Curriculum Mapping as a Tool for Continuous Improvement of IS Curriculum

Natasha F. Veltri
Harold W. Webb
Information & Technology Management Department
The University of Tampa
Tampa, FL 33606, USA
nveltri@ut.edu hwebb@ut.edu

Alexei G. Matveev
Enrique G. Zapatero
Norfolk State University
Norfolk, VA 23504, USA
agmatveev@nsu.edu egzapatero@nsu.edu

ABSTRACT

Employers, accreditation and governmental agencies increasingly call for Information Systems (IS) programs to ensure, document, and demonstrate that their curricula embody coherent courses of study that systematically integrate statements of intended learning outcomes. This paper presents a comprehensive and structured curriculum mapping framework that is applied to examine an IS baccalaureate program. The framework assists curriculum as well as accreditation self-study committees to evaluate how intentionally IS curricula advance expected program learning outcomes and ensure that students receive appropriate instruction and assignments in the desired order, so that learning outcomes are effectively achieved in a field marked by technology-driven change. As part of a continuous improvement cycle, the curriculum map, evolving IS model curriculum guidelines, and the outcome assessment data from an IS baccalaureate program are used to revise the existing program. Recommendations are made for use of curriculum mapping in evaluating intended program learning outcomes, program design, course design, course implementation, assessment design, and assessment implementation.

Keywords: Curriculum design & development, Model curricula, Program assessment/design

1. INTRODUCTION

Under the current conditions of labor market uncertainty, economic instability, and rapid technological change, strategies for developing integrated curricula that would provide a coherent, aligned educational experience to students and would address increasing calls for accountability, efficiency, and transparency become a prominent concern for faculty and administrators. For example, the Commission on Colleges of the Southern Association of Colleges and Schools (SACS, 2005) states, "[curriculum] coherence is a critical component of a program and should demonstrate an appropriate sequencing of courses, not a mere bundling of credits, so that student learning is progressively more advanced in terms of assignments and scholarship required and demonstrates progressive advancement in a field of study that allows students to integrate knowledge and grow in critical skills" (p. 12). Similarly, the Accreditation Board for Engineering and Technology, ABET mandates the program's requirements to be consistent with the program's educational objectives and stipulates that the designed curriculum should focus on achieving each one of the program outcomes (ABET, 2009) . Likewise, the Association to Advance Collegiate Schools of Business, AACSB emphasizes the importance of the alignment between learning goals and curricula. According to AACSB, the outcomes assessment process is meaningless unless learning goals are addressed in the curricula (AACSB, 2007).

Guidance on curricular content within the field of IS has been developed and revised three times over the past two decades by various task forces commissioned by the Association for Computing Machinery (ACM) and Association for Information Systems (AIS). The most recent iteration is the IS 2010 Model Curriculum Guidelines, which address rapidly changing knowledge areas within the field of IS. This model addresses curricular requirements at a global level by identifying high-level capabilities and then translating them into a detailed set of knowledge and skills in three core categories plus a number of specialty areas (Topi et al. 2010). The curriculum guideline is semi-flexible allowing individual institutions around the globe to design their IS curricula to meet local requirements. The authors of the guidelines explicitly state that "IS 2010 is not directly linked to a degree structure in any specific environment but it provides guidance regarding the core content of the curriculum that should be present everywhere and suggestions regarding possible electives and career tracks based on those." (Topi et al., 2010, p. vii). Even when adhering to these guidelines the responsibility for proper IS curriculum design and successful implementation remains with the individual educational institution.

Surprisingly, despite the fundamental focus on systems in the IS education field, there appears to be a lack of conceptually framed studies on the coherence of IS college curricula (Hatzakis, Lycett and Serrano, 2007). In fact, McGann, Frost, Matta, and Huang (2007) recently pointed out the lack of publications discussing IS curriculum model implementation and integration in mainstream IS journals, despite a clearly identified problem of scattered courses in existing IS curriculum. Curriculum mapping provides a visual tool to capture and study the integration of program curricula. It is an analytical approach that allows faculty to specify key components of program curricula, arrange them in relation to each other in a visual format, and capture an overarching curricular structure that provides cognitive scaffolding for teaching and learning processes (Cuevas, Matveev and Feit, 2009). Curriculum mapping has been extensively utilized in British, Australian, and Canadian colleges and universities (Bath et al., 2004; Harden, 2001; Jones et al., 2007; Robley, Whittle and Murdoch-Eaton, 2005; Sumsion and Goodfellow, 2004; Tariq et al., 2004; Willett, 2008). In U.S. higher education, program curriculum and course mapping exercises have been primarily discussed in the context of focusing institutional assessment efforts (Allen, 2004, 2006; Driscoll and Wood, 2007; Maki, 2004; Palomba and Banta, 1999), as an approach to address requirements of specialized accreditation agencies in business, engineering, and pharmaceutical education (Stivers and Phillips, 2009; Kelleyet al., 2008; Plaza et al., 2007; Wigal, 2005), as an effective curriculum improvement process (Kopera-Frye, Mahaffy and Svare, 2008; Bloomberg, 2009), or as a faculty development tool (Uchiyama and Radin, 2009).

