Enhancing Dynamic-Content Courses with Student-Oriented Learning Strategies: The Case of Computer Security Course

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ABSTRACT
Constant risk to the confidentiality, integrity and the availability of information in our everyday lives and work has increased the need for responsible use and handling of information. Security education is becoming an integral part of any undergraduate curriculum in computer science and information systems. The evolving role of security in this digital era makes it nontrivial to decide the appropriate topics that need to be covered during the course duration in a way that all aspects of security deployment are examined. The only approach to this challenge is to use student-oriented learning strategies to encourage the students not only to recognize relationships between concepts and comprehend the underlying structure of what is being learned but also expose them to methods where they are responsible for their own independent learning. The current study examines the experiences gained in COMP-431 Computer Security, a senior-level undergraduate computer security course using such methods, with an emphasis on the students’ reactions, perceptions, and experiences as well as the educator’s role in the teaching and learning process.

Keywords: Association for Computing Machinery (ACM), Computer Security, Dynamic Content-Courses, Student-Centered Approach, Undergraduate Course

INTRODUCTION
The importance of security in almost all aspects of digital communications, either for business, computing, science, finance, or entertainment reasons, is undeniably acknowledged. The Association for Computing Machinery (ACM), in its recent revised curriculum guidelines for a computer science program, emphasizes the topic of security as one of the directions that needs to receive special attention (ACM, 2008). With this in mind, higher education institutions try to integrate the topic of information security in various specializations such as computer science, information systems, engineering, business, telecommunications, management, human resources, law, finance and health sciences. The evolving role of security in this digital era makes it nontrivial for educators to have a consensus on a specific fixed list of
topics that need to be covered throughout the course duration so that all dimensions of security deployment are examined.

One approach to this challenging matter is to provide the foundations of security while at the same time create a learning environment where the students explore on their own several other topics that interest them. Student-oriented learning is a pedagogical paradigm that encourages the students not only to recognize relationships between concepts and comprehend the underlying structure of what is being learned but also expose them to methods where they are responsible for their own independent learning. It has been observed that the common reason for students to abandon sciences is the lack of connection between the course material and the real world (Kardash & Wallace, 2001; Seymour & Hewitt, 1997). Thus, academics and instructors should seek solutions to motivate and respond to the specific needs of students by applying a student-centered method where the student is responsible for his/her own learning (Ktoridou, 2010).

During the last few decades, research efforts on educational matters presented a broad variety of student-centered teaching methods, with evidence that a proper implementation of a student-centered method could lead to a rise in motivation towards learning, a more positive attitude toward the subject and greater retention of knowledge and a deeper understanding (Bonwell & Eison, 1991; Johnson et al., 1991; McKeachie, 1986; Meyers & Jones, 1993). A student-centered approach includes inductive teaching and learning where students are primarily faced with challenges (questions, contextualized problems, complex problems, open-ended problems, authentic problem sets, authentic cases) and continue learning the course material in the context of addressing these challenges (Ktoridou, 2010).

The authors of the presented research work explored the practice of student-oriented teaching in an undergraduate computer security course by incorporating the following three inductive methods: discovery-based learning, problem-based learning, and case-based learning. More specifically, an investigation is presented that aimed to examine the students’ reactions, perceptions, and experiences as well as the educator’s role in the teaching and learning process. Based on this study, the authors came to the conclusion that for courses that the content is dynamic, as in the case of security, the student-oriented teaching is a suitable strategy that enhances and enriches the teaching process, increases motivation, develops students’ critical thinking and creative problem-solving skills, fosters a deeper understanding, and creates confidence in the students’ knowledge or skills towards the subject of information security.

LITERATURE REVIEW

Before describing the study and its findings, a brief description on related terms and concepts is provided in this section. In particular, an overview of student-oriented learning and inductive methods are presented, followed by a discussion on the computer security course logistics.

Student Oriented Teaching Methods

During the last few decades, education literature presents a broad variety of student-oriented centered teaching methods and presents evidence that a proper implementation of a student-centered method could lead to: rise of motivation towards learning with more positive attitudes toward the subject, greater retention of knowledge and deeper understanding (Schunk, 1999; Bonwell & Eison, 1991; Johnson, Johnson, & Smit, 1991a; McKeachie, 1986; Meyers & Jones, 1993).

Student-oriented teaching methods shift the focus of activity from the educators to the learners and include active learning, competitive learning and inductive teaching and learning, placing the emphasis on learning instead of teaching. Educators are continuously seeking ways to enhance, enrich their classes as well as motivate their students towards a more productive learning. More specifically, in
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