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**Flipping the Online Security Classroom – Improving Retention of Security Student Pipeline through Early Intervention**

Objectives and Methods. There is a shortage of talent to meet the economic and national security threats posed by cyber attacks, which is expected to worsen as potential students migrate away from information technology fields. The proposed project addresses this national need by using innovative teaching methods (flipped classrooms), developing shared resources (cloud-computing laboratories), helping faculty stay current with practices and methods in the field (training for trainers), and creating a pipeline from community colleges to 4-year schools in cyber security education.

Intellectual Merit. This project combines the concept of “flipping the classroom” with cyber security education in blended learning and online environments. In the flipped classroom students engage in online course modules on their own and work in virtual labs collaboratively under instructor supervision through various modalities including individual video chats, group video chats (e.g. Google Hangout), simulated virtual environments (e.g. Second Life) or the classroom itself. Flipping the classroom provides greater opportunity for active learning for students and increases enthusiasm for continued learning. Technological and resource barriers make it difficult to develop laboratories for the hands-on learning needed in cyber security and digital forensics. Technology constantly changes requiring recurrent maintenance costs in addition to initial hardware and software investments and yearly licensing fees. Also, educators need to remain up-to-date on tools and techniques to create relevant practical exercises for students. This project provides a replicable system that will amortize costs and resources and allow multiple institutions to sustain and support a successful cyber security and digital forensics program, starting at the community college-level. Cloud technology is used to create a remotely accessible cyber security and digital forensics laboratory environment and tools for students across multiple community colleges. In addition, a train-the-trainer program allows instructors to share the load of developing lab exercises and expertise in tools. This solution is cost-effective by amortizing development and maintenance costs over a large pool of students. Over the past 8 years, we have developed and implemented a teaching hospital model for information security incorporating both online and face-to-face (F2F) learning. This new “virtual” teaching hospital model is based on our previous experiences (both pedagogic and logistic). Building context of real problems goes a long way towards maintaining student
enthusiasm, and flipping the classroom helps immensely in building this context by allowing valuable instructor time to be devoted to hands-on training and active learning for students. A variety of interactive techniques are linked together to promote greater understanding of course material. The cloud-based laboratory tools and activities will improve student understanding through hands-on experience, and this approach will reduce the cost of delivering education while ensuring high academic standards and improving educational quality.

Broader Impacts. This project increases accessibility to state-of-the-art tools to institutions that would otherwise lack resources to obtain them. The project broadens the impact of our work to community colleges that provide more than half the undergraduate education in the country. The student population of community colleges tends to be ethnically, racially, and economically more diverse than four-colleges and universities. Thus, this project will broaden participation in cyber security. The project will also benefit society by increasing the talent pool for the cyber security profession. Successful development of cloud computing laboratories for this purpose will result in best practices and lessons learned for other disciplines and institutions.