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Challenges Of Establishing Centers Of Excellence In Information Assurance At An HBCU: A Case Study

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Abstract - There is a strong need for minority institutions to establish their place in the Information Assurance (IA) education arena. The Information Systems and Decisions Sciences Department at Howard University believes that we can extend our programs to incorporate the rapidly developing field of information security. Howard hosts both Bachelor in Business Administration in Computer Based Information Systems with a concentration in Information Assurance (IA), and a Master of Science with an Information Security certificate programs. This paper first presents the status of the many factors that are associated with the barriers of starting and sustaining a Center for Information Assurance, and then proposes a strategic plan to accomplish such a goal. The strategies and approaches adopted are justified through consultation with major stakeholders (students), our experiences and are made adaptable to fit the information security curriculum development process.

Index terms - Information Assurance, Minority, Security Curriculum, Stakeholder

I. INTRODUCTION

Information Assurance is becoming one of the fastest developing fields within the technology industry. To fulfill this industrial need with qualified professionals, NSA is encouraging and designating additional education institutions to qualify to be Centers of Academic Excellence in Information Assurance (IA). Many distinct but interrelated skill sets are necessary to become a part of the information assurance workforce. These professions at a minimum include systems security administrators and planners, security analyst, software security specialist, and database managers, all requiring skills which graduate and undergraduate institutions deliver.

Our study is focused primarily on understanding and presenting cause of the under-representation of the minority workforce within the information assurance profession. We further identify issues that arise from the implementation of a focused information security curriculum into a pre-existing information systems curriculum at the Business School at Howard University. We conclude by presenting a framework that will aid in establishing a future information security curriculum into the present Howard University Information Systems Curricula.

The research of this report displays the factors that affect college students' Information Assurance career interests, and it also displays why many of their fellow peers (particularly minorities and women) are represented by only a fragment of a percentage of the total workforce. Furthermore, the research framework will assist in the formulation of a solution towards overcoming a subset of the many barriers that prevent this institution from establishing a center of excellence, specifically in the business school.

II. IMPLEMENTATION BARRIERS AND MINORITY UNDER-REPRESENTATION

Crowley states that there doesn't seem to be clear consensus about what differentiates information systems security training from education [1]. For, example while the National Plan for Information Systems Protection Refers to "training and education" in several places,

those terms remain undefined. This lack of precision and consensus has created tension. Compared to more mature disciplines, such as Computer Science and Computer Engineering, where there is already a universally accepted curriculum, the Information Assurance field has continuing efforts in order to define a model curriculum. Hence, establishing a formal set of topics for assurance training and education, especially within a Business School arena where the technical and application of information assurance must be carefully balanced, has been on major implementation barrier.

There is a growing concern of the factors that cause the under-representation of the minority workforce within the information assurance profession. The report of IT workforce by the Department of Commerce indicates that one underlying cause of this deficit in the IT workforce is under representation of minorities in the math and computer science related education pipeline [2]. Science and engineering (S&E) Indicators 2006 present that African Americans account for 6.9% of S&E workforce and Hispanics constitute 3.2%. The indicators provide alarming information that 24% of the U.S. total population is minorities, only 13% of college graduates are minorities and 10% of college graduates in S&E occupations are minorities. Moreover, African Americans represent only 4% of computer scientists and mathematicians [3].

One theory that gives reason to the cause of these statistics is the Social Cognitive Theory. The SCT defines human behavior as a triadic, dynamic, and reciprocal interaction of personal factors, behavior, and the environment [4, 5, 6]. Response consequences of a behavior are used to form expectations of behavioral outcomes. It is the ability to form these expectations that give humans the capability to predict the outcomes of their behavior, *before* the behavior is performed. This behavior leads to a variable known as outcome expectation. Bandura describes outcome expectation as an anticipation of physical, social and self-evaluated outcome [5].

Also, there is the obvious factor being the interest of the career. Lent, Brown, and Hackett define vocational interest as patterns of likes and dislikes, and indifference regarding career relevant activities and occupations [7].

Low expectation outcomes explained by the Social Cognitive Theory and the lack of interest in the career, they both introduce barriers. Perceived barriers toward career are discussed by numerous researchers as a critical in one's entrance or continuation of career [8, 9]. Luzzo presents four barrier categories by interviewing 375 college students [8].

There are family related barriers (e.g. balancing work, family, responsibilities, finding day care for children), study skills barriers (e.g., poor study habits, lack of basic skills education), ethnic identity barriers (e.g., job discrimination on the basis of race, different treatment by teachers based on ethnicity), and financial barriers (e.g., lack of funds for higher education). Career outcome expectation can also be considered a barrier towards career development. Occupational outcome expectation tends to restrict a person's career possibility at an early age [10].

