_____

A Study of Information Systems Programs Accredited by ABET In Relation to IS 2010

David Feinstein
dfeinstein@southalabama.edu

Herbert E. Longenecker, Jr.
longeneckerb@gmail.com

Dina Shrestha
ds607@jagmail.southalabama.edu

School of Computing,
University of South Alabama
Mobile, AL 36688, USA

Abstract

This article examines the relationship between ABET CAC standards for undergraduate programs of information systems and IS 2010 curriculum specifications. We have reviewed previous work that identifies course structures from accredited IS programs. In addition, the discontinuity observed in curriculum advancement over the years courses with IS 2010 provided background for comparison of required courses within IS 2010 and those of accredited programs. Also, we utilized survey of industry and government data to compare ABET/CAC expectations with IS 2010. A disconnect exists in comparing IS 2010 and ABET/CAC. It is suggested that new work is necessary to resolve these differences.

1.0 Introduction and Background

ABET is the accrediting organization that accredits our discipline. It has in helping to improve IS programs. Specifically,
"Why Accreditation Matters
Simply put, accreditation is value. Reaching into our public, private, and professional lives, accreditation is proof that a collegiate program has met certain standards necessary to produce graduates who are ready to enter their professions. Students who graduate from accredited programs have access to enhanced opportunities in employment; licensure, registration and certification; graduate education and global mobility.

ABET is an integral part of each of these areas because we accredit over 3,100 applied science, computing, engineering, and engineering technology programs at more than 670 colleges and universities in 24 countries worldwide. Approximately 85,000 students graduate from ABET-accredited programs each year." (ABET, 2013)

Academic societies in computing, ACM and IEEE-CS, have a relation to ABET by helping to provide leadership in developing criteria. These

_____

_____

criteria form the basis for evaluating programs. ABET develops the accreditation process, manages an institution visitation and review process. It is comprised primarily of volunteers. Programs are not required to be accredited but do so do enhance their standing with potential students. ABET derives operating funds from the reviewed institutions and from the professional societies.

The curriculum specifications of any ABET model must be consistent with the served constituency, in this case, the IS industry. Scholars and industry participants take part in determining the needs of the constituency. These needs become encapsulated as student outcome and program objectives.

Since the curriculum IS 2010 (Topi, 2010) was published there has been significant interest in this curriculum's lack of technical subjects such as programming, data communications and networking, and database management compared with earlier models (Couger, 1997; Davis, 1997; Gorgone, 2003). To more precisely understand how the IS 2010 specifications differ with what many IS programs are currently covering we choose to look at a well-defined subset of programs in the United States that are accredited by the Computing Accreditation Commission (CAC) of ABET. Currently there are 37 such programs (http://main.abet.org/aps/Accreditedprogramse arch.aspx). The study was done by reviewing the catalogs for each program. There are 10 international programs. We choose not to look at these because difficulties reading their languages.

A review and analysis of course offerings from accredited schools (Larson, 2012) presented an excellent study of the nature of ABET/CAC programs of IS. They found heterogeneous behavior in courses offered both by title and composition. This is compatible behavior for accredited institutions since the goal of accreditation is to ensure that within broad guidelines, institutionally set objectives and provided measures of outcomes ensure quality standards.

2.0 METHODOLOGY

We extracted the list of ABET accredited information systems programs from the ABET website. For each program the catalog course listings were inspected to ascertain coverage of

the seven IS 2010 courses. Using the same set of programs and relevant course data, the coverage of two of ABET/CAC criteria coverage of modern programming languages and data communications and networking was analyzed.
The next step was to analyze the data from Apigian and Gambill review of 240 business programs (2010) in with comparison with the set of accredited programs.

Finally, the ABET/CAC criteria were mapped to a competency classification categories converting the 100 point scale to a 4 point version (Longenecker, Feinstein and Babb, 2013). IS Industry skills demand, and IS 2010 outcomes were likewise mapped to the competency categories to enable ABET/CAC and IS 2010 satisfaction of expectations comparison.

