Comparing Two Program Contents with Computing Curricula 2005 Knowledge Areas

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ABSTRACT

The purpose of this paper is to compare the content of two computer programs with the different knowledge areas listed in the standard curricula that was published in 2006 and named Computer Curricula 2005 (CC2005). The paper begins by giving some description of CC2005, a brief history of the standard curriculums in the computer area and then explains the content of both programs intended to be discussed here. The two programs being discussed are the Technology Support and Training department (TST) at Eberly College of Business – Indiana University of Pennsylvania (IUP) and the Computer Information Systems (CIS) program at Robert Morris University (RMU). Both of these programs are technology programs but neither name is listed in the five computing areas described in CC2005. Thus a discussion is needed regarding the placement of these two programs within the traditional programs listed in CC2005.

Keywords: Comparing two computer programs with CC2005, Computer programs and standard curriculum, Computer programs and, Model technology curriculum CC2005

INTRODUCTION

The introduction of the Computing Curricula 2005 (CC2005) is considered the first comprehensive study in a number of years to suggest a

standardized curriculum for multiple technology programs. The CC2005 report is different from prior reports in two ways: First it provides suggestions for knowledge areas for five different technology fields: Software Engineering (SE), Computer Engineering (CE), Computer Science (SC), Information Systems (IS) and Information Technology (IT), and Second, it provides a scoring board for minimum and maximum coverage in the knowledge areas specified.

The knowledge area in CC2005 is a comprehensive list that covers a wide range of computing topics. This list suggests topics in the five computing related fields noted in CC2005. However, there are many other degree names that far exceed the five listed in CC2005. The disposition of these "other" program names in CC2005 is unknown. In other words, it is not known whether these programs are considered IS, IT or CS. In these cases an examination of their content with CC2005 may be helpful.

This paper compares the content of two computer programs with the knowledge area in listed CC2005: TST program at (IUP and the CIS program at RMU. The paper begins by giving a snapshot of CC2005, a brief description and course content for both programs under consideration. Then the paper compares the content of the two programs with the knowledge areas listed in CC2005.

CC2005 – A Snapshot

Creating a standard curriculum in the technology field is not something new. Instead, publishing standard curriculum dates back to 1968 when the first computer curriculum was published for computer science (CS) by the Association of Computing Machinery [3]. The Association for Computing Machinery followed that by a series of curriculum standards that include in the latest technology fields, such as the information systems (IS2002) and the software engineering (SE2004), and computer engineering (SE2004) [5]. All these volumes were specific to one computer field and none crossed multiple technology fields.

The efforts of establishing guidelines for multiple technology fields started with the creation of a task force for the computing curriculum in 2001 (CC2001). The CC2001 was intended to create a volume that spans multiple

computer disciplines. However, the same task force soon realized that their participants were mostly computer science majors. As a result, the CC2001 task force issued the CC2001 on the basis that it is focused on computer science majors, and recommended establishing another committee to overlook the creation of newer cross-major volume [2]. The CC2005 task force picked up from CC2001 to establish a report and articulated their goal from this report:

> "The foundation of this report is the set of standards that exist for undergraduate degree programs in five major computing-related field …. Each of the specific curricula volumes represents the best judgment of the relevant professional, scientific, and educational association and serves as a definition of what these degrees should be" [1, p. 4).

In order to set the standards for these different computer-related fields, the CC2005 listed a "knowledge area" that lists the "core" of knowledge that the different computer programs may provide in their curriculum. 40 knowledge areas were listed in this report. Table 1 below lists the 40 different knowledge areas listed in CC2005.

The 40 knowledge areas are supposed to be the "Input" that each program provides into the curriculum. However, the list is not intended to be covered by each of the 5 majors. Instead, CC2005 established a scoring guideline that establishes the minimum and maximum coverage that each program is suppose to provide within the 40 knowledge area listed. The range of score or coverage areas are from zero (lowest) to five (highest). Table 2 below shows a partial listing of the knowledge areas in CC2005. It shows also the suggested scoring (both min and max) for each of the knowledge areas.

While the establishment of the knowledge areas constitutes the input into the program, CC2005 went a step further to create Relative Performance Capabilities of Computing Graduates by Discipline. Table 3 below shows a partially displayed list of the performance capabilities. The table suggests the "output" from the different program or the suggested skills that graduate from each major is supposes to have. As a matter of further explanation, this table groups the knowledge areas together into logical units so that they can be further categorized and compared.

Table 1: Knowledge Areas in Computing Curricula 2005 – Source CC2005

Knowledge Area	Knowledge Area	Knowledge Area	Knowledge Area
Programming Fundamentals	Integrative Programming	Algorithms and Complexity	Computer Architecture and Organization
Operating Systems Principles & Design	Operating Systems Configuration & Use	Net Centric Principles and Design	Net Centric Use and Configuration
Platform Technologies	Theory of Programming Languages	Human-Computer Interaction	Graphics and Visualization
Intelligent Systems	Information Management (DB) Theory	Information Management (DB) Practice	Scientific Computing (numerical Methods)
Legal / professional / Ethics / Society	Information Systems Development	Analysis of Business Requirements	E-Business
Analysis of Technical Requirements	Engineering Foundation for SW	Engineering Economics for SW	Software Modeling and Analysis
Software Design	Software Verification and Validation	Software Evolution (maintenance)	Software Process
Software Quality	Comp Systems Engineering	Digital Logic	Embedded Systems
Distributed Systems	Security Issues and Principles	Security implementation and Management	Systems Administration
Management of Info Systems Org	Systems Integration	Digital Media Development	Technical Support

Table 2 – Scores of Knowledge Area Coverage in CC2005 – Partial List

Knowledge Area	CE		CS		IS		IT		SE	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Programming fundamentals	4	4	4	5	2	4	2	4	5	5
Interactive Programming	0	2	1	3	2	4	3	5	1	3
Algorithms and Complexity	2	4	4	5	1	2	1	2	3	4
Computer Architecture and Organization	5	5	2	4	1	2	1	2	2	4
Operating Systems Principles & Design	2	5	3	5	1	1	1	2	3	4

Table 3 - Partial Relative Performance Capabilities (1st two rows) - Source CC2005

Area	Performance Capability	CE	CS	IS	IT	SE
Algorithms	Prove theoretical results	3	5	1	0	3
	Develop solutions to programming Problems	3	5	1	1	3
	Develop proof-of-concept programs	3	5	3	1	3
	Determine if faster solutions possible	3	5	1	1	3
Application Programs	Design a word processor program	3	4	1	0	4
	Use Word Processor Features Well	3	3	5	5	3
	Train and Support Word Processor Users	3	4	1	0	4
	Design a spreadsheet program (e.g. Excel)	3	4	1	0	3
	Use spreadsheet features well	2	2	5	5	3
	Train and support spreadsheet users	2	2	4	5	2

The TST Program at IUP

The Technology Support and Training (TST) program at Eberly College of Business – Indiana University of Pennsylvania offers a Bachelor of Science degree in Business Technology Support. Students are required to take a total of 120 credits in order to complete the requirements for this degree. As the case with many other degrees, the students are required to take university required courses, college required and the remaining courses in the major field. However, the knowledge areas in CC2005 shown in Table 1-3 above lists only the technology related areas. Thus, this section emphasizes only the required technology courses so they will be compared with CC2005 knowledge area. Table 4 below shows the required technology courses for the students to take at the TST program at IUP.

Table 4 - List of technology courses for the for the TST program at IUP

IFMG 300	Information Systems: Theory and Practice
BTST 273	Hardware Support Solutions
BTST 310	Telecommunications
BTST 311	Training Methods in Business and Information Technology Support
BTST 383	Microcomputer Software Solutions
BTST 411	Technology Support Development
BTST 413	Enterprise Technology Support
BTST 480	Seminar in Business Technology Support
COSC/IFMG 352	LAN Design and Installation
Controlled Electives: Two courses from the following:	
BTED 201	Internet and Multimedia
BTST 401	Web Design
BTST 402	Website Development and Administration
BTST 493	Internship
COSC 110	Problem Solving and Structured Programming
COSC 304	Interactive Internet Programming with Java

The CIS Program at RMU

The department of Computer and Information Systems at the College of Communication and Information Systems – Robert Morris University offers a Bachelor of Science degree in Computer Information Systems. This degree requires different courses that are specific to the general requirements for the university and for the college. It also requires different technology courses. Table 5 lists the technology courses required by this program:

Table 5 Technology Courses for the CIS degree at RMU

INFS1050	Fund Of Information Systems
Two Courses in the Same Programming Language	
INFS2210	Operating Systems Concepts
INFS3150	Intro Web Dev & E-Commerce Technology
INFS3220	Systems Analysis and Design
INFS3221	Advanced Sys Analysis/Design
INFS3231	Network Technology & Mgt (N+)
INFS4240	Database Management Systems
INFS4810	Project Management
TRACK CONCENTRATION 12 Credits Required	
4 INFS courses relevant to one of the tracks: Software Development, Health Care Systems, Network Administration, Office Information Systems, Web Development	

Comparing the Two Programs

In this section we compare the courses listed in table 4 and 5 above with CC2005 knowledge areas listed in table 1. In comparing the two, we took the course name, studied the description for the courses and then compared them with the knowledge areas listed in table1. In cases where the description does not give a clear clew about what knowledge area it belongs to, we examined this further by looking at the relative performance of knowledge areas listed in table 3 above. In all cases we relied also on our experience and knowledge of the courses when things did not seem to match up.

In cases we found out that there are courses that belong to more than one knowledge area. In these cases we listed the course under one knowledge area to avoid redundancy. At the same time we found one knowledge area span more than one course. In these cases we listed each course under one knowledge area. We also noticed that both programs offer elective courses that students may not take. This will not fulfill the "input" that the knowledge area listed for the programs. We nevertheless listed the courses in the table because the program offers this knowledge; though some students may not take them.

A further note can be said about our comparison is that we did not assign numeric values to each topic as is the case in CC2005. We feel that such numeric values is beyond the scope of one conference paper and need to further analyze the contents and the knowledge areas before making a judgment on the numeric value for each course content. After further contemplating the course contents and the knowledge area, we came up with a list of courses as they match each of the knowledge areas. Table 6 below list the knowledge areas and the courses that are listed in the two programs: The TST program at IUP and the CIS program at RMU.

Table 6 – Comparing TST and CIS Programs with CC2005 Knowledge Area

Knowledge Area	TST Courses at IUP	CIS Courses at RMU
Integrative Programming		INFS4150
Algorithm and Complexity		INFS3185
Computer Architecture and Organization		INFS2210
Operating Systems Principles and Design		
Operating Systems Configurations & Use	BTST383	INFS2211
Net Centric Principles and Design		INFS3230
Net Centric Use and Configuration		INFS3231
Platform Technologies	BTST273	INFS3236
Theory of Programming Languages	COSC110	INFS2110
Human-Computer Interaction	BTST310, BTST311	INFS3160
Graphics and Visualization		
Intelligent Systems (AI)		
Information Management (DB) Theory		
Information Management (DB) Practice		INFS4240
Scientific Computing (Numerical Methods)		
Legal/Professional/Ethics/Society		INFS4170
Information Systems Development		INFS3221
Analysis of Business Requirements	BTST480	INFS3220
Engineering Foundation for SW		
Engineering Economics for SW		
Software Modeling and Analysis		
Software Design	COSC304	
Software Verification and Validation		
Software Evolution (Maintenance)		
Software Process		
Software Quality		
Comp System Engineering		
Digital Logic		
Embedded Systems		
Distributed Systems	COSC352	
Security Issues and Principles		INFS3235
Security Implementation and Management		
Systems Administration		
Management of Information Systems Organization		
Systems Integration	BTST402	
Digital Media Development	BTST401	
Technical Support	BTST411, BTST413	

Conclusion and Future Plan

From the last table we can notice that there are a number of knowledge areas that are neither covered in the TST program nor the CIS program. We also notice that some of the knowledge areas are covered in more than one course. However, it is apparent that both curricula lack coverage in the areas of software validation, intelligent systems, graphics and visualization, information management theory, software engineering evolution and process as well as security implementation and management.

Except for the security implementation and management, most of the course content not covered in the two programs involves the domain of software and electrical engineering in the CC2005 knowledge areas. Thus our recommendation for both programs is to include coverage of information security and assurance and eliminate the redundancy of courses within each knowledge area.

Near the completion of writing this paper, we learned of a new standard curriculum being developed for the information technology (IT)

field. A draft copy of the IT2005 has been published [3] and we are in process of reviewing it to see their applicability to each of the programs. In is worthy to note that in both IUP and RMU, another program in IS exists. At IUP there is another program under the name Management Information Systems and in RMU there is another degree by the name Information Systems Management. In our opinion, all four programs need to be evaluated in the context of the latest standard curriculum. It is our intention that we conduct another study to compare the courses that are offered at the TST and CIS programs with IT2005 (or IT2006). This comparison will be conducted at different course levels and the number of hours assigned for each topic.

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