Exploring Students’ Experiences in Using a Physical Laboratory for Computer Networks and Data Security

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CNT 4504 – Computer Networks

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15 April 2022

The paper done by faculty at the University of Novi Sad in Serbia explores more on the topic of data and computer network issues as it is becoming more common in a profession setting, such as in an education setting and workplace. It also explores the idea of implementing computer network security curriculum and personal experiences for students to prevent certain issues from arising in these profession settings. The purpose of this paper is to perform a qualitative study on exploring the experience students have when placed into a physical laboratory dealing with data security and computer networks. The experiences identified would create a framework of an improved on previous learning material and laboratory work. Before preforming the study, the researchers looked more in-depth into undergraduate curriculums developed by the Institute of Electrical and Electronics Engineers (IEEE) and have learned that there are many topics on security the IEEE establishes as beneficial for students, but their operations can be costly for universities. Research into VPNs was also implemented into this study as the idea of VPN is to provide a secure anonymous network for users. For background research, the faculty began looking into other related works, such as tools used in network security education such as OPNET Modeler, NEMESIS, and VMWare virtual machines; all provide ways to experience computer networks in a laboratory type setting for students to have hands-on experience and provides models for implementing education related to the topic. There have been plenty of studies through engineering topics that have involved students through engineering disciplines dealing with the use of virtual machines and labs to practice working on networks in virtual settings. Researchers have also investigated digital libraries containing books about computer networks and data security, but found out that these books are rare, especially the ones also discussing student’s experiences when dealing with these concepts. With this background research and research performed by the faculty, it is revealed that there are many gaps when talking about computer networks and data security and these concepts in relation to the student. Therefore, the research conducted this study to fill in these gaps and provide students with real-life experiences to be better aware about computer networks and data security.

Major ideas presented in this research study include the use of technology in educational settings and improving on previous curriculum to have students better equipped in professional settings. The study has noted the use of tools that were recommended by certain networking courses for graduate degrees that will be discussed later when talking about tests performed by the researchers. The exercise performed in the study is a VPN exercise, which is one of the tools discussed that students need more experience with. The VPN exercise was divided up into two laboratory sets: one based on Cisco routers, and one based off Allen–Bradley Routers. This exercise points out the major idea of technology that the researchers believe should be implemented, and the study will further prove this point. Other major idea presented in this research study the use of learning materials to gain more knowledge with the addition of experience. As previously mentioned, there is little to no books or other material solely related to computer networks and the technology used that is ideal for students. For this study, researchers have comprised learning material through course lectures to learn more about how students will use it. Other major ideas include using this learning in certain scenarios related to networks in data security, as well as solving the problems that arise in those scenarios. These ideas are to discuss how to improve on the experiences students deal with when dealing with computer networks through physical laboratories.

Before the study, the researchers created the laboratory sets of Cisco routers and Allen–Bradley Routers. Students were asked to complete a series of tasks to which the course lecturer would ask students to explain their results. There were eight steps in total, configuring the routers for both sets, generating traffic and unencrypting traffic analyses, setting up the VPN tunnel, and finally generating traffic and unencrypting traffic analysis for the tunnel. For this part of the study, four students were divided into groups of two for both laboratory sets. The researchers collected data through an interviewing process where students would explain their experiences, and their words would be transcribed imported into the software tool QDA Miner Lite. The transcripts were analyzed to where researchers picked out five categories relating to certain concepts and experiences that would be connected to create a new learning framework. This framework was examined through member check interviews, which consisted of students who participated in the laboratory sets, to see if the framework truly reflected off their experiences. All research performed was used in creating the educational framework that contained the categories comprised of students’ experiences. Researchers have learned that with how complex the data security and computer network, it creates a complex framework for educational purposes. The complexity created these five categories: experience through implementing VPNs, experience in using learning material, experience in solving problems, experience in using scenarios for learning, and experience using laboratory sets. With learning material, they’ve established that it provides students the necessary information for network concepts. With solving problems, it was revealed that with a lot of problems going on through the laboratory sets, students have experienced a positive outcome when solving them. Researchers also highlighted the importance of learning scenarios as they can gain experience, especially in this setting as hardware cost are expensive when learning is done in a private setting. Laboratory sets are part of that real-life experience, providing students equipment and tools that will be necessary in their professional careers. Implementing VPNs, according to the researchers, is necessary as many concepts related to computer networks use VPN to understanding said concepts. Through their research, the faculty recommended the following implementations: improve learning material by including a review of topics, additional material for students wanting to learn advance topics, improving laboratory equipment by providing new modern high-tech equipment and equipment that would help for advance topics. All of this is to provide a better education curriculum in for students in computer networks and data security after being proven to not have a lot of support due to its complexity.

From this peer-reviewed article, I’ve learned about the complexity of create a framework for any educational concepts. There is a lot of background research, research, experimenting, and execution that is involved through the process. Computer networks and data security appears to be an underappreciated field of study due to its complexity; there’s a lack of study material as was discussed through background research and a lack of opportunities for students to have hands-on experience on these concepts. There are curriculums that do try to cater to cater to this hands-on experience have costly operations; it’s something that I don’t think about as a student. I believe that cost shouldn’t be hindering a student’s experience if it will prepare them for their future careers. However, it is a problem that many universities experience, and this study was performed to find new ways in delivering these concepts to students. Computer networks and data security are more important than ever because of the rise of the internet and the transfer of data from one system to another; we need security more than ever. This peer-reviewed article has highlighted the importance of computer networks and data security and the importance of having students better prepared for dealing with situations that might arise when working with computer networks. I believe that’s why the new framework is so complex; it’s the idea of these concepts being complex overall and having to ensure that students can fully grasp them. Through this article, I’ve also learned more about VPNs and laboratory sets as I’ve never heard about the Cisco and Allen–Bradley Routers and was able to learn what they are and how they functioned for this study. I also grasped a better understanding of VPNs and how they’re more than just protected browsing; VPNs help students and other users grasp certain concepts relating to computer networks. Hopefully with this study, there will be better curriculums implemented for students wanting to go into data security or computer networks in the future as their career as something so big is so underappreciated.

Work Cited

Stojanov, Zeljko, et al. “Exploring Students’ Experiences in Using a Physical Laboratory for Computer Networks and Data Security.” *Computer Applications in Engineering Education*, vol. 25, no. 2, Mar. 2017, pp. 290–303., https://doi.org/10.1002/cae.21797.