3.0 COMPUTING ACCREDITATION COMMISSION CRITERIA

ABET criteria consist of nine separate criteria (http://www.abet.org/DisplayTemplates/DocsHa ndbook.aspx?id=3148). These are

1. Students
2. Program Educational Objectives
3. Student Outcomes
4. Continuous Improvement
5. Curriculum
6. Faculty
7. Facilities
8. Institutional Support
9. PROGRAM CRITERIA for Information Systems and Similarly Named Computing Programs

Of these nine criteria the only ones that effect a program's selection of courses are Student Outcomes, Curriculum and the Program Criteria for Information Systems. The relevant statements are found in Table 1.

Table 1. Relevant ABET/CAC Criteria

Student Outcomes
> An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution
> An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs

_____

_____

Curriculum

> 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.

Program Criteria for Information Systems

> coverage of the fundamentals of a modern programming language
> data management
> networking and data communications
> systems analysis and design

Two specific criteria are 1--An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs, and 2--An ability to use current techniques, skills, and tools necessary for computing practice. ABET (2013b). Methods to attain these outcomes must be well documented and collected periodically to enable review and revision.

IS 2010 provides a single programming course, however it is not specified as a required component of the degree. Also, the description of the course does not define it as an object oriented programming course. To attain adequate professional ability as required by the CAC standard would require multiple years of experience to achieve such a competency (Babb, Longenecker, Baugh, and Feinstein, 2013).

There is also some question about the coverage of fundamental and advanced topics since IS 2010 has a relatively flat prerequisite structure with IS 2010.1 the sole prerequisite for the next five courses.

IS 2010.1 Foundations of Information Systems

↓

IS 2010.2 Data and Information Management
IS 2010.3 Enterprise Architecture
IS 2010.4 IS Project Management
IS 2010.5 IT Infrastructure
IS 2010.6 Systems Analysis and Design

There is limited curriculum coverage in IS 2010 for networking and operating systems. Likewise, there is no capstone course that is designed to extend development of higher level skills.

4.0 CAC ACCREDITED PROGRAMS COVERAGE OF IS 2010.

Table 3 shows the coverage of IS 2010 courses. Data was available for 35 of the 37 programs accredited by CAC/ABET.

Based on Table 3 coverage by CAC/ABET programs is good for Data Information and Management and Systems Analysis & Design with 34 and 30 programs respectively offering these topics.

Foundations of Information Systems and IS Project Management are in the middle of the coverage with 21 and 18 programs covering this material.

Enterprise architecture and IT infrastructure is only offered by 10 and 11 programs respectively.

Similar to Larsen et al (2012) we note that there may be some level of inaccuracy due to inconsistency with the naming of courses.

However it is obvious from Table 3 and the discussion that the coverage of IS 2010 courses by the ABET accredited IS programs is spotty at best. **In fact there is only a 55 percent coverage of the IS 2010 courses by the IS programs accredited by ABET/CAC**.

5.0 CAC ACCREDITED PROGRAMS COMPARED TO A TECHNOLOGY SUITE OF TOPICS

Table 1 exhibited the characteristics that are required for IS programs to be accredited by ABET/CAC. Table 3 compares these CAC accredited programs with these characteristics.

The data from Table 3 demonstrates the **almost complete coverage of these topics by the accredited IS programs. In fact there is 86 percent coverage of the topics**. The few programs that do not cover the topics must have them covered in some other location. This is not surprising since, in order to be accredited a program must cover these topics.

6.0 COMPARISON WITH BUSINESS IS PROGRAMS

IS 2010, the current information systems curriculum model, was developed with a core to be utilized with several electives. According to Apigian and Gambill who reviewed 240 business

_____

_____

programs by studying catalog copy considerable support was found for programming. This is somewhat surprising as IS 2010 has dropped any programming requirement from the model curriculum. Also, they noted that programs required somewhere between 4 and 16 courses with an average of 9 courses. The sample of these 240 courses is not dissimilar with the CAC accredited programs. (See Table 2 below:)

Table 2. Comparison of ABET and Business IS Programs in Completing Requirements.

Required Courses	Percent of Programs Attaining Requirement	
	ABET Programs	240 Business Schools
Programming, Applications Development	97	99
Data And Information Management	97	99
Systems Analysis & Design	86	85
Data Communications and Networking	89	54
Intro to Information Systems	60	76
Project Management	51	54
Other courses not shown		

Note: Column 2 is from the current study showing percentage of ABET accredited programs matching the required course criterion; the numbers of column 2 are similar to those reported by Larsen (2012), while Column 3 data is taken from Apigian and Gambill 2010.

