Course Design and Project Evaluation of a Network Management Course Implemented in On-Campus and Online Classes

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ABSTRACT

This article describes a course framework designed for a network management course in information computer technology education. A combination of four learning techniques was used as the pedagogical method: lecture-based learning, lab-based learning, inquiry-based learning, and project-based learning. The article also discusses in detail the project implemented in the course. A formal evaluation of the project has been carried out for both on-campus and online students. It demonstrated that the project achieved a successful outcome and was a highly effective learning experience for the students.

KEYWORDS

Course Design, Inquiry-Based Learning, Lab-Based Learning, Lecture-Based Learning, Network Management, On-Campus, Online, Project-Based Learning

1. INTRODUCTION

Today’s network infrastructures include hundreds or thousands of network devices. Network management involves a wide range of tasks to ensure that the entire network and individual devices are both running smoothly. The tasks include gathering the statistics of network traffic, recording network topology changes, adjusting network configuration, analyzing alert notifications, and monitoring any unusual events or equipment failures.

So far, there is no universal standard to group these network management tasks into categories. Some classify the tasks into network provisioning, network operation, and network maintenance (Burke, 2004). Others add one category, network administration, to the above three groups (Clemm, 2007). Among different categorizations, FCAPS is probably the most popularly used network management reference model. It sorts the network management tasks into the following categories: fault management, configuration management, accounting management, performance management, and security management (M.3400, 2000).

It is obvious that network management covers a broad range of subjects related to the management of networks themselves, along with services running over entire networks. Therefore, it has become challenging for instructors to teach these subjects within the field of network management successfully. In the past, academic educators have tried to employ techniques to teach the fundamental concepts and principles of network management in classes. For example, Markovits and Braun used traditional teaching methods (lectures, assignments, on-line quizzes and formal exam) to allow students to develop their understanding of planning, provisioning, operating, and maintaining services of networks in a telecommunication network management course (Markovits & Braun, 2006). Meanwhile, Wu et
al. integrated research-based teaching into a computer network management curriculum to teach students textbook knowledge and train students in research and innovation (Wu, Chen, & Liu, 2014).

Besides the theoretical aspect of computer network management, realistic hands-on experience should also be offered so students are able to apply theory to real-life network management platforms. A variety of strategies have been adopted to create a learning lab environment for computer network and system management education practices. For example, a combination of physical devices and virtualization technologies has been employed to make the learning of computer network and system management more effective and efficient (Yalcin, Altun, & Kose, 2015). In order to allow students to study the properties of a real network management platform, simulation-based approaches were adopted to simulate network devices and different patterns of management data (Pattinson & Dacre, 1998; Pattinson, 2000). In addition, commercial software and freeware were used within the context of network management courses (Beasley & Floyd, 2014; Hernández-Leo, Bote-Lorenzo, Asensio-Pérez, Gómez-Sánchez, Villasclaras- Fernández, Jorrín-Abellán, & Dimitriadis, 2007; Luo, 2010; Ulema, 2008).

In order to provide students with a comprehensive study within the context of network management, we combined four learning techniques (lecture-based learning, lab-based learning, inquiry-based learning, and project-based learning) as the pedagogical method in a network management course offered in Information Computer Technology undergraduate program in the Department of Technology Systems at East Carolina University.

During the lecture sessions, relevant learning resources were identified and well-organized. Lecture-based learning helped students acquire central concepts within the course discipline. In addition, labs related to the learning resources were designed for hands-on practice. These labs enabled students to build a deeper understanding of course content while developing experimental and problem-solving skills. Lastly, the course included examples of inquiry-based learning and project-based learning. Students were engaged in inquiry-based learning by reading articles weekly. The objective of this reading comprehension strategy is to broaden students’ perspectives of network management and develop students’ abilities to grasp key ideas in the articles. We expected the project would enable students to successfully engage in the exploration and investigation of specific issues related to network management.

While lecture-based learning served as a teacher-centered teaching strategy, lab-based learning, inquiry-based learning and project-based learning acted as student-centered learning. These four learning techniques complemented each other and thus each technique proved to be an indispensable element of a network management related course. In this paper, we describe each technique in detail. In addition, evaluations of the project’s effectiveness have been carried out. We discussed the project implementation and the survey results. They disclosed that the project achieved a successful outcome and was a very effective learning experience for the students.

This paper is organized as follows: Section 2 presents the course framework designed for the course. Section 3 describes project requirements. We then demonstrate the survey design, followed by a discussion of results and findings. Finally, we conclude our work in the last section.

2. COURSE FRAMEWORK

A major goal of this course was to prepare students with both theoretical knowledge and practical skills to operate, administer, maintain, and provision network systems. Upon completion of the course, students are expected to be able to perform tasks related to the concepts and technologies of computer network management. To achieve this goal, the course was designed to include four learning modules as shown in Figure 1. They were lecture-based learning, lab-based learning, inquiry-based learning, and project-based learning. We expected this combination to provide students with an effective learning experience and lead to academic success.
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