Roadmap for incorporation Vocational Certification into University Curriculum

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ABSTRACT

To reduce the gap between market trends and graduate students is critical issue for all universities. The most important indicator for successful colleges of computer sciences is the graduates' employability in IT professional's career. This challenge requires college of computer sciences to enhance the study plan and curriculum by practical skills. The vocational certificates provide skill sand good reputation demanded by the labor market. This paper proposes a framework of curriculum development of some courses teaching in most study plans at college of computer sciences. . It also focuses on incorporating vocational certification courses into practical part of curriculum. Furthermore, the paper reviews some vocational qualifications to be integrated into specific courses in college of computer science and information systems at Najran University as an example.

Key words : Computer Sciences Curricula, IT Professional's Career.

1. INTRODUCTION

Current Computer Sciences (CS) curricula can be modified to include vocational qualification into practical part for specific courses. General view and survey of most CS courses can observe similarity of their syllabuses in theory part of many CS colleges at Kingdom of Saudi Arabia (KSA). However, many CS colleges have different approaches and different syllabuses of practical part for most CS courses. Most syllabus designers of practical part of CS courses started out by addressing some questions like: What curriculum should be trained during lab hours? What are the best ways to teach practical skills to students for such courses? How can we align the curriculum to match the student's needs? And how to make assessment for practical skills rather than testing knowledge only? All of these wonderings need to be considered in the curriculum design process.
Most of CS colleges at KSA either accredited by Accreditation Board for Engineering and Technology

(ABET) or seeking ABET accreditation. In effective reviews during the 2015-2016 accreditation cycle of ABET describes Criterion 5. Curriculum as " …The curriculum must combine technical and professional requirements with general education requirements and electives to prepare students for a professional career and further study in the computing discipline associated with the program, and for functioning in modern society. The technical and professional requirements must include at least one year of up-to-date coverage of fundamental and advanced topics in the computing discipline associated with the program…."[1]. To implement previous point efficiently, a practical part curriculum of some CS courses can be assisted by specific professional certificates.

This paper suggests a framework which can be implemented in some of the current courses in college of computer science and information system at KSA universities. These courses can be integrated with appropriate vocational qualifications. The suggested courses should include, as a minimum, computer security, computer networks, database, and object-oriented programming. Since most of syllabuses of CS colleges at KSA are almost similar, college of CS at Najran University will be taken as a case study. Following sections discuss a proposed approach in detail

2. A PARALLEL COMPUTER SCIENCE CERTIFICATION

According to [2], practical advantages of professional certificates make these certificates used as a reference. Moreover, the results study showed that professional certification is valuable and earned equivalent levels of academic degree. In addition to university degree certificate, some alumni seek professional certificates to gain more qualification. CS colleges can integrate curricula and mix certifications with the offered degree to prepare students for career.

Designing a curriculum from scratch is a complex and challenge task [3]. Therefore, professional certification behind theory is an alternative procedure to develop curriculum instead of entire modification. Furthermore, it is obviously beneficial to students to study contents of professional certification curricula which ensure most

updated technology and industry requirements. Figure 1 below shows how professional certificates can be incorporated within course syllabus.
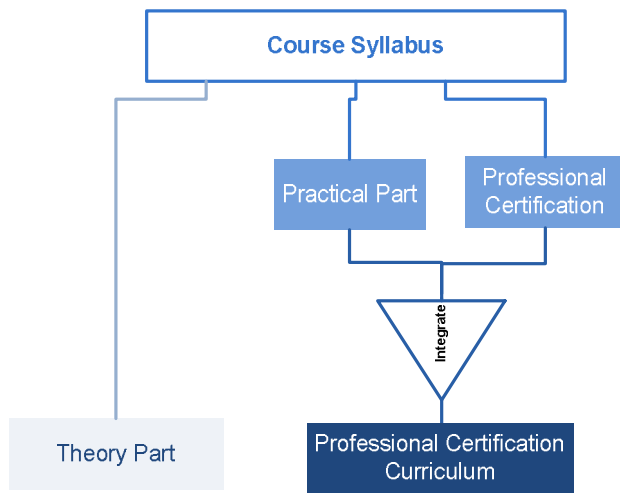
Figure 1: A framework of course syllabus integrated with professional certificates

Following sections discuss some CS courses that can be integrated and modified to include suggested professional certifications.

A. Computer Security

In most CS colleges at KSA, a computer security course considers as advanced course. Students study this course mostly before graduation as a required course (examples: CSC 429 King Saud university, 1401432-3 Umm Al-Qura University, and 429CSS-3 Najran University). The computer security course offers opportunities to introduce security principles, models, and attacks [4]. Course syllabus should also covered conventional cryptography algorithms, authentication, and access control etc.,.. Mainly, most of computer security syllabuses that we have seen are similar or even identical written curricula to Security+ Certificate [5].

The CompTIA Security+ objectives have been recognized in five domains: Network Security, Compliance and Operational Security, Threats and Vulnerabilities, Application, Data and Host Security, Access Control and Identity Management, and Cryptography [6]. In fact, Security+ Certificate can be selected as the most adequate professional certificate that serve the same learning outcome to CS curricula. More details can be seen in Table1.