7.0 ABET/CAC STUDENT OUTCOMES AND CURRICULUM COMPARED WITH IS INDUSTRY EXPECTATIONS AND IS 2010 OUTCOMES

Table 5 show data collected from ABET, surveys of IS industry and government expectations and IS 2010 outcomes statements from required courses. Competency categories and Survey data were utilized from Longenecker, Feinstein and Babb (2013). IS 2010 course outcome statements were mapped to the competency categories as well—skill levels were interpreted based on the statements IS 2010 skill level chart.

ABET student outcome and curriculum statements mapped easily and completely to the competency categories. Likewise Colvin's data (2008) surveying graduates 3-5 years post graduation, the data of Aasheim, et al 2012 surveying IS industry professionals, and the Department of Labor expert statements regarding related STEM cell opportunities mapped well to the competency categories. The average of these surveys produces what we labeled as an "Average Industry Demand". That demand was compared with the IS 2010 curriculum outcome statements. Several significant gaps were detected in Personal and Interpersonal Skills, and in Programming whereas other areas were well suited by the IS 2010 curriculum specifications.

8.0 CONCLUSION

The IS 2010, the ABET/CAC criteria and IS accredited programs along with several published surveys were analyzed to ascertain differences between the accredited programs and IS 2010.

It was not surprising that we found almost complete coverage of the criteria specified material by the accredited IS programs. When we compared the same IS accredited programs the sample of 240 business schools, we found great similarity except for the CAC Criteria requirement of data communications and networking. The ABET accredited programs coverage was 35% higher than the selected business programs.

There are two significant observations relative to the ABET/CAC accredited IS programs and IS 2010. The first is that the there is only a 55 percent coverage of the IS 2010 courses by the ABET/CAC programs. On the other hand the same programs have an 86 percent coverage of the ABET/CAC criteria topics. This indicates there is a significant disconnect between IS 2010 and the ABET/CAC IS accredited programs. The indication is that for these programs, some modification of IS 2010 is warranted.

IS 2010 attention to personal and interpersonal skills probably relates to a decision to not include the topics as formal outcome specifications.

_____

_____

The decision of the IS 2010 authors to leave out programming while including enterprise computing topics represents the view that the new topics are important, and that leaving out programming enables flexibility for exploration by universities. We feel that industry demand for programming is strong and that most programs in recognition of this fact are teaching programming in support of the careers of their students.

9.0 REFERENCES

Aasheim, C., Shropshire, J., Li, L., Kadlec, C. (2012). Knowledge and Skill Requirements for Entry-Level IT Workers: A Longitudinal Study, *Journal of Information Systems Education. Summer 2012, Vol. 23 Issue 2,* p193-204

ABET (2013b). ABET CAC-Criteria-2013-2014.pdf p5), http://abet.org/accreditation-criteria-policies/ retrieved May 31, 2013

ABET (2013). "Why Accreditation", http://www.ABET.org/why accreditation/retrieved May 31, 2013

Apigian, C. H. and Gambill, S. E. (2010). Are We Teaching the IS 2010 Model Curriculum? *Journal of Information Systems Education*, Volume 21, Number 4, Winter 2010, pp. 411-420.

Babb, J.S., Longenecker, H.E., Baugh, J. and Feinstein, D.L. (2013). Confronting the Issues of Programming In Information Systems Curricula: The Goal is Success. Proceedings of ISECON 2013 – San Antonio, Texas.

Couger, J. D., Davis, G.B., Feinstein, D.L., Gorgone, J.T. and Longenecker, H.E. (1997). IS'.97: Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems, *Data Base,* Vol. 26 No. 1, pp. I-94.

Davis, G., J. T. Gorgone, J. D. Couger, D. L. Feinstein, and H. E. Longenecker. (1997). IS'97: Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems. *ACM SIGMIS Database*, 28(1).

Davis, G.B., Couger, J. D., Feinstein, D.L., Gorgone, J.T. and Longenecker, H.E. "IS '97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems," ACM, New York, NY and AITP (formerly DPMA), Park Ridge, IL, 1997.

Gorgone, J.T., Davis, G.B. Valacich, J., Topi, H., Feinstein, D.L. and Longenecker. H.E. (2003). IS 2002 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems. *Data Base* 34(1).