Visual depiction of the curricular structure is not a new approach to curriculum development and review in the MIS education field (Swanson et al., 1979). However, published studies based on formal curriculum mapping exercises in IS are a relatively recent phenomenon (Daigle et al., 2004; Landry et al., 2009; White and McCarthy, 2007). In fact, Daigle and colleagues, mapping pioneers in the IS field, point out a significant gap in their discussion of the IS 2002 model curriculum. They note that "…despite the fact that curriculum mapping is used in K-12 education, and that it is a fundamental, possible use of the model curriculum, we are aware of no such efforts to publish such an approach to using the IS model curriculum" (p. 3). Therefore, the purpose of this paper is three-fold. The first objective is to introduce a holistic curriculum mapping framework deliberately designed to study coherence of academic program curricula. The second objective is to illustrate the utility of the mapping technique for program review. The third objective is to demonstrate the use of curriculum mapping and outcome assessment for continuous improvement of the curriculum.

2. CONCEPTUAL FRAMEWORK

Development of the curriculum mapping framework presented in this paper was informed by program and course mapping approaches described by Allen (2004, 2006), Bloomberg (2009), Daigle et al. (2004), Driscoll and Wood (2007), Maki (2004), and others. A distinctive characteristic of the framework is that it is built on a clearly specified conceptual model (Figure 1) and is intentionally designed to capture the degree of curriculum coherence by systematically exploring relationships between and among five major curriculum components -- intended program learning outcomes, course sequence, syllabi, instructional activities, and assessment of learning -- through the double lens of outcomes integration and alignment between curriculum components. This proposed conceptual model extends prior course mapping approaches by integrating outcome communication and assessment aspects of curriculum into the model and introducing a quantitative indicators scheme to facilitate comparative analysis and capture curriculum development over time.

There is a consensus in the curriculum development literature that institutions may have multiple curricula in place, and those curricula may have little to do with one another in content, coverage, or effectiveness (Ewell, 1997). The essential purpose of curriculum mapping projects is to determine the degree of consistency between what faculty expect students to learn, what learning experiences faculty design, what faculty tell students about expected learning, what faculty think they teach, and what faculty assess. The presented curriculum mapping framework elaborates on Cuevas et al.'s (2009) model and is built on the assumption that, *from an instructor's perspective*[1], there might be at least 5 different conceptions of curriculum – intended, designed, communicated, enacted, and assessed (Figure 1) (cf., Ewell, 1997; Hatzakis, Lycett and Serrano, 2007; Kopera-Frye, Mahaffy and Svare, 2008; Harden, 2001; Robley, Whittle and Murdoch-Eaton, 2005).

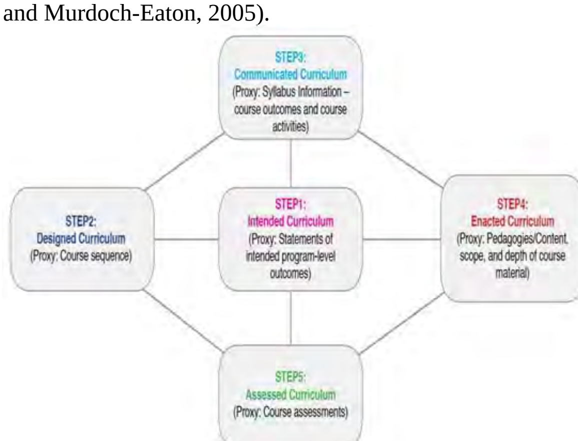

Figure 1. Conceptual Framework.

This conceptual framework builds on the “learning outcomes model” (Tariq et al., 2004). Statements of intended program outcomes express collective faculty expectations about the program curriculum and serve as a conceptual anchor for the mapping exercises. The *intended* curriculum is reflected through program catalog descriptions and, more specifically, articulated statements of intended program-level outcomes. The *designed* curriculum is reflected through degree plans and course sequences. The *communicated* curriculum consists of course-level outcomes as well as specific teaching and learning activities listed in course syllabi. The *enacted* curriculum refers to classroom pedagogies and the content, scope and depth of the material delivered by an instructor in the classroom. The *assessed* curriculum consists of the type and content of specific assessment tasks assigned to students in a given course.

3. MAPPING STEPS

A curriculum matrix is a two-dimensional data recording tool that facilitates the assignment of selected intended program outcomes (proxy indicator of *intended* curriculum) to core program courses (proxy indicator of *designed* curriculum) listed in the order that a “typical student” would follow while identifying the level at which the outcomes are addressed in each course (at the intersection of columns and rows) (Figure 2). There are three sub-columns in each outcome column, which represent proxy indicators for the three types of curricula – *communicated* curriculum, *enacted* curriculum, and *assessed* curriculum – in relation to the given program outcome. The first sub-column, “Outcomes Statement,” indicates whether and how the given program outcome is communicated to students through the syllabus of a given course. The second sub-column, “Level,” represents the level at which the content of the given course reflects the given program outcome. The third sub-column, “Feedback,” indicates whether the students in the given course are provided with feedback on their performance in the given outcome area. The curriculum mapping process is designed to engage faculty members in a structured analysis of the extent to which program curricula intentionally and transparently integrate intended program outcomes.

