INTED 2010

International Technology, Education and Development Conference

Valencia (Spain)
8th-10th of March, 2010

CONFERENCE PROCEEDINGS

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WELCOME INTRODUCTION

Dear INTED2010 participants,

It is a great honour to welcome you to this forth annual edition of INTED2010 (International Technology, Education and Development Conference).

The main aim of this conference is to provide an international forum, counting with experts in different fields and disciplines from more than 60 countries who will present and discuss the latest innovations in education, technology and development.

With the presence of more than 400 attendants, INTED2010 also aims to be a social platform and a great opportunity for networking, which makes this experience more interesting for its international and multicultural atmosphere.

Valencia, venue of this conference, will provide you with the opportunity to discover a city with impressive architecture, interesting museums, lovely beaches and a varied cultural offer that will make your stay unforgettable.

Thank you very much for coming to INTED2010 and for contributing to the improvement of Education with your projects and experiences. We wish you a fruitful conference!

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CONFERENCE SESSIONS

ORAL SESSIONS, 8th March 2010.

e-learning & Blended Learning (1)
Educational Software and Serious Games (1)
University-Industry Collaboration
Curriculum Design in Engineering Education
Architecture & Urban Planning: Pedagogical & Didactical Innovations
e-learning & Blended Learning (2)
Educational Software and Serious Games (2)
Enhancing Learning and the Undergraduate Experience (1)
Engineering Education: Pedagogical & Didactical Innovations
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Foreign Languages: Experiences in Education
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Teacher and Pre-service Teacher Education Experiences
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Foreign Languages: Pedagogical & Didactical Innovations
Experiences in Education
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POSTER SESSIONS, 9th March 2010.

Poster Session1. Experiences in Education and Research & International Projects
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VIRTUAL SESSIONS

Computer Supported Collaborative Work
Curriculum Design and Innovation
E-content Management and Development
Educational Software and Serious Games
Experiences in Education
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Experiences in Education. Learning Experiences in Primary and Secondary School
Experiences in Education. New projects and innovations
General Issues. Barriers to Learning
General Issues. Education, Globalization and Developmnet
General Issues. Organizational, legal and financial issues
International Projects
New Trends in the Higher Education Area. ETCS experiences and Joint degrees programmes
New Trends in the Higher Education Area. New challenges for the Higher Education Area
Pedagogical & Didactical Innovations. Collaborative and Problem-based Learning
Pedagogical & Didactical Innovations. Evaluation and Assessment of Student Learning
Pedagogical & Didactical Innovations. Learning and Teaching Methodologies
Quality assurance in Education
Research in Education. Academic Research Projects
Research in Education. Experiences in Research in Education
Research in Education. Research on Technology in Education
Technological Issues in Education. E-learning and Blended Learning
Technological Issues in Education. Technology-Enhanced Learning
University-Industry Collaboration
Virtual Universities. Distance education

ABOUT INTED2010 Proceedings CD

HTML Interface: Navigating with the Web browser

This CD includes all presented papers at INTED 2010 conference. It has been formatted similarly to the conference Web site in order to keep a familiar environment and to provide access to the papers trough your default Web browser (open the file named "INTED2010.html").

An Author Index, a Session Index, and the Technical Program are included in HTML format on this disk to aid you in finding particular conference papers. Using these HTML files as a starting point, you can access other useful information relating to the conference.

The links in the Session List jump to the corresponding location in the Technical Program. The links in the Technical Program and the Author Index open the individual paper in a new window. These links are located on the titles of the papers and the Technical Program or Author Index window remains open.

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2. A new window will appear with search options. Enter your search terms and proceed with your search as usual.

For Acrobat 8:

1. Open the Search window, type the words you want to find, and then click Use Advanced Search Options (near the bottom of the window).
2. For Look In, choose Select Index.
3. In the Index Selection dialog box, select an index, if the one you want to search is available, or click Add and then locate and select the index to be searched, and click Open. Repeat as needed until all the indexes you want to search are selected.
4. Click OK to close the Index Selection dialog box, and then choose Currently Selected Indexes on the Look In pop-up menu.
5. Proceed with your search as usual, selecting other options you want to apply, and click Search.

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1. In the "Edit" menu, choose "Full Text Search".
2. A new window will appear with search options. Enter your search terms and proceed with your search as usual.