Larson, S., Harrington, M.C.R. (2012). A Study of ABET Accredited Information Systems Programs in the USA, *2012 Proceedings of the Information Systems Educators Conference, New Orleans, Louisiana, USA,* p1,18.

Longenecker, H.E., Feinstein, D.L. and Babb, J.S. (2013). Is there a need for a CIS Model Curriculum?, *Proceedings of ISECON, San Antonia 2013.*

Topi, H., Valacich, J., Wright, R.T., Kaiser, K.M., Nunamaker, J.F., Sipior, J.C., and Vreede, G.J. (2010). IS 2010 Curriculum Guidelines for Undergraduate Degree Programs in Information Systems, Association for Computing Machinery (ACM), Association for Information Systems (AIS)", retrieved July 14, 2012: http://www.acm.org/education/curricula/IS%202010%20ACM%20final.pdf

_____

_____

Appendix

Table 3. ABET/CAC Accredited Schools Coverage of IS 2010 Courses

	IS 2010 Curriculum	*Foundations of Information Systems*	*Data and Information Management*	*Enterprise Architecture*	*IS Strategy, Management, and Acquisition*	*IS Project Management*	*IT Infrastructure*	*Systems Analysis & Design*
	LIST OF UNIVERSITIES							
1	ARKANSAS TECH UNIVERSITY	√	√				√	√
2	CALIFORNIA STATE UNIVERSITY	√	√	√				
3	CALIFORNIA UNIVERSITY OF PENNSYLVANIA	√	√			√		√
4	DREXEL UNIVERSITY	√	√	√		√	√	√
5	EAST TENNESSEE STATE UNIVERSITY	√	√	√	√			
6	FLORIDA MEMORIAL UNIVERSITY	√	√			√		√
7	GANNON UNIVERSITY		√				√	√
8	GRAND VALLEY STATE UNIVERSITY	√	√		√	√		√
9	ILLINOIS STATE UNIVERSITY	√	√	√			√	√
10	JACKSONVILLE STATE UNIVERSITY		√					
11	JAMES MADISON UNIVERSITY		√	√		√		√
12	KENNESAW STATE UNIVERSITY	√	√		√	√	√	√
13	METROPOLITAN STATE UNIVERSITY OF DENVER	√	√		√			√
14	NEW JERSEY INSTITUTE OF TECHNOLOGY	√	√		√			√
15	PACE UNIVERSITY	√	√			√	√	√
16	QUINNIPIAC UNIVERSITY		√	√		√		√
17	RADFORD UNIVERSITY		√				√	
18	REGIS UNIVERSITY	√	√		√	√	√	√
19	ROBERT MORRIS UNIVERSITY		√	√	√	√		√
20	SLIPPERY ROCK UNIVERSITY	√	√		√	√		√
21	SOUTHERN UTAH UNIVERSITY		√					√
22	THE UNIVERSITY OF TAMPA	√	√	√		√	√	√
23	UNIVERSITY OF ARKANSAS AT LITTLE ROCK		√					√
24	UNIVERSITY OF HOUSTON – CLEAR LAKE	√						√
25	UNIVERSITY OF HOUSTON, COLLEGE OF TECHNOLOGY	√	√			√		√
26	UNIVERSITY OF NEBRASKA AT OMAHA	√	√			√		√

_____

_____

#	University							
27	UNIVERSITY OF NORTH ALABAMA		√					√
28	UNIVERSITY OF NORTH FLORIDA		√	√		√		
29	UNIVERSITY OF PUERTO-RICO, RIO PIERDAS CAMPUS		√					√
30	UNIVERSITY OF SOUTH ALABAMA		√		√	√		√
31	UNIVERSITY OF SOUTH CAROLINA		√					√
32	UTAH STATE UNIVERSITY	√	√					√
33	UTAH VALLEY UNIVERSITY	√	√					√
34	VIRGINIA COMMENWEATLTH UNIVERSITY		√			√	√	√
35	WRIGHT STATE UNIVERSITY	√	√	√	√	√	√	√
	Total	21	34	10	10	18	11	30