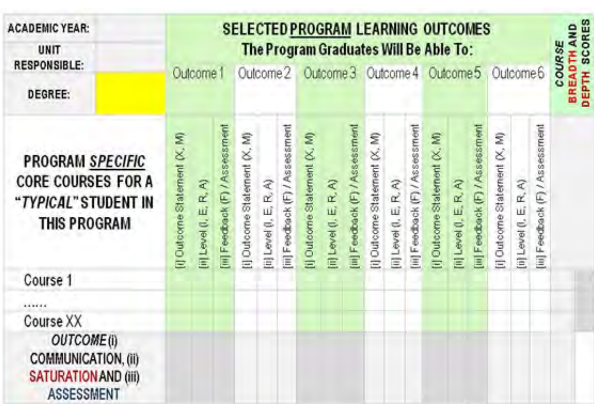

Figure 2. Curriculum Matrix

3.1 Step 1: Intended Curriculum

Learning outcome[2] refers to an intended effect of the program educational experience that has been stated in terms of specific, observable, and measurable student performance. Program learning outcomes specify knowledge, skills, values, and dispositions students are expected to attain in an academic course of study. Well-developed statements of intended program learning outcomes provide a coherent starting place to begin examining program curricula (Palomba and Banta, 1999). Unless the outcomes are developed and agreed upon by program faculty, the whole curriculum mapping exercise will be meaningless and may even be destructive.

The statements of intended program outcomes are listed in the top horizontal row of the matrix. Practice shows that six to eight outcomes is an optimal number for program mapping exercises. Six to eight outcomes can effectively reflect the core of the program and demonstrate its scope but, at the same time, keep the mapping process manageable. If a program has (e.g., mandated by specialized disciplinary accreditors) more than eight intended outcomes, the outcomes can be alternated for mapping per year or semester. This is consistent with recommendations to keep the assessment process manageable by spreading tasks across multiple years (Rogers, 2003).

3.2 Step 2: Designed Curriculum

Program core courses are listed in the left vertical column. Generally, core courses include required program-specific courses and two or three of the most popular program-specific electives. It is customary for the courses to be arranged in the order that a “typical student” takes to progress through the program curriculum. Some programs might find it necessary to analyze transcripts of recent graduates to identify a typical curriculum progression path. It also might be necessary to develop different maps for different program concentrations if the transcript analysis uncovers substantially different pathways for different student populations.

3.3 Step 3: Communicated Curriculum

Course syllabi serve as an important tool to ensure, document, and demonstrate curriculum intentionality. Syllabi can articulate specific course outcomes in the context of broader program outcomes, direct student effort, and specify type and level of expectations (Eberly, Newton and Wiggins, 2001). Furthermore, course syllabi can serve as a source of data to examine content and coverage of a given course as well as conformity of the course with the intended program outcomes (Ewell, 1997). However, research shows that syllabi are rarely considered as part of curriculum review and redesign (Eberly, Newton and Wiggins, 2001).

This step involves analysis of each core course to determine whether each program outcome is explicitly or implicitly mentioned among the course outcomes on the syllabus. In other words, at this step faculty focus on the communication aspect of curriculum coherence – how well intended program outcomes are communicated in the program courses.

An *explicit* statement of intended outcome indicates that a program outcome is fully and directly expressed or referenced in a course syllabus. For example, if a program has development of a computer program as one of the programmatic outcomes and the syllabus for a given course states: "At the end of the course students will be able to … develop a computer program using a contemporary programming language," then the faculty member completing the map for the course would put "X" (eXplicit) in the first sub-column for the scientific reasoning outcome.

The *implicit* statement of intended outcome indicates that the program outcome is indirectly expressed or referenced in a course syllabus. For example, if a program has critical thinking skills as one of the outcomes and the syllabus for a given course states: "The student will use and process arrays in a problem-solving context," then the faculty member completing the map for the course would put "M" (iMplicit) in the first sub-column for the critical thinking skills. If a given program outcome is not referenced in the course syllabus, then the cell is left blank.

3.4 Step 4: Enacted Curriculum

"Instruction brings life to curriculum goals and objectives" (Palomba and Banta, 1999, p. 278). In this step faculty members reflect on the level of course content delivery, make professional judgments, and indicate whether each intended program outcome is Introduced (I), Emphasized (E), Reinforced (R), or Advanced (A) in the given course by listing an appropriate code (I, E, R, A) in the second sub-column for each outcome. The *level of content delivery* refers to the scope and complexity of the knowledge and skills that are expected to be taught and learned in a course.

Allen (2006) notes that a simple check can be used to indicate that a given course addresses a given outcome, but more details (codes) show how the curriculum builds on itself. Such scaffolding reflects the developmental nature of learning, demonstrates sequential alignment of program curriculum, and provides a roadmap for developing and assessing intended learning outcomes at increasingly sophisticated levels and documenting curriculum progression. Biggs' work on the Structure of the Observed Learning Outcome (SOLO) provided a general foundation for developing the I,E,R,A coding system in the presented curriculum mapping framework (Biggs, 1996; Biggs and Tang, 2007). The SOLO taxonomy "provides a systematic way of describing how a learner's performance grows in complexity when mastering many academic tasks;" it describes the development of outcomes in terms of "a quantitative accrual of the components of a task [intended outcome], which then become qualitatively restructured" (Biggs, 1996, p. 350).

