

# Information Security Education: A Competency Based Approach and Exemplification

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**Abstract** – *Information security is a topic of frequent discussion within the larger community of information systems (IS) and information technology (IT). The high cost of information security breaches heightens the importance of information security within all levels of an organization. However, despite this reality a need exists for qualified information security professionals to fill these important roles within organizations. This paper presents a competency based approach to information security education. Competency based education provides a mechanism to allow individuals to obtain an education within a particular field not by completing a certain number of seat hours, but instead by demonstrating competency in the required subject matter. This model allows individuals to accelerate through the areas that they are already competent in, while slowing down to gain competence in areas where they may be lacking such skills. Additionally, this paper also presents an exemplification of how a degree program in information security can be successfully implemented utilizing a competency based approach.*

**Index terms** – **Competency based education, information security training, security education, IT security education, distance IT security education**

## I. INTRODUCTION

Information security plays an important role in organizations of all sizes, public and private. While information security is not a new field, the increasingly higher costs of security breaches [1] have placed heightened focus on the need for information security within an organization [2]. This has created a demand for qualified security professionals that are able to fulfill such security positions within organizations. However, providing training and education for security professionals can be a challenging feat to accomplish [3].

One such reason is that most information security professionals are spawned and grown from the ranks of general information technology (IT) staff. Even more are those who currently serve as technology professionals but wish to enter the field of information security. The challenge however exists in acquiring the necessary skills to make the transition from an IT generalist to an IT security professional [4]. Individuals who have extensive experience in IT may already hold a large amount of the foundational knowledge which is required for a security professional. Yet many IT professionals may hesitate to

embark an educational journey in IT security where they are required to complete coursework that they are already familiar with. Completing coursework that students may already have competence in increases the amount of time needed to complete the program and the overall program cost.

As such, a competency based approach provides a mechanism for which individuals can learn in areas where deficiencies exist, but accelerate through areas in which they are already knowledgeable by demonstrating their competency [5]. The goal of competency based education is to provide an educational model where individuals gain a degree not by completing a certain amount of credit hours, but by proving competence in the necessary areas [6].

This paper will discuss the importance of information security education, present a competency based approach to such education and also identify an institution that has successfully implemented such an educational approach.

## II. IMPORTANCE OF INFORMATION SECURITY EDUCATION

There are many reasons to be concerned with information security within the organization. Information security breaches can be a cause of extensive losses and can impact an organization in various other manners [7]. The immediate financial and data losses may appear easy to quantify. However, the long lasting effects on the reputation and future confidence in an organization after a security breach can be far reaching and devastating [8]. The media has demonstrated an interest in various aspects of information security such as identify theft, cyber-warfare, hacking and privacy breaches.

The increased public awareness of the importance of information and privacy at all levels has forced even small organizations to take steps to safeguard their enterprise [9, 10]. However, organizations face many challenges when trying to provide secure yet accessible technologies for employees or customers. The rapidly evolving nature of IT security creates a constant battle between the organization trying to secure its resources and those who are determined to compromise them.

Experienced and properly trained security professionals are hard to come by. The U.S. Bureau of Labor Statistics

shows a growing demand for IT security professionals [11]. This is testament to the need to provide accessible education to newcomers and experienced IT professionals alike. However preparing an individual for a career in information security is by no means an easy task [12]. A security professional in IT requires many skills to be successful. The reality is that many of those who go back to school to enter the security field already have extensive knowledge in the field of information technology [13].

Yet, many of these individuals that wish to advance in the security field are required to complete degree programs which have fixed requirements for all students. This fixed nature of most degree programs implies that all students who complete the program require equal amounts of preparation and training. In many instances, such an approach is redundant and causes students of such programs to sit through courses which cover material in which they are already competent in [6].

The demand for security professionals is high and the salaries of such professionals are at the higher end of IT salaries [11]. Organizations too are anxious to employ individuals that are competent and experienced in information security. However, as mentioned earlier the issue with the educational models that support individuals to gain such competence often requires students to complete a degree program for which they already have competence in various subject areas.

Is a traditional education the only solution to support the growing need to prepare information security professionals? Does a more efficient and affordable method to gain such an education exist? The competency based educational approach provides a mechanism to achieve cost-effective and efficient IT security education.

### III. WHAT IS COMPETENCY BASED EDUCATION?

In traditional higher-education institutions, degree programs usually require a fixed number of “credits” or “units”. The definition of a unit or credit is closely correlated to the number of seat hours a student must spend in class along with outside preparation and studying. Therefore a traditional bachelor’s degree program that requires 120 credit hours would require that all students spend an equal amount of time in class and in most instances take the same sequence of courses.