Table 1: Comparison between 429CSS-3 Computer Security and Security+ Syllabus

429CSS-3 Computer Security	Security+
Brief list of topics to be Covered: Introduction to computer security concepts, Cryptographic	CompTIA Security+ certification included: Network security concept, cryptography, security
Tools, User Authentication, Symmetric encryption & message confidentiality, Public key cryptography, Hash Algorithms, Key management & distribution, Internet security protocols, Internet authentication applications, Intrusion detection & prevention, Malicious software, DOS & Firewalls.	operation, attacks and weaknesses as well as application, data and host security. Also included access control, detection & prevention, and identity management

B. Object Oriented Programming (OOP)

Object-oriented programming (OOP) is a type of programming language which supports the implementation of an object oriented model [7]. Most CS colleges at KSA teach OOP at the Fourth Level (examples: 113CSS-4 Najran University, CSC153-4 Qassim University, and 114CSM-4 King Khaled University). It is also notable that OOP is four credit hours in most courses plan. Learning Objectives of OOP are almost same in most of CS colleges as well as the topics covered. Course description shows that Java Programming is taught in practical part during lab hours. The course is an introduction to Java programming and to object-oriented techniques in Java. Definitely, the appropriate professional certification course to be taught during lab hours is Java Programmer Language Certification. Table 2 below shows the topics covered in more details.

Table 2: Topics covered in object oriented programming & programmer level

113CSS-4 Object Oriented Programming	Java Programmer Language Certification: Programmer Level I
Introduction to object oriented programming (OOP) concepts, basic Java syntax, introduction to objects and classes, data types, variables and operators, selection and control structures, array, properties of classes, inheritance, package and interface, abstract class, polymorphism, exception handling, thread.	The topics included: Java syntax, introduction to data types, operators, variables and constructs. Constructs of arrays, classes, and loop. Constructs of methods and encapsulation. Polymorphism, inheritance, exception handling, thread.

C. Database

Database course covers database design and the use of database management systems for applications [8]. Students study this course at intermediate level at most CS colleges (examples: 222ISM-4 King Khaled University, INFS221 Jazan University, and 380CSS-3 Najran University). Syllabus of practical part shows that SQL training and SQL programming language are taught

during lab hours. Curriculum description is almost matched up with Oracle Database 11g: SQL Fundamentals I [9]. More details showed in Table 3.

Table 3: Topics covered in 380 CSS-3 & Oracle Database 11g: SQL Fundamentals I

380 CSS-3 Fundamentals of Database Systems	Oracle Database 11g: SQL Fundamentals I
Study of fundamental concepts and techniques of modeling and design of databases and database programming languages. We begin with an introduction to Databases, architecture of Database Management Systems (DBMS), overview of database design and SQL programming language. Advanced SQL covers sub-queries and views, triggers integrity constraints. Brief overview of XML data model, data warehouse, data mining, and data security. Create Database Physically, Physical Schema, (Conceptual Schema Implementation) Constraints Physically on Database Tables, Data Types, Specifying Constraints and Default Values Lab SQL: Introduction to SQL-PLUS , Joining of Tables, Conditional Statements. Performance function in Oracle, Nested Queries and Set Comparisons Explicit Sets and NULLS in SQL Aggregate Functions and Grouping.	The topics included in the Oracle certificate are: fundamental concepts of selecting data using structure query language, using SELECT Statement, sort and restriction of data, triggers integrity constraints, conversion functions, group functions, joining of tables, conditional statements, DDL statements, explicit sets and NULLS in SQL, data manipulation, table management and manipulation, report of data manipulation, nested queries and subueries, and aggregate functions.

D. Computer Networks

Computer networks course introduces the fundamental of computer communication networks and problems of networking [10]. Typically, topics should include transport layer protocols, network interfaces, local and wide area networks, wireless networks, bridging and routing, and application [11]. In most CS colleges at KSA, students study this course as advanced course (examples: CPCS-371 King Abdul-Aziz University, CSC 329 King Saud University, and 329CSS-3 Najran University). In addition, computer networks practically is a prerequisite for computer security course.

CompTIA Network+ demonstrates a basic understanding of networking technology and break into entry-level roles in network installation and maintenance [12]. Topics covered in Network+ correspond and be alike with syllabus of computer networks course taught in CS colleges. More details showed in Table 4. Some related topics are covered in [13]

Table 4: Topics covered in 329CSS-3 & CompTIA Network+

329CSS-3 Data Communication and Computer Networks	CompTIA Network+ certification
Data transmission and physical infrastructure, flow control and error control, layered models, LAN and WAN-systems, packet and circuit switching, internetworking and IP, transport layer protocols (e.g. TCP and UDP), communication Models, applications (DNS, SMTP, FTP, HTTP, Telnet, etc.).	The CompTIA Network+ certificate required to pass exam that include: the knowledge and skills to work with network architecture, faundamental of security, configuration, solving isseues related to devises, tools, and technologies related to network. Knowledge of LAN and WAN-systems, packet and circuit switching, traffic analyzation, protocols such as: (DNS, SMTP, FTP, HTTP, Telnet, etc.). Troubleshoot of network tools and network technologies.

3. CONCLUSION

This paper has proposed framework for incorporating professional certificates into practical part of some current CS curricula. Additionally, titles of professional certificates have been recommended, however, selection of certification that fulfill the requirements of practical skills and meet the need of students is critical decision and it is important to consider compatibility issues. Obviously, conducting surveys is very important and helpful during selection process. In most CS colleges, the committee of curriculum development has the responsibility to determine which curriculum contents are most adequative to be given during practical part.

It is an innovative idea to see on future colleges of computer science offer their own professional certificates in addition to degree certificate which would be officially recognized and approved from ministry of education.

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