At the Introduced (I) level, students are not expected to be familiar with the content or skill at the collegiate level. Instruction and learning activities focus on basic knowledge, skills, and/or competencies and entry-level complexity. Only one aspect of a complex program outcome is addressed in the given course. At the Emphasized (E) level, students are expected to possess a basic level of knowledge and familiarity with the content or skills at the collegiate level. Instruction and learning activities concentrate on enhancing and strengthening knowledge, skills, and expanding complexity. Several aspects of the outcome are addressed in the given course, but these aspects are treated separately. At the Reinforced (R) level, students are expected to possess a strong foundation in the knowledge, skill, or competency at the collegiate level. Instruction and learning activities continue to build upon previous competencies with increased complexity. All components of the outcome are addressed in the integrative contexts. Finally, at the Advanced (A) level, students are expected to possess an advanced level of knowledge, skill, or competency at the collegiate level. Instructional and learning activities focus on the use of the content or skills in multiple contexts and at multiple levels of complexity. Complex program outcomes are reconceptualized at a higher level of abstraction, which in turn enables generalization to a new context and self-reflection (Biggs, 1996).

Alternatively, programs can use Kelley et al.'s (2008) four-level coding systems to define where and to what extent or level the outcomes are taught in the curriculum; Tariq et al.'s (2004) levels of content delivery that combine indicators of the complexities of content presented and the degree of learner autonomy required to achieve a particular outcome; Daigle et al.'s (2004) four-level "depth metric" based on the IS model curriculum to indicate "an educational depth level of coverage to which the learning unit [i.e., outcome] was targeted" in the given course (p. 5); or White and McCarthy (2007) levels of content coverage based on the temporal measure.

3.5 Step 5: Assess Curriculum

In this step, faculty review course syllabi assignments and indicate whether students in the given course have opportunities to demonstrate what has been learned in each program outcome *and* receive feedback in a formal way (e.g., grade, score, written feedback). A strong syllabus can function as an effective communication device about the assessed curriculum (Parkes, Fix and Harris, 2003). Indeed, a well-developed syllabus "communicates the overall pattern of the course, so a course does not feel like disjointed assignments and activities, but instead an organized and meaningful journey. …a good syllabus clarifies the relationship between goals and assignments" (Slattery and Carlson, 2005, p. 159).

The intent of this step is to gather information about the assessed curriculum. If students are asked to demonstrate their learning on the given program outcome through course homework, projects, tests, etc. and are provided formal feedback, then the faculty member completing the map for the given course would indicate "F" (Feedback) in the third sub-column for the outcome. If a given program outcome is not reflected in the course assignments, then the cell is left blank. For example, a course syllabus statement -- "Students are required to develop an information technology service request, study and analyze a business system, gather additional information if required, and specify system requirements and develop a test plan for the system" -- warrants the label "F" for the application of systems theory program outcome.

3.6 Step 6: Key Quantitative Indicators

Step six involves computation of the following five quantitative indicators: (i) relative level of intentionality with which the program outcomes are presented in syllabi, (ii) relative weight of program outcomes in the curriculum, (iii) relative degree of program outcomes assessment focus, and relative contribution of program courses to the development of program outcomes in terms of (iv) breadth and (v) depth of program outcomes coverage. Table 1 presents computation procedures for the five indicators.

4. UPU's MAPPING CURRICULUM

In the following sections we illustrate the utility of the curriculum mapping approach in program review and redesign. The Urban Private University (UPU) is located in a Southeastern state in the USA. UPU is a comprehensive university offering undergraduate and graduate programs to over 6,000 students. The university is accredited by the Southern Association of Colleges and Schools (SACS) and its College of Business is accredited by AACSB International. Students majoring in Management Information Systems (MIS) are required to complete at least 124 hours of undergraduate courses and are awarded the Bachelor of Science degree. A curriculum map of UPU's bachelors program in MIS is presented in Figure 3. This map is based on the program in place in the fall of 2007, when the last review of the curriculum was conducted. UPU's MIS program, which was designed for consistency with the IS 2002 model curriculum, has ten program outcomes approved by program faculty. To keep the mapping process manageable only seven outcomes were selected for mapping, with the remaining outcomes to be rotated in and mapped in a different year (Rogers, 2003). The MIS curriculum map is based on eight required courses as well as the two most popular electives.

Quantitative Indicators	*Computation Procedures*
(i) Relative level of outcome intentionality	Sum the codes in the first sub column: X (explicit) = "2," M (implicit) = "1"
(ii) Relative weight of an outcome	Sum the codes in the second sub column: I (introduced) = "1," E (emphasized) = "2," R (reinforced) = "3," A (advanced) = "4"
(iii) Relative degree of assessment focus on a given outcome	Sum the codes in the third sub column: F (feedback) = "1"
(iv) Course scope or breadth	Count the number of program outcomes addressed by the course
(v) Course intensity or depth	Sum the codes for each row that reflect how each program outcome is addressed in a given course: I (introduced) = "1," E (emphasized) = "2," R (reinforced) = "3," A (advanced) = "4"

Table 1. Quantitative Indicators

	Indicators	*Measures*	*Findings*
1	Outcome scope score	Number of courses addressing each program outcome	All program outcomes are explicitly addressed in 3 or more courses
2	Outcome communication score	Number of courses explicitly and implicitly reflecting the given program outcome on the syllabus	Outcomes 3 and 4 were not explicitly addressed in IS 260 and IS 350
3	Course breadth score	Number of program outcomes addressed by each course	Courses have different breadth, capstone course is broadest
4	Course depth score	Sum of I,E, R, A scores for the given course	Capstone course IS 450 has the greatest depth, as expected
5	Outcome saturation score	Sum of I, E, R, A scores for the given outcome	Outcome 7 has the lowest saturation score, seems to be neglected
6	Assessment points score	Number of courses integrating assessment of the given program outcome	Outcome 7 has the lowest assessment score and needs to have more assessment points in the curriculum