ORIENTATION OF SECURITY IN THE ACM CURRICULA

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Abstract

It is evident that information has become one of the main assets of organizations, and in many cases represents the main strategic element in the fulfilment of their objectives and as a support for their activities. Organizations invest enormous amounts of time and money in creating information systems that offer them the highest productivity and quality, and it is for this reason that security related issues are gaining importance at both an international and a national level.

Security is currently considered to be a new area of engineering, and computer security engineers are those professionals that are most in demand in this area. Security deals with highly diverse areas of computer science, which are applicable to a wide range of fields such as business, scientific research, medicine, manufacturing, logistics, banking, meteorology, law and networks, among many others. Given the importance that such professionals represent for organizations, and owing to the increasing potential that information technologies are taking on in improving organizations' productivity, ensuring their survival, and even changing their way of life (e-Government, e-Commerce, etc.), the tremendous importance of the implementation of security in our modern society is justified.

It would therefore appear logical to believe that there should be a correspondence between the importance of security, and the weight that it receives in the curricula of our universities. This paper discusses what the current situation with regard to Security is within the various sub-disciplines of computing defined in the Computing Curricula of ACM. The different proposals related to security as defined in each of these sub-disciplines are studied in detail, and the recommendations offered by each are also presented.

Keywords - Security, ECTS, Computer Engineering, ACM curricula.

1 INTRODUCTION

Government and commercial organizations rely heavily on the use of information to conduct their business activities. Compromise of confidentiality, integrity, availability, non-repudiation, accountability, authenticity and reliability of an organization's assets can have an adverse impact. Consequently, there is a critical need to protect information and to manage the security of ICT systems within organizations. This requirement to protect information is particularly important in today's environment because many organizations are internally and externally connected by networks of ICT systems not necessarily controlled by their organizations [1].

Software systems are created to satisfy business and mission goals. To ensure that the system satisfies these goals, you must ensure that the various activities involved in the creation of the system (requirements engineering, architecture design, and implementation) conform to the business and mission goals of the system.

The Computing Curricula provides an overview of the different kinds of undergraduate degree programs in computing that are currently available and for which curriculum standards are now, or will soon be, available. Teachers, administrators, students, and parents need this report because computing is a broad discipline that crosses the boundaries between mathematics, science, engineering, and business and because computing embraces important competencies that lie at the foundation of professional practice. Computing consists of several fields, and many respected colleges and universities offer undergraduate degree programs in several of them such as *computer science, computer engineering, information systems, information technology, software engineering*, and more. These computing fields are related but also quite different from each other. The variety of degree programs in computing presents students, educators, administrators, and other community leaders with choices about where to focus their efforts [2].

Given how important it is for organizations to have security professionals, and because of the increasing potential that are becoming the information technology to improve productivity of organizations, to ensure their survival, and even change our lifestyle (eGovernment, eCommerce, etc.), is warranted the great importance of the implementation of security in our modern society and connected. Despite its great importance in the current curricula (plans to extinguish) is not considered as an important subject and defined as specific elective subjects or as free configuration about security, devoting a very small amount of credits, or talking about security in a paragraph within the compulsory subjects of your degree, such as operating systems or networks.

That is the reason why we study the different disciplines of Computing Curricula trying to find the more important security aspects of each discipline for incorporating to the new curricula which are been implemented in the EU states.

The remainder of this paper is organized as follows: Section 2 briefly show the different curricula proposed by the ACM/IEEE for Computer Engineering; Section 3 analyses the main security topics considered for a computer engineer and how these topics are covered by the curricula; finally, Section 4 presents our conclusions.

2 COMPUTING CURRICULA OF ACM

In 1998 ACM and the Computer Society of IEEE set up a scientific committee called Year 2001 Model Curricula for Computing (CC2001) [3], to whom were asked to review the curriculum of 1991 and develop a set of curriculum guidelines that address the latest developments of information technology in the past decade and to resist the next decade. The CC2001 report is divided into six parts: A general volume (general principles and common parts to all volumes of specific disciplines) and five volumes of specific disciplines. All these disciplines are: 1) Computer Science (CS 2008); 2) Computer Engineering (CE 2004); 3) Software Engineering (SE 2004); 4) Information Systems (IS 2002); and 5) Information Technologies (IT 2008).

In 2005 the so-called Computing Curricula 2005 (CC2005) [2] was published, which is a clear evolution of CC2001, which consists of a report called “Overview Report”, which attempts to summarize the content of the specific reports of each discipline.