However, a college degree in a certain discipline is nothing more than a document that serves as proof of instruction and competence in a specified area. Thus, if the purpose of a college degree is to demonstrate student competence in a subject area, the focus should not be placed on instruction time, seat time, or credit hours, but instead on the competence of the student [14].

Competency based education serves that purpose. Students should not be required to learn what they already know, but required to prove that they do in fact hold competence in a given area. It is important to note that a competency based educational model is not one that simply gives credit for life experience. This has been a major point of contention with many known “diploma mills” that ask the student to write a simple life story and are granted a degree as fast as their check clears.

In a competency based program, students demonstrate competency through various methods. For example, students can be asked to complete realistic scenarios, analyze and interpret case studies and produce other hard deliverables which serve as proof of student mastery in a given area.

### IV. AN EXEMPLIFICATION OF COMPETENCY BASED EDUCATION

Many advantages of competency based education have been discussed thus far. While the benefits are apparent, many institutions have yet to fully embrace such a model across the entire institution. An exception to this is Western Governors University (WGU). WGU was founded in 1997 by 19 of the western state governors, hence the name Western Governors University [15]. WGU is a private, non-profit [16] higher education institution offering undergraduate and graduate degrees and is composed of four colleges: Teachers College, College of Business, College of Information Technology and the College of Health Professions.

Competency based education is an important part of WGU and is incorporated into their institutional mission:

*“The principal mission of Western Governors University is to improve quality and expand access to post-secondary educational opportunities by providing a means for individuals to learn independent of time and place and to earn competency-based degrees and other credentials that are credible to both academic institutions and employers [17].”*

WGU is a virtual and fully online institution. All coursework with the exception of student teaching, a nursing practicum and health informatics professional practicum are conducted online. To accomplish the institution’s mission the university uses a disaggregated faculty model. In a traditional university setting, the faculty member is typically responsible for developing the course, providing instruction, advising the student and grading student work. To ensure quality and avoid any potential conflicts of interest WGU separates out these roles. Different teams are responsible for creating and developing curriculum, another focuses on instruction,

one for student coaching and advising and lastly another that is responsible for scoring, grading and assessment.

As such WGU presents and utilizes a radical post-secondary educational model. It revolutionizes the common perceptions of education and promotes a model for efficient, affordable and accessible education [6]. Of particular interest is the Master of Science in Information Security and Assurance (MSISA) program offered by the College of Information Technology (IT) within the university. The following subsections discuss the unique approach that this program utilizes in preparing incumbents to enter or continue in a career of information security.

Yet despite these unique characteristics the university has successfully gained recognition from employers, the public and accreditation bodies [18, 19].

#### *A. About the Program*

The Master of Science in Information Security and Assurance program is one of the graduate programs within the College of IT. The program consists of a total of 15 courses and 36 competency units. While WGU does not operate on credit hours it uses what the university terms competency units. One competency unit is equivalent to one semester credit of learning [20].

The program is built around the 10 security domains that serve as the foundation to the Certified Information Systems Security Professional (CISSP®) body of knowledge. The program also incorporates the strict guidelines for information security programs that are set forth by the National Security Agency (NSA). This program, like all other programs at the university is offered fully-online where students can complete the requirements for the degree in an asynchronous fashion independent of time and place. The university is regionally accredited by Northwest Commission on Colleges and Universities and nationally accredited by the Distance Education and Training Council (DETC) [21].

#### *B. Learning Resources*

The MSISA program utilizes a variety of learning resources to support students in gaining subject matter competency. A *learning resource (LR)* is any textbook, simulation, video, case study or other resource that can support student learning in a given area.

Learning resources are carefully selected as part of the curriculum and program development process. Each LR is expected to support students in meeting the competency for the course in an independent fashion. Student self-service is key. When students must wait for books, wait

for a faculty member or any other item learning comes to a halt. As such the MSISA program like the other programs within the university seeks to develop independent learning that need not wait for external intervention.

#### *C. Program Advising and Mentoring*

Each student enrolled at the university is assigned an individual mentor that stays with the student throughout the program. Students are required to have weekly contact with their mentor to ensure appropriate progress through the program and to discuss any potential needs or issues that arise. The mentor assists the student in creating a graduation plan outlining the planned sequence in which a student will complete their coursework.

The mentoring approach is one that makes WGU both innovative and unique. The mentor is a valuable resource to the student and ensures that all necessary resources are provided to the student to aid in their success. The majority of instructional materials are available through digital delivery to the student. This eliminates the need to wait for textbooks or other materials to be mailed to the student. These mentors are called “student mentors” as they interact and work with the student throughout their entire degree program.