Table 2. Outcome Integration: Results of MIS Map Review

4.1 Analysis of the Program Outcomes Integration and Alignment

All seven program outcomes were explicitly addressed in the course syllabi in three or more courses. Outcome 3, critical thinking, was reflected on the syllabi of every single course, albeit not always explicitly (see indicator 1 and 2 in Table 2). Although all program outcomes appeared on the syllabi, it is evident that the value that faculty assigned to different program outcomes was not uniform. While outcomes 3 and 4 enjoyed major emphasis in the designed program, outcomes 2, 6 and 7 were addressed only in three courses. This reflects misbalance in outcome coverage and should be reviewed in the context of the documented gaps between faculty priorities, industry needs, and student perceptions (Martz and Cata, 2008; Plice and Reinig, 2007).

In terms of course coverage, the majority of courses addressed three or four learning outcomes and did not vary much on breadth (indicator 3). Some of the courses had a narrower focus on a specific area of Information Systems. For example, IS 280 – Data Communications Systems is a required course intentionally designed to give students an in-depth exposure to concepts of data communication, thus it only addressed two program level outcomes. The course that addressed six out of seven program outcomes (IS 450 – Systems Analysis and Design II) is a capstone course that students take in their final year. This course also exposed students to all program learning outcomes at greatest depth (indicator 4). By ensuring a relatively broad scope of most program courses and by implementing a required capstone

ACADEMIC YEAR: 2007-2008	SELECTED PROGRAM LEARNING OUTCOMES The Program Graduates Will Be Able To:																					*COURSE* BREADTH AND	DEPTH SCORES
UNIT RESPONSIBLE: MIS DEPARTMENT	1. Develop a computer program using a contemporary programming language, programming algorithms and data structures.			2. Properly use and implement a database using a contemporary database management system.			3. Apply critical thinking skills in decision making in the context of systems development.			4. Apply systems theory and information concepts in the analysis of organizational problems and opportunities.			5. Properly design and implement information systems.			6. Understand the architectural concepts of computers and computer networks.			7. Apply project and risk management principles and techniques to an information systems project.				
DEGREE: **Bachelor of Science Management Information Systems (MIS) Major**																							
PROGRAM *SPECIFIC* CORE COURSES FOR A "*TYPICAL*" MIS STUDENT	[i] Outcome Statement (X, M)	**[ii] Level (I, E, R, A)**	[iii] Feedback (F) / Assessment	[i] Outcome Statement (X, M)	**[ii] Level (I, E, R, A)**	[iii] Feedback (F) / Assessment	[i] Outcome Statement (X, M)	**[ii] Level (I, E, R, A)**	[iii] Feedback (F) / Assessment	[i] Outcome Statement (X, M)	**[ii] Level (I, E, R, A)**	[iii] Feedback (F) / Assessment	[i] Outcome Statement (X, M)	**[ii] Level (I, E, R, A)**	[iii] Feedback (F) / Assessment	[i] Outcome Statement (X, M)	**[ii] Level (I, E, R, A)**	[iii] Feedback (F) / Assessment	[i] Outcome Statement (X, M)	**[ii] Level (I, E, R, A)**	[iii] Feedback (F) / Assessment		
IS 220 "Information Technology"				X	*I*	F	X	*I*	F	X	*I*	F				X	*I*	F	X	*I*		**5**	**5**
IS 250 "Programming Theory and Concepts"	X	*E*	F				X	*E*	F	X	*I*	F	X	*I*	F							**4**	**6**
IS 260 "Web Programming"	X	*R*	F				M	*E*	F	M	*I*		X	*E*	F							**4**	**8**
IS 280 "Data Communications Systems"							X	*I*	F							X	*E*	F				**2**	**3**
IS 310 "Systems Analysis and Design I"							X	*E*	F	X	*E*	F							X	*E*	F	**3**	**6**
IS 350 "Advanced Programming"	X	*A*	F				M	*E*	F				X	*E*	F							**3**	**8**
IS 410 "Database Design and Administration"				X	*E*	F	X	*E*	F	X	*E*	F										**3**	**6**
IS 420 "Network Management" (Elective)							X	*E*	F							X	*A*	F				**2**	**6**
IS 430 "Information Systems in the Global Environment" (Elective)							X	*E*	F	X	*E*	F										**2**	**4**
IS 450 "Systems Analysis and Design II"	X	*R*	F	X	*R*	F	X	*R*	F	X	*A*	F	X	*R*	F				X	*E*	F	**6**	**18**
***OUTCOME* (i) COMMUNICATION, (ii) SATURATION AND (iii) ASSESSMENT**	**8**	**12**	**4**	**6**	**6**	**3**	**18**	**19**	**10**	**13**	**13**	**6**	**8**	**8**	**4**	**6**	**7**	**3**	**6**	**5**	**2**		

Figure 3. UPU Curriculum Map for 2007-2008 Academic Year.

course, UPU's MIS program contributed to the development of integrative thinkers.