This “Overview Report” summarizes the body of knowledge of the courses of degree of each one of the five disciplines, highlighting their commonalities and differences. In addition, this document includes “The Guide to Undergraduate Degree Programs in Computing”. This guide has been produced with the aim of serving a wider audience and provides a more concise characterization of each discipline and characteristic factors that students can take into account when selecting an area of study in “computing”.

Next, we will summarize the most important aspects of each discipline of the Computing Curricula.

A. Curriculum ACM/IEEE CS 2008

Since the development of CS2001, some relevant trends in the evolution of the discipline of computer science have become apparent. These include: the emergence of security as a major area of concern; the growing relevance of concurrency; and the pervasive nature of net-centric computing.

Early in its history, the original CS2001 Task Force identified a set of 14 areas that together represented the body of knowledge for computer science at the undergraduate level. This structure remains in this interim report. Therefore, the CS2008 [4] establish the following main areas in the body of knowledge for computer science: Discrete Structures, Human-Computer Interaction, Programming Fundamentals, Graphics and Visual Computing, Algorithms and Complexity, Intelligent Systems, Architecture and Organization, Information Management, Operating Systems, Social and Professional Issues, Net-Centric Computing, Software Engineering, Programming Languages and Computational Science.

This new volume captures in a succinct form the major changes that appear as a consequence of this interim review of the CS2001 Computer Science volume. In summary, this new report

- *recognizes the existence of additional curricular advice that has been published since around 2001*
- *incorporates a general updating of the body of knowledge*
- *includes advice on new courses or course fragments that are provided as exemplars.*

B. Curriculum ACM/IEEE SE 2004

The document known as SE 2004 (Software Engineering 2004 – Curriculum Guidelines for Undergraduate Degree Programs in Software Engineering) [5] was developed by ACM and the education activities team of IEEE-CS. Other participating organizations are the Australian Computer Society, British Computer Society and the Japan Information Processing Society.

The main objective of this report is to provide guidance to academic institutions and accreditation agencies about what should constitute the education degree in IS. The two main contributions of this report are: i) Education knowledge of software engineering that every graduate should know (known as SEEK - Software Engineering Education Knowledge) and ii) the curriculum, i.e., the various ways in which this associated knowledge and skills can be acquired.

The ten knowledge areas that make up the SEEK are: Computing Essentials, Mathematical & Engineering Fundamentals, Professional Practice, Software Modelling & Analysis, Software Design, Software Verification & Validation, Software Evolution, Software Process, Software Quality, and Software Management.

C. Curriculum ACM/IEEE IS 2002

The Information Systems curriculum [5] is an initiative of ACM, AIS and AITP. It has been widely accepted and has become the basis for the accreditation of degree programs in information systems. IS 2002 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems is the latest report on the model curriculum work in the information systems field. This report specifies a set of grouped courses of the following way:

- *Prerequisites: IS 2002.P0 Personal Productivity with IS Technology.*
- *Information Systems Fundamentals: IS 2002.1 Fundamentals of Information Systems; IS 2002.2 Electronic Business Strategy, Architecture and Design.*
- *Information Systems Theory and Practice: IS 2002.3 Information Systems Theory and Practice.*
- *Information Technology: IS 2002.4 Information Technology Hardware and Software; IS 2002.5 Programming, Data, File and Object Structures; IS 2002.6 Networks and Telecommunications.*
- *Information Systems Development: IS 2002.7 Analysis and Logical Design; IS 2002.8 Physical Design and Implementation with DBMS; IS 2002.9 Physical Design and Implementation in Emerging Environments.*
- *Information Systems Deployment and Management: IS 2002.10 Project Management and Practice.*

D. Curriculum ACM/IEEE CE 2004

Computer Engineering is a growing and important area of endeavor. The Computer Engineering Task Force established a set of principles to guide its work that reflects in part those that appeared in the Computer Science Report [6]. They appear here with appropriate rewording and modification to reflect better the tenets expected from a computer engineering program: Computer engineering is a broad and developing field; Computer engineering is a distinct discipline; Computer engineering draws its foundations from a wide variety of other disciplines; The rapid evolution of computer engineering requires an ongoing review of the corresponding curriculum; Development of a computer engineering curriculum must be sensitive to changes in technology, new developments in pedagogy, and the importance of lifelong learning; The Computer Engineering Task Force should seek to identify the fundamental skills and knowledge that all computer engineering graduates must possess; The required core of the body of knowledge should be as small as reasonably possible; Computer engineering must include appropriate and necessary design and laboratory experiences; The computer engineering core acknowledges that engineering curricula are often subject to accreditation, licensure, or governmental constraints; The computer engineering curriculum must include preparation for professional practice as an integral component; The computer engineering report must include discussions of strategies and tactics for implementation along with high-level recommendations; The development of the final report must contain a broad base; The computer engineering final report must strive to be international in scope.

This curriculum defines a set of disciplines such as: Algorithms, Computer Architecture and Organization, Computer Systems Engineering, Circuits and Signals, Database Systems, Digital Logic, Digital Signal Processing, Electronics, Embedded Systems, Human-Computer Interaction, Computer Networks, Operating Systems, Programming Fundamentals, Social and Professional Issues, Software Engineering, and VLSI Design and Fabrication.

E. Curriculum ACM/IEEE IT 2008

The academic discipline of Information Technology can well be characterized as the most integrative of the computing disciplines. One implication of this characteristic is that a graduate of an IT program should be the first one to take responsibility to resolve a computing need, no matter the source or description of the problem, and no matter the solution that is eventually adopted. The depth of IT lies in its breadth: an IT graduate needs to be broad enough to recognize any computing need and know something about possible solutions. The IT graduate would be the one to select, create or assist to create, apply, integrate, and administer the solution within the application context.

In formulating this curriculum [7], the working group followed the following principles: Although this document can in principle be used as a stand-alone document, the formulation of the curriculum was governed by the desire to provide a blueprint to create accreditable programs; This curriculum is intended to exist as part of the CC2005 series; Despite the rapidly evolving nature of information technology, we wanted to formulate a curriculum with some longevity; The curriculum must be flexible and the required body of knowledge must be as small as possible; The curriculum must reflect those aspects that set Information Technology apart from other computing disciplines; The curriculum must reflect the relationship of Information Technology to other computing disciplines; This curriculum is aimed at four-year programs offered at U.S. institutions of higher learning, but should also be applicable in other contexts; The development of this volume must be broadly based; This volume must go beyond knowledge areas to offer significant guidance in terms of implementation of the curriculum.

In developing a curriculum for four-year study in Information Technology, one of the first steps is to identify and organize the material that would be appropriate for that level. A set of knowledge area focus groups and assigning to each one the responsibility of defining the body of knowledge associated with one of the following knowledge areas: Information Technology Fundamentals, Human Computer Interaction, Information Assurance and Security, Information Management, Integrative Programming and Technologies, Math and Statistics for IT, Networking, Programming Fundamentals, Platform Technologies, Systems Administration and Maintenance, System Integration & Architecture, Social and Professional Issues, and Web Systems and Technologies.

3 SECURITY RECOMENDATIONS FOR EACH DISCIPLINE

The increasing importance of security in our society has been taken into account in the curricula's revision. Thus, curricula in computer science have been improved by including more security contents related in the existing subjects and also by creating new security subjects.

Since the depth of the security knowledge defined and recommended by the curricula, security cannot be directly included into the educational innovation project, being necessary to extract the most interesting security topics and to define several core subjects. These subjects should cover all the security concepts that a professional in computer science has to know.

	CS 08	SE 04	IS 02	CE 04	IT 08	MSIS 06
Security Fundamentals	X	X	X	X	X	X
Standards and certifications	X	-	-	P	-	-
Ethics	X	P	P	P	X	X
Risks	X	P	P	X	P	P
Threats	X	-	-	X	X	X
Security Techniques	X	-	-	X	P	P
Cryptographic techniques	P	X	-	X	X	P
Secure Development	P	X	P	-	P	-
Security on Operating Systems	X	-	X	X	-	-
Security on Networks	X	X	X	X	X	X
Security on Data Bases	-	X	X	-	-	-
Security in ecommerce	-	X	-	-	-	X

Table 1. Security topics overview

Therefore, this paper analyses what security topics we consider as more important for a professional and how these are included in the different curricula. Tables 1 and 2 show the main security topics related with each curriculum. Table 1 is an overview and Table 2 shows more information about the concepts dealt by each security topic. If the topic is completely fulfilled by the curriculum by a core subject ("X"), if it is partially fulfilled by elective subjects ("P") or if it is not considered ("-").

Firstly, all curricula dealt with security fundamentals and the importance of security by spending some time of core subjects on each field, for instance systems' development, networks, operating systems, etc. Furthermore, security on networks is a topic considered in all curricula and used to dedicate several core subjects to explain a secure design of networks and the use of firewalls, VPNs, and so on.

Other security topics such as ethic issues, threats and risks, are mainly taken into account by the more recent curricula (CS 08, IT 08 and CE 04) which spend several core subjects, whereas the remainder of curricula spend elective subjects to cover them.

Since there are laws to protect personal data in many countries, this is an ethic issue considered in all curricula, however other ethic-related aspects such as intellectual property or cybercrime are less important for these curricula. The list of security threats studied in these curricula is quite complete and includes the most common threats related with Internet such as viruses, worms, Trojan horses, DoS attacks or phishing. Finally, security risks are considered by all curricula but not in a complete way. They spend some core and elective subjects on security risks but do not cover all the stages related: analysis, control, evaluation and recuperation.

The most recent curricula (CS 08, IT 08 and CE 04) also teach security and cryptographic techniques such as authentication protocols, access control mechanisms, security policies, confidentiality and integrity models, auditing and logging, encryption, keys (public, private and symmetric) and digital signatures.

Nevertheless, there are some important security topics which are not completely covered by these curricula. These are security standards and certifications, secure development of information systems and security on operating systems, data bases and ecommerce. Although some curricula deal with security on the development of information systems, they do not cover all the development stages: requirements, analysis, design, implementation and testing.

	CS 08	SE 04	IS 02	CE 04	IT 08	MSIS 06
Security Fundamentals	X	X	X	X	X	X
Standards and certifications	X	-	-	P	-	-
▪ Standards	P	-	-	P	X	-
▪ Certifications	X	P	-	-	-	-
Ethics	X	P	P	P	X	X
▪ Personal data protection	X	X	X	X	X	X
▪ Intellectual property	X	-	-	-	X	P
▪ Cibercrime, ciberwar	X	-	-	-	-	X
Risks	X	P	P	X	P	P
▪ Analysis	P	X	-	P	-	-
▪ Control	P	-	-	P	-	-
▪ Evaluation	P	-	-	P	-	-
▪ Recuperation	P	X	-	P	X	-
Threats	X	-	-	X	X	X
▪ Viruses, worms, trojan horses, DoS attacks, phising.						
Security Techniques	X	-	-	X	P	P
▪ Authentication protocols	-	-	-	X	X	-
▪ Access control mechanisms	X	-	-	X	-	-
▪ Security policies	X	-	-	P	-	-
▪ Confidentiality models	X	-	-	X	X	-
▪ Integrity models	X	-	-	X	P	-
▪ Auditing and logging	P	-	-	-	P	P
Cryptographic techniques	P	X	-	X	X	P
▪ Encryption, public keys, private keys, symmetric keys, digital signatures.						
Secure Development	P	X	P	-	P	-
▪ Security Requirements	-	X	-	-	X	-
▪ Secure Modelling	X	X	-	-	-	-
▪ Secure Design	-	X	X	-	-	-
▪ Secure Implementation	X	-	-	-	X	-
▪ Security Testing	X	X	-	-	-	-
Security on Operating Systems	X	-	X	X	-	-
▪ Security topics related with OS, design principles, policies.						
Security on Networks	X	X	X	X	X	X
▪ Design, firewalls, VPNs.						
Security on Data Bases	-	X	X	-	-	-
▪ Design, policies.						
Security in ecommerce	-	X	-	-		X
▪ Accounting, policies, strategies.						

Table 2. Security topics detailed

4 CONCLUSIONS

The main international curricula related to Computer Engineering try to ensure the best possible training for students according to the requirements of the computer industry for different professional profiles. Due to the importance of the information for the organizations, security is a critical issue which has to be considered in all the aspects related with Computer Engineering, thus taking a special role in the new curricula.

This paper analyses the main security topics which should to be included in these curricula and how curricula are actually covering these topics.

The main conclusion is that the most recent curricula (CS 2008, IT 08, CE 04) offer a more complete study of security topics. They spend several core subjects on ethic issues such as personal data protection, security threats related with Internet such us viruses, worms, Trojan horses, phishing, etc. and security and cryptographic techniques such us authentication protocols, confidentiality and integrity models, auditing, encryption, keys, etc.

Nevertheless, all the stages involved in the secure development of information systems are not completely covered by using core subjects. We think that it is a very important topic to consider in the curricula, security issues should to be included in the whole development process (requirements, analysis, design, implementation, testing) and enough core subjects should be provided to cover them in the different curricula. Furthermore, although standards are included in the curricula, they do not pay special attention into security standards.

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