In an earlier study Matt Bishop and Deborah Frincke discussed that there are three requirements that any workforce-development program must address [11]. We have encountered challenges within recruitment, training, and placement and each is a challenge in its own right. Perhaps one of our greatest challenges has been recruitment of minority students into the Department of Information Systems and Decision Sciences at Howard University. There are many factors that influence the recruitment aspect. It has been found through primary data, collected from Washington DC Metropolitan high school seniors that poor recruitment stems from the perception of a weak career outcome expectation. Through interviews conducted, it has been understood that the Information Systems or Information Assurance field is not what is considered "fast money" and requires an exceptional amount of math and sciences.

Bishop and Frincke were also able to recognize an additional problem that relates to misunderstandings and jealousies on the part of hard-working students in non-security fields [11]. These students (and their professors) are not able to realize why there is such a progression towards the advancement of the computer security field. As we encounter these many barriers, Howard University's Information Systems department actively pursued new

solutions to overcome these barriers. This included hiring Information security faculty, creating an undergraduate concentration in IA., attempts to provide money for undergraduate students pursuing IA and attaining feedbacks from companies hiring our IA students.

Another issue that has arisen is the investment of resources to the program. The award of industrial and government research funds is as equally important to the program's development, as the development of a credible faculty. To improve to quality of the faculty, many of the staff would have to be updated on disciplines within the security realm (i.e. assurance, client server technology, web design and implementation, networks and advance network security).

III. FRAMEWORK FOR A CENTER OF ASSURANCE

These above factors can be used to better understand/address why minorities are under-represented and can inform a creation a framework that will overcome barriers in implementing a center of excellence. Given the need for graduates of such Centers of Excellence, minority serving institutions (i.e., Historically Black Colleges or Universities, universities serving the Latino community, or tribal colleges) must seek collaborations with industry and other universities to create the necessary infrastructure, as suggested by prior researchers [12]. These collaborations would mutually benefit Institutions having the center of excellence status by allowing them to fulfill their mission of extending IA knowledge and opportunities.

Our experience extends this idea by suggesting that a successful framework must include addressing the issues surrounding the personal and professional goals expressed by the minorities in pursuing IT as a career. Furthermore, given Howard University's strategic location in the District of Columbia, Howard has an opportunity to form mutually beneficial strategic partnership with industry and governments, both federal and local. Howard has a competitive advantage in developing an IA program that helps the government, and industry to meet their information assurance needs in a grand capacity.

Howard University and the School of Business, Department of Information Systems and Decision Sciences and the College of Engineering, Architecture and Computer Science, Systems and Computer Science department wish to continue to develop a program of the highest quality in the area of Information Assurance—an area of the greatest national need—in a community and region with arguably the greatest responsibility to respond to this need. In addition, given Howard's historical mission and current contribution to the development of African-American leadership in the US society, we will produce a critical increase in the number of talented African-American and other information security professionals through the implementation of this project.

Howard University is on a path to establish a strong educational information assurance program embedded with labs and participation in security research from faculty and graduate/undergraduate students. Beginning successes to this initiative included validation from NSA for the mapping at 100% for the Committee on National Security Systems (CNSS) National Standard(s) 4011 and 4012. Howard University has previously applied to be designated as a Center of Excellence in Information Assurance, yet has failed at that attempt. Hence, a primary component of the framework is to develop and offer specific Information Assurance (IA) courses along with embedding IA concepts throughout the school core courses.

Lessons learned include the recognition of a need for a stronger inter-disciplinary collaboration and a need to have a larger pool of students. The catalyst for such a pool must be scholarships (such as from Scholarships for Service, NSF, or other funding sources who value and share the vision to encourage and increase the number of minorities who choose Information Assurance as a career choice. Lack of this support lowers the probability of increasing student population in the department, and hence decreasing the possibility of recognition from NSA.

We have begun with faculty development, student research and development in information security, conferences, continuing curriculum review and modification, student recruitment and initiatives in conducting collaborative research

with student from University of Tulsa. In terms of academic programs, the Information Systems and Decision Sciences department has an approved concentration in IA. This includes 3 information security courses: Foundations of Information Security, Network Security, and Information Assurance: Policy, Ethics and Legal Issues.