Significant misbalance in program outcome coverage was further reflected in the relative weights of program outcomes and courses in the curriculum (indicator 4). For example, examining outcome saturation scores (second sub-column), it was evident that outcome 3 (score of "19") was emphasized in the curriculum at the level more than three times higher than outcome 7 (score of "5"). In fact, outcome 7 appeared to be the most neglected area of the curriculum. Although it was addressed in three courses similar to outcomes 2 and 6, its saturation score (a sum of I, R, E and A) was only "5" compared to "6" and "7" for outcomes 2 and 6 respectively.

Baxter, Magolda and King (2007) argued that an important step that educators need to take to effectively help students to achieve core learning outcomes "is to understand the developmental foundation that makes achievement of these outcomes possible" (p. 491). Overall, the course sequence appeared to reflect the developmental pattern of student cognitive development. Most courses were arranged progressively by the intellectual depth scores: program learning outcomes were first introduced (I score), then emphasized (E), reinforced (R) and finally advanced (A). However, it is important to note that outcome 1 was missing the Introductory (I) level and Outcomes 2, 3, 5 and 7 were missing the Advanced (A) level. These findings pose important questions, such as – "Where do students acquire basic knowledge and skills related to computer programming?" and "Are we graduating students who have not fully achieved our intended outcomes?" – and have serious implications for student retention and the employability of program graduates. These questions should be discussed among program faculty, shared with colleagues teaching general education courses and industry advisory boards, and used for further curricular enhancements.

Eisner (1998) pointed out that "[m]ore than educators say, more than they write in curriculum guides, evaluation practices tell both students and teachers what counts. How these practices are employed, what they address and what they neglect, and the form in which they occur speak forcefully to students about what [educators] believe is important" (p. 81; quoted from Taylor and Haynes, 2008, p. 4). Each program outcome had at least three assessment points in the curriculum, except outcome 7 (indicator 5). The misbalance in outcomes coverage mentioned above was reflected and, consequently, reinforced, by assessment practices; thus, different outcomes appeared to have different assessment values. To ensure that the curriculum is supported by a comprehensive assessment program, faculty needed to take a closer look at outcomes 2, 6 and especially 7. For outcomes 2 and 7 the students are not provided with opportunities to demonstrate their achievement of these outcomes at the Advanced (A) level. Therefore, summative assessments at the capstone course might lack validity, since it did not assess student achievement of the full range of knowledge, skills, abilities, and dispositions associated with the program outcomes.

Overall, MIS 2007-2008 curriculum appeared to be relatively well-aligned. For example, outcome 6 was mentioned in the syllabi of three courses, taught in three courses, and assessed in three courses. Similarly, the syllabus for IS 250 – Programming Theory and Concepts specified several course outcomes dealing with various application programming competencies: variables, algorithm structures, data arrays, text files, etc. The course involved a series of projects each focusing on a specific programming competency and gradually building up from more basic to more advanced competencies. Student performance was graded for each project and the student received feedback in the form of a grading rubric based on the intended outcomes.

5. USING CURRICULUM MAPPING FOR CURRICULUM REVISION

UPU recently underwent a comprehensive curriculum redesign of its undergraduate MIS program to align it with the new IS 2010 model curriculum. Statements of intended program learning outcomes were reviewed to reflect the changes in the IS field and to maintain alignment with the general direction of the new model curriculum. The core curriculum was significantly modified in consultation with the UPU's industry advisory board and currently consists of 7 required courses and 1 elective. Courses were concurrently changed from 3 to 4 credit hours based on a college-wide program change, allowing for a substantial increase in course content. Building on the model IS 2010 curriculum, course syllabi, containing course level learning outcomes, were created for each course. Course learning outcomes were then mapped to UPU's MIS program learning outcomes to ensure coherence of the program curriculum (Figure 4).

In 2008 UPU began using the Information Systems Analyst (ISA) certification exam as a direct measure of student learning. The use of this instrument in IS programs is consistent with a number of ABET accredited MIS programs. The exam contains 258 questions that can be mapped to program and course learning outcomes allowing UPU to determine how well the assessed curriculum aligns with the designed curriculum. The availability of comparative national results, primarily from ABET accredited programs, provides an external benchmark for evaluating student performance at a very granular level. ISA exam results helped identify neglected areas in the existing 2007-2008 curriculum and were subsequently addressed in the revised 2010-2011 curriculum.

6. CLOSING THE LOOP: MEASURING IMPROVEMENT

In conducting its curriculum review UPU faculty had to take into account a number of competing factors. First, the IS 2010 curriculum guidelines significantly reduced the focus on programming, relegating it to an elective course. The guidelines concurrently added new content on enterprise systems. Other content areas were reorganized with IT Infrastructure subsuming the topics of data communication, operating systems, and hardware. Working on curriculum revision, UPU faculty had multiple meetings with its industry advisory board. Both faculty and advisory board disagreed with eliminating programming from the required set of courses. This was consistent with ABET's IS program criteria, which include a required programming course. UPU faculty also considered the results of the ISA exam during the redesign with the goal of strengthening areas that revealed weakness. While UPU faculty did decide to reduce the emphasis on programming, it elected to retain one required programming course and offer an advanced programming course as an elective.