To further support students, each course has one or more dedicated *course mentors*[22]. The role of a course mentor is to support a student throughout a specific course. When a course is designed, the best learning resources are selected to help the student gain competence in a given subject area. The goal is to provide learning resources that allow the student to independently learn and acquire knowledge within a specific topic.

However, when students run into trouble or have difficulty with a concept they are not required to get through this challenge alone. This is where the course mentor(s) steps in to help. Students can contact a course mentor via phone, email, instant message and through other internal discussion forums and interactive learning communities.

The course mentor is a seasoned professional in the subject matter who has both academic and industry qualifications in the subject. The course mentor assists the student through a variety of mechanisms to reinforce the material that will eventually allow them to gain the competence in the desired subject area.

The notion is while students are given the tools and resources to learn individually they are offered a wide spectrum of tools to support their learning.

#### D. Program Faculty and Instruction

At WGU program faculty do not teach courses or classes. For most, this may sound a bit alarming or concerning. Instead, program faculty work alongside with other members of the university to set and develop the necessary competency for each subject area, work with subject matter experts and select the best learning resources to support a student through a given course.

The university utilizes a mentoring model. Student mentors who were described earlier are responsible for guiding the student through their degree program from enrollment to graduation. Course mentors provide subject matter expertise and guidance for specific courses.

#### E. Program Evaluation and Assessment

Proper evaluation and assessment of student competence is at the heart of competency based education. The MSISA program at WGU utilizes five different assessment and evaluation mechanisms to ensure student competence: performance assessments, objective assessments, certification assessments, capstone project, and an oral defense.

*Performance assessments* can consist of a variety of project such as essays, research papers, case study analyses and other similar demonstrations [20]. Successfully passing a performance assessment provides a validation mechanism that a student can in fact perform the duties, skills, tasks or procedures for a given competency area. Students submit performance tasks to an online project management and grading system known as TaskStream. Here qualified adjunct faculty grade, evaluate and provide feedback to students. Students who do not successfully complete a task on their first attempt are given detailed feedback and necessary support to revise their task for future resubmission.

*Objective assessments* are typically exams that are used to assess a student's competence in a given area. They can be comprised of multiple choice, multiple selection, matching and other types of simulation questions [20].

The MSISA program utilizes six (6) different *certification assessments* as part of the program. A certification assessment is an industry recognized exam that typically leads to professional certification upon successfully passing the examination. The six certification assessments that are used in the program are:

- Cisco Certified Network Associate (CCNA®)
- Cisco Certified Entry Network Technician (CCENT)

- EC-Council Disaster Recovery Professional Exam (312-76)
- EC-Council Ethical Hacking and Countermeasures (EC0-350)
- EC-Council Computer Hacking Forensic Investigator (EC0-349)
- GIAC G2700 (Standards and Policies)

As part of the degree program MSISA candidates will complete a *capstone project*. The capstone project is composed of two sections. The first section requires the student to develop a practical solution to an issue or problem within the field of information security. The second part of the capstone provides a written capstone report which summarizes the purpose and importance of the project endeavor [20].

The final component is an *oral defense* of the capstone project. The oral defense is conducted by the capstone chair along with other invited university faculty. The purpose of the oral defense is to serve as a final form of validating the student's competence gained through completion of the MSISA program. The student first presents the project to faculty and then faculty follow up with additional questions on the topic [20].

These various assessment mechanisms provide several levels of authentication and validation of student competence. This is reiterated by the inclusion of industry standard certifications into the MSISA program. Industry standard certifications also promote employer acceptance of the students training and degree program. While the program is structured into a series of courses, students can accelerate through portions of the course in which they can prove existing competence.

#### V. CONCLUSION

This paper has demonstrated the importance and need for information security education. Like in other areas, challenges exist in training and educating new incumbents to the IT security profession. This reality is exacerbated by traditional educational programs that require students to complete a standardized set of courses regardless of their existing competence.

As a remedy for this, the concept of competency based education was introduced to the field of information security education. Competency based education hinges around having students prove subject matter competence irrespective of where or how the knowledge was obtained. Competency based education provides a mechanism for students to efficiently gain an education in the field of information security.

Furthermore, Western Governors University was presented in this paper to the general IT security education community. To date this is the only university which is completely competency based. WGU employs a competency based model in all of its educational programs including the Master of Science in Information Security and Assurance program. This unique program provides a great opportunity and contribution to education and information security professionals.

While no educational model or ideology is without scrutiny, this paper seeks to increase the knowledge and awareness of the information security education community of new methods to train IT security professionals. It provides an opportunity for discussion within the community and seeks to embrace further acceptance of such a model.

Information security is an important and fast changing field. As such, the educational institutions that provide such education must be creative in adopting, promoting and creating new pedagogical strategies to enhance IT security education. A call to other institutions is given to adopt and learn about competency based education.

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