_____

_____

Table 4. CAC/ABET Programs Compliance with ABET Accreditation Specifications

	LIST OF UNIVERSITIES	BASIC PROGRAMMING	DATA COMMUNICATIONS AND NETWORKING
1	ARKANSAS TECH UNIVERSITY	√	√
2	CALIFORNIA STATE UNIVERSITY	√	
3	CALIFORNIA UNIVERSITY OF PENNSYLVANIA	√	
4	DREXEL UNIVERSITY	√	√
5	EAST TENNESSEE STATE UNIVERSITY	√	√
6	FLORIDA MEMORIAL UNIVERSITY	√	√
7	GANNON UNIVERSITY	√	√
8	GRAND VALLEY STATE UNIVERSITY	√	√
9	ILLINOIS STATE UNIVERSITY	√	√
10	JACKSONVILLE STATE UNIVERSITY	√	√
11	JAMES MADISON UNIVERSITY	√	√
12	KENNESAW STATE UNIVERSITY	√	
13	METROPOLITAN STATE UNIVERSITY OF DENVER	√	√
14	NEW JERSEY INSTITUTE OF TECHNOLOGY		
15	PACE UNIVERSITY	√	√
16	QUINNIPIAC UNIVERSITY		√
17	RADFORD UNIVERSITY	√	√
18	REGIS UNIVERSITY	√	√
19	ROBERT MORRIS UNIVERSITY	√	√
20	SLIPPERY ROCK UNIVERSITY	√	√
21	SOUTHERN UTAH UNIVERSITY	√	√
22	THE UNIVERSITY OF TAMPA		
23	UNIVERSITY OF ARKANSAS AT LITTLE ROCK	√	√
24	UNIVERSITY OF HOUSTON – CLEAR LAKE	√	√
25	UNIVERSITY OF HOUSTON, COLLEGE OF TECHNOLOGY		√
26	UNIVERSITY OF NEBRASKA AT OMAHA		√
27	UNIVERSITY OF NORTH ALABAMA	√	√
28	UNIVERSITY OF NORTH FLORIDA	√	√
29	UNIVERSITY OF PUERTO-RICO, RIO PIERDAS CAMPUS	√	√
30	UNIVERSITY OF SOUTH ALABAMA	√	√
31	UNIVERSITY OF SOUTH CAROLINA		
32	UTAH STATE UNIVERSITY	√	√
33	UTAH VALLEY UNIVERSITY	√	√
34	VIRGINIA COMMENWEATLTH UNIVERSITY	√	√
35	WRIGHT STATE UNIVERSITY	√	√
	Total Programs	29	29

_____

ABET Specification	Competencies			IS Industrial Skills Demand			Average Total Demand	Academic	Gap
				Survey	Survey	Department of Labor			
1	2		3	4	5	6	7	8	9
Student Outcomes and Curriculum	Definition		Sub-Category	Recent Grads Colvin 2008	IT Professionals Aasheim 2012	IS related Jobs Sys. Analyst, DBA, App Develop, Web Develop	4 +5 +6	IS 2010 Outcomes	7 - 8
Professional, ethical, security, social, security issues; communicate with a range of audiences; engage in life-long learning; fundamentals of IT and mathematics	People Skills	1	Personal	3.2	3.2	2.56	2.89	0.00	2.89
Function on Teams to Accomplish Goal		2	Interpersonal	3.6	3.16	2.40	3.05	0.00	3.05
Background in topics regarding the IS environment		3	Organizational	3.64	2.84	2.80	3.11	3.00	0.11
Role of IS in Organizations; integrate IT solutions into user environment	Technology	4	IT Alignment	3.16	2.88	2.64	2.89	2.68	0.21
Networking and Data Communications		5	Networking and Operating Systems	2.68	2.84	2.84	2.79	3.00	-.21
Data Management		6	Database	2.96	2.8	3.08	2.95	3.04	-.09
Systems Analysis & Design; processes supporting delivery of IS; local & global impact of IT on individuals and organizations		7	Sys Analysis & Design	3.28	3.08	2.76	3.04	3.00	0.04
Modern Programming Language; design and implement a solution based on current techniques		8	Programming	3.04	2.96	3.32	3.11	0.00	3.11
Participate in Project Planning		9	Project Management	3.64	2.40	2.76	2.93	3.00	-.07

Table 5. IS industrial expectations versus outcomes of IS 2010 Curriculum compared with ABET student outcomes.

_____

_____