UPU faculty increased the emphasis on systems development in the large-scale enterprise environment at the suggestion of its industry advisory board. This was consistent with the new emphasis on enterprise systems in the IS 2010 curriculum. UPU had joined the SAP University Alliance in 2008 and had already increased the emphasis on enterprise systems as a pilot program. This was consistent with advice UPU faculty had received from its industry advisory board.

The factors discussed above drove the changes in program and course redesign at UPU. Emphasis on programming decreased while emphasis on systems analysis, design, database, infrastructure, implementation, and project management increased. The emphasis on critical thinking skills and systems thinking were maintained. During the process new course designs were developed complete with course change documentation, new syllabi, and the mapping of course outcomes to program learning outcomes. While the fundamental program learning outcomes were not changed, the emphasis of each was adjusted through the curriculum redesign process. All program and course changes were required to be approved at university level, driven primarily by the change from 3 to 4 credit hour courses. Courses were renamed to facilitate alignment with the IS 2010 curriculum, and some content was redistributed among courses. The revised syllabi were then mapped to the program learning outcomes and analyzed in terms of outcomes, structure and assessment (Figure 4).

Comparison of the summary scores from the 2007-2008 and 2010-2011 curriculum maps could be used to measure improvement in the curriculum. The overall impact of the

ACADEMIC YEAR: 2010-2011	SELECTED **PROGRAM** LEARNING OUTCOMES The Program Graduates Will Be Able To:																					COURSE BREADTH AND DEPTH SCORES	
UNIT RESPONSIBLE: MIS DEPARTMENT	1. Develop a computer program using a contemporary programming language, programming algorithms and data structures.			2. Properly use and implement a database using a contemporary database management system.			3. Apply critical thinking skills in decision making in the context of systems development.			4. Apply systems theory and information concepts in the analysis of organizational problems and opportunities.			5. Properly design and implement information systems.			6. Understand the architectural concepts of computers and computer network.			7. Apply project and risk management principles and techniques to an information systems project.				
DEGREE: **Bachelor of Science Management Information Systems (MIS) Major**																							
PROGRAM *SPECIFIC* CORE COURSES FOR A *"TYPICAL"* MIS STUDENT	[i] Outcome Statement (X, M)	**[ii] Level (I, E, R, A)**	[iii] Feedback (F) / Assessment	[i] Outcome Statement (X, M)	**[ii] Level (I, E, R, A)**	[iii] Feedback (F) / Assessment	[i] Outcome Statement (X, M)	**[ii] Level (I, E, R, A)**	[iii] Feedback (F) / Assessment	[i] Outcome Statement (X, M)	**[ii] Level (I, E, R, A)**	[iii] Feedback (F) / Assessment	[i] Outcome Statement (X, M)	**[ii] Level (I, E, R, A)**	[iii] Feedback (F) / Assessment	[i] Outcome Statement (X, M)	**[ii] Level (I, E, R, A)**	[iii] Feedback (F) / Assessment	[i] Outcome Statement (X, M)	**[ii] Level (I, E, R, A)**	[iii] Feedback (F) / Assessment	COURSE BREADTH	DEPTH SCORES
IS 220 "Information Systems"				X	***I***	**F**	X	***I***	**F**	X	***I***	**F**				X	***I***	**F**				**4**	***4***
IS 250 "Application Development"	X	***E***	**F**				X	***E***	**F**				X	***I***	**F**	X	***I***	**F**				**4**	***6***
IS 280 "IT Infrastructure"							X	***I***	**F**				X	***I***	**F**	X	***E***	**F**	X	***I***	**F**	**4**	***5***
IS 310 "Systems Analysis, Design and Project Management"							X	***E***	**F**	X	***E***	**F**	X	***E***	**F**				X	***E***	**F**	**4**	***8***
IS 350 "Advanced Application Development" (Elective)	X	***A***	**F**	X	***I***	**F**	X	***E***	**F**				X	***E***	**F**	X	***E***	**F**				**5**	***11***
IS 370 "IT Security and Risk Management" (Elective)							X	***E***	**F**	X	***E***	**F**							X	***E***	**F**	**3**	***6***
IS 410 "Data and Information Management"				X	***E***	**F**	X	***E***	**F**	X	***R***	**F**										**3**	***7***
IS 420 "Advanced IT Infrastructure" (Elective)							X	***E***	**F**				X	***E***	**F**	X	***A***	**F**				**3**	***8***
IS 430 "Global IS Management"							X	***E***	**F**	X	***E***	**F**										**2**	***4***
IS 450 "Enterprise Architecture and Systems Design"	X	***R***	**F**	X	***R***	**F**	X	***R***	**F**	X	***A***	**F**	X	***R***	**F**	X	***E***	**F**	X	***A***	**F**	**7**	***22***
OUTCOME **(i) COMMUNICATION, (ii) SATURATION AND (iii) ASSESSMENT**	**6**	**9**	**3**	**8**	**7**	**4**	**20**	**19**	**10**	**12**	**14**	**6**	**12**	**11**	**6**	**12**	**12**	**6**	**8**	**9**	**4**		

Figure 4. Map of the Revised Curriculum.

curriculum change is reflected in Figure 5, which depicts the percentage change for each program learning outcome for outcomes, structure and assessment. This mapping confirms that the desired changes approved by the faculty and recommended by the industry advisory board were in fact implemented in the revised course syllabi. The MIS program has clearly decreased the emphasis on programming while maintaining a high level of emphasis on critical thinking and application of systems thinking to IS problems. Significant increases are reflected in the areas of database, system design and implementation, architecture and project management. For example, outcome 7, which was identified as the most neglected in the earlier 2007-2008 curriculum, received an 80% boost in its outcome saturation scores and 100% improvement on its feedback score. A similar analysis could be conducted at the course level to examine changes to both course breadth and depth.

