pages or more |
| 2 | 45 points in total， 2 pages or more |
| 3 | 20 points in total， 3 pages or more |

## V. RESULT

The class has 63 students, each student is numbered according to 1-63， we score for each student's work in accordance with the standard score by blind trial strictly. In our scoring criteria, the first part reflects the student's ability to grasp and study skills, the second part reflects creative ability of the students and its highest score is 45 points to improve the students ability to grasp the forefront of technology. Each student's score and the distribution of scores as shown Figures 1 and Figure 2 respectively.
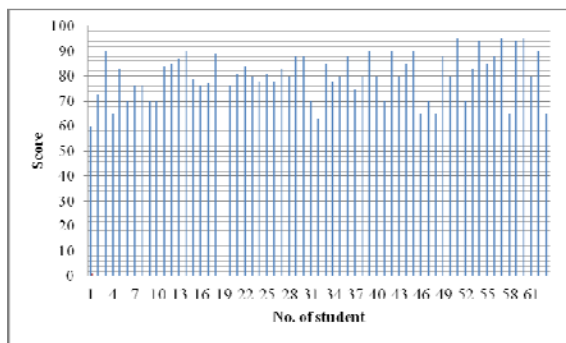


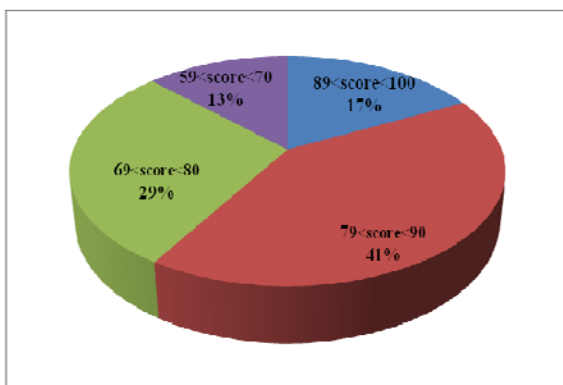Figure 2. Scores of students



Figure 3. Distribution of Score

From Figure 1, we can see that score of each student is 60 points or more, the scores are divided into four intervals i.e., (59,70) (69, 80) (79,90) (89,100). Figure 2 shows that the number of students in (79,90) is maximum and its

percentage is 41% ,the students in (69, 70) is followed(21%）(89,100) and (59,70) are ranked third and fourth. Combined scoring criteria we can analyze that at the initial stage, research-based teaching mode have a good effect at undergraduate teaching, and to get good results. In order to achieve the ideal state, we need to practice and explore in the future.

## VI. CONCLUSION

With the update of the network management knowledge quickly , teaching is no longer to teach students only textbook knowledge, but is more importantly to train students in research and innovation. Acquirement of knowledge for students not only depends on the forced indoctrination and training of teachers, but also depends on active exploration and thinking for yourself in the teacher's advocate. Therefore, this article combines experience of undergraduate teaching in network management, integrates the research-based teaching into teaching process of computer network management. We introduce teaching content, specific implementation of research-based, and made a scoring criteria. Practice has proved that research-based teaching model has good effect, and effectively exercise the students research and technological innovation.

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