

Faculty Innovator Grant 2017
Center for Learning and Teaching

Final Report Form

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Project Title: (10 words or less)	Creating a Video based Cybersecurity Hands-on Labs Learning Environment for Cybersecurity Education

Other faculty:

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1. Describe the specific teaching and learning issues being addressed by the proposal.

Cybersecurity is a national priority education area. In cybersecurity education, hands-on labs play a significant role to help students understand concepts and technologies. However, teaching hands-on labs using the conventional text and picture based lab manuals is a great challenge, in particular for distance learning students. In this project, we have developed video based lab manuals, using a widely used video editing software Camtasia, and designed a web annotation system to significantly improve teaching and learning of hands-on labs in cybersecurity courses, particularly for distance learning students.

2. Describe the revised specific teaching and learning issues being addressed by the proposal (if applicable):

N/A

3. Describe the development activities involved addressing the learning or teaching issue.

To achieve our objectives to improve teaching and learning for hands-on labs in cybersecurity courses, we have developed self-paced video based lab manuals and materials, including video clips for the steps in a hands-on lab, so that students can choose to view the steps they had difficulty with. We have developed an annotation based lab feedback website and integrated the videos with this website, so that student can easily enter notes and ask questions if they don't understand the actions in a video clip of a lab.

We have developed video materials for three comprehensive cybersecurity hands-on labs, Network Tracing, Firewall, and WiFi Password Cracking, to help students to master cybersecurity principles and skills to defend cyber systems. In the Network Tracing lab, students learn how to use network tracing tools such as Wireshark and TCPdump to capture and analyze the network traffic trace to examine possible ongoing attacks and anomaly of network activities. In the Firewall lab, students learn to configure a firewall to protect a network from attacks of external networks or Internet, using an open source firewall package, pfSense. In the WiFi Password Cracking lab, students use dictionary attacks and brute force attacks to crack the Wi-Fi Protected Access (WPA) passphrase of WiFi networks, using the aircrack-ng utility.

We have used the Camtasia software, <https://www.techsmith.com/camtasia.html>, to develop video clips for four hands-on labs. Camtasia is a widely used video editing software to create video tutorials and presentations directly via screencast, or via direct

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recording to Microsoft PowerPoint. For each hands-on lab, we divided it into multiple steps. For each step, we created a video clip. The video clips are then edited into a DVD style video file with a menu. A student can watch the entire video or select a certain video clip for one step. This allows a student to complete a lab through multiple stages. As completing one entire lab can take 3 or more hours, the students have the flexibility to carry out one part of the lab at each stage, to better fit their schedule.

4. Describe the learning outcomes attained by the project.

This project has accomplished the following learning outcomes:

1. The effectiveness of using the self-paced video based lab manuals has been demonstrated, compared with conventional text and picture based lab manuals. The developed resources greatly increase distance learning/online students' ability in completing the required hands-on cybersecurity labs.
2. The exemplary self-paced video based lab materials have been created and can be used by others in teaching and learning.
3. Students learning experience and satisfaction on cybersecurity hands-on labs have been improved, measured by survey questionnaires.

5. Describe unexpected outcomes, if any.

N/A

6. Describe the impact of the completed project on your colleagues, department, college, or community.

The self-paced video based lab manuals significantly improved teaching and learning in cybersecurity courses taught by faculty affiliated with the ODU Center for Cybersecurity Education and Research. They also increased ODU's competency in teaching cybersecurity and enhanced ODU's application for accreditation to become a National Centers of Academic Excellence in Cyber Defense. Our developed approach and method can be used as a model for other instructors to develop cybersecurity hands-on labs to support learning and teaching of cybersecurity principles and technologies. In addition, the proposed approach and methods can also be used by instructors in other fields such as business, engineering, and science to teach concepts and knowledge in their own subjects.

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7. Describe how the project can be a model, template, or prototype for use by other instructors.

Our developed approach and method can be used as a model for other instructors to develop cybersecurity hands-on labs to support learning and teaching of cybersecurity principles and technologies. Our project activities are well aware by the faculty of the ODU Center for Cybersecurity Education and Research. They can directly use our developed video lab manuals and hands-on labs in their courses. Moreover, they can adopt our approach and methods to develop video lab manuals for their own hands-on labs. The details about our approach and methods are given to the faculty. The proposed approach and methods can also be used by instructors in other fields such as business, engineering, and science to teach concepts and knowledge in their own subjects.

8. Describe the technology used to help address the issues described in the proposal.

We have used the Camtasia software, <https://www.techsmith.com/camtasia.html>, to develop video clips for three cybersecurity hands-on labs. Camtasia is a widely used video editing software to create video tutorials and presentations directly via screencast, or via direct recording to Microsoft PowerPoint.

9. Describe products, if any, that are a result of the project.

This project produced three comprehensive, illustrative video based lab manuals for three corresponding hands-on labs. In addition to the cybersecurity courses taught by the faculty members, the videos have also been used in our summer camps hosted in summer 2017 for more than 40 local middle school students. Those video lab manuals have been demonstrated very helpful for students to understand the materials, and complete the hands-on labs. In particular, the videos tremendously helped out the students who fell behind in the camps. They can watch the videos at home to make up if they got lost during the class.

10. Describe the future plans for this project, if any.

We plan to continue to expand the developed hands-on labs and the video based lab manuals. Moreover, we plan to increase the reach to the freshmen students and prospective students, the local high school students, through outreach activities. We will continue to develop the video based lab manuals for our future summer camps.

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11. Attach a financial report with updated Budget Plan Matrix.

Final Budget Matrix

Budget Item (equipment, personnel, software, etc.)	Qty	Total Cost	Source of Funds	
			Amount from FIG	Amount from Other Source
Faculty stipend	2	\$2000	\$2000	
Equipment	2	\$995.80	\$995.80	