We also offer a 15-credit graduate certificate program in Computer Security, housed in the Systems and Computer Science department with courses also offered by the Information Systems department. Howard has strengthened its infrastructure through the following activities:

1. Joint Faculty Research- Faulty and undergraduate Information Systems students will conduct experiments on and discuss current security related issues.

2. Development of an information Assurance curriculum by enhancing faculty knowledge base as well as increasing resources to be used in classroom exercises. A test bed environment for information security development and testing will be provided. Offering an IA concentration will encourage students to do a set number of IA courses, then placing this on there resumes leading to possible careers in IA.

3. Continuing development of the Information Systems department lab to be available for applications for student hand's on exercises (e.g. vulnerability testing and forensics). Enhancing a dedicated computer lab would assist in the development of an acceptable research and teaching environment. It is proposed to be equipped with simulation techniques, and activities in how to secure telecommunication systems. More important in faculty becoming aware of Information Assurance hands-on Labs for undergraduate education. These would be used to facilitate the delivery of concepts and to improve student understanding of the core IA concepts.

   From a business application perspective, the graduating student will be able to understand vulnerability testing and security risk assessment of systems. Optimal setup of lab will assistant in students understanding of how to handle security incidents, protecting the privacy of customer and employee information (secure ecommerce class). Moreover, lab would strengthen the research activities in the information assurance and information security. Our students and faculty both would be able to conduct empirical study on information assurance.

4. Increase the number of undergraduate students following the Information Security concentration in the Bachelor of Science program and to increase the number of graduate students following the Information Security graduate certificate program in the Master of Science program by the end of the program period. This will be accomplished by recruiting more students by word of mouth and an increase of both campus-based and community advertising.

5. Introducing a seminar/colloquium series featuring speakers working in the Information Systems domain. Increasing exposure to how IA and IT are career paths in financial

To successfully imbed an IA program, our case study suggests an approach which integrates a multi-pronged strategy must first be specially stated and recognized by decision making parties. First, the IA program director must outline a rigorous campaign which illustrates to the students the financial benefits of choosing an IA career path. This will help minorities better understand and overcome perceived barriers toward career outcome and expectations.

Next, the strategy must suggest that a primary method to recruit students is by offering scholarships and potential internship/job opportunities. When students realize that they can overcome their huge financial barriers associated to obtaining a college degree by choosing the IA degree program, they will decide to pursue IA and focus on the studies, not on earning monies.

Furthermore, a strategy must include a declaration about the IA curriculum itself. Resources must be allocated to keeping the program current and interdisciplinary in order to provide multiple competitive options for the student to pursue. The collaborations with other universities as well as conversations with

associates at NSA (in local proximity of Howard) will provide the Howard IA program director with insight on keeping the materials updated as well as abilities to engage in lab work and research opportunities. This will strengthen student retention in the program as well as ensure job opportunities.

Also, the program which encourages faculty development opportunities enhances the level of involvement towards the IA program. Faculty members must to aware of the state of art student labs that other universities are conducting as well as current security and the IA research. Again grants/funds must be seeked to provide resources for speakers to come to Howard and for travel for Information Systems faculty. Also, establishing faculty/student mentorship programs and embedding Undergraduate IA research opportunities would assist in the creation of a sustainable program.

Enhancing a dedicated computer lab to Information Assurance would help us developing a good research and teaching environment. For this, the strategy is to collaborate with established IA programs; Howard faculty would get some assistance from professors teaching in existing IA programs on how to create different information assurance scenario in testing the securities issue under the client –server environment. Lab will be well equipped with the simulation techniques, and learn how to secure telecommunication systems.

Finally, the hurdle most difficult, yet most essential, is awareness, presentation and development of passion for Information Systems at the high school level. Before entering the HBCU, the students must have been exposed to the advantages of professions in the math and science disciple. When deciding a major, not only must a student perceive the career and financial benefits, but also enjoy the field of study itself.

The impact to be expected resulting from the completion of this project will be:

1. A large number of students from an underrepresented population graduating with a concentration in Information Assurance.

2. There will be a growing awareness if Information Assurance among students in Computer Science and Information Systems. As well as, awareness amongst professors of other disciplines within the School of Business and professors of disciplines in other schools (e.g. Department of Political Science and Graphic Design majors).

IV. CONCLUSIONS

The outcome of our Howard University case study exhibits that the collaboration between the Computer Science Information Assurance masters program and Information Systems IA concentration serves as a pathway for the minority university to build competencies in information assurance. However, much more needs to be invested in addressing the recruitment and increasing the interest of minorities into Information Assurance career paths. The HBUCs need more funds/scholarship money to attract potential students and develop stronger programs.

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