The use of the curriculum mapping tools discussed in the paper has allowed UPU faculty to identify the current status and profile of its MIS program in a useful compact format. Using the tools as a starting point, other data such as direct measures of student learning, changes in national curricular guidelines, changes to related university curriculum, and technology changes adopted by industry can be evaluated for future review. Once curricular changes are implemented, the curriculum mapping tools can be applied to model the new curriculum. Program changes are readily apparent and can be used to confirm that communicated curriculum is aligned with both the intended and the designed curriculum.

This curriculum mapping can further be used to engage the students in discussions of the program curriculum. The map could be included in syllabi and class discussions to illustrate to students how a particular course and specific course material relate~~s~~ to the overall MIS program. As assessment instruments evolve, such as the release of the 2010 ISA examination, the model is again useful in validating the alignment of the updated assessed curriculum with the updated designed, intended and enacted curricula.

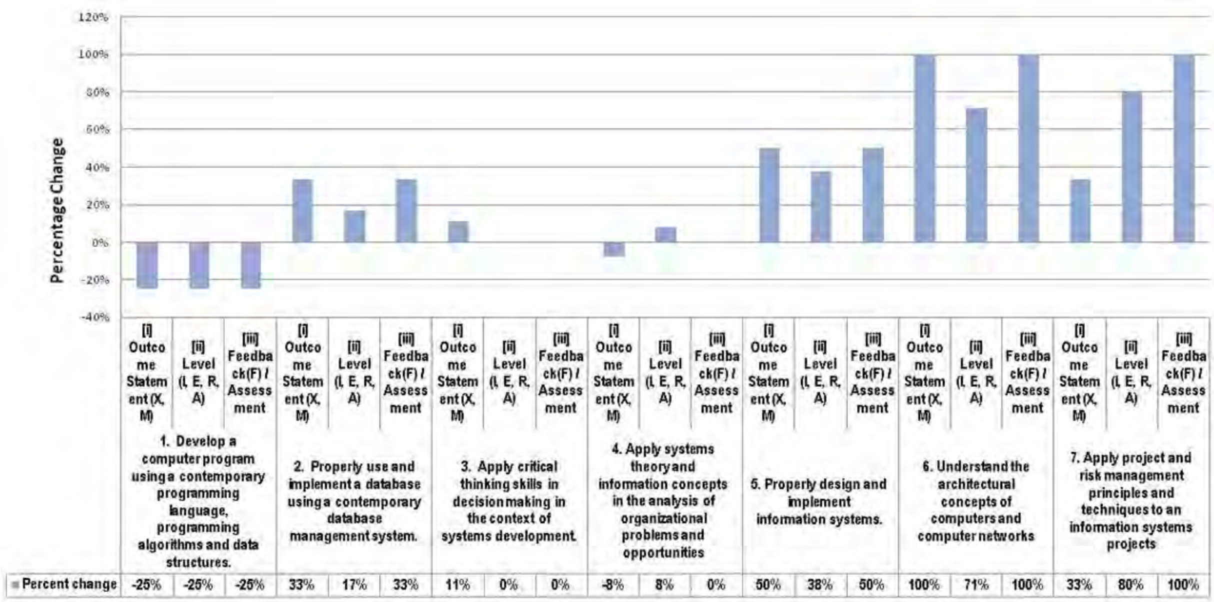

Figure 5. Program Learning Outcomes Changes From 2007-2008 to 2010-2011

Thus, the completed mapping serves as the baseline for future curricular reviews and provides a new starting point for the next iteration of the continuous improvement process.

7. CONCLUSION

Surendra and Denton (2009) pointed out that “a basic task for educators and administrators in IS programs is to design a curriculum that provides value for their students,” and they posed a question commonly faced by curriculum committees – “What courses are most appropriate to provide students with the necessary background, skills, and abilities required to become successful practitioners in their fields?” (p. 78). Model IS curricula (e.g., IS 2002, 2010) attempt to answer this question and provide a good foundation for IS curriculum design. However, compliance with model IS curricula is not uniform (Choi, Ulema and Waldman, 2008; Apigian and Gambill, 2010). The lack of a comprehensive and structured curriculum review framework in the MIS field could be one possible reason for these compliance issues. For example, McGann and colleagues (2007) lamented that the IS 2002 model did not specifically address the essential links and relationships that exist between the IS 2002 model courses or how to integrate those courses into a coherent IS curriculum. As a result many programs fail to comply with the IS model curricula by taking unsystematic -- single course-focused rather than program-wide -- approaches to curriculum development.

The mapping framework presented in this paper, builds on best practices from a variety of disciplines and provides a comprehensive and objective approach to capture and review the structure of program curricula by analyzing relationships between and among key curricular components. Existing curriculum mapping models generally focus on program outcomes coverage by capturing only the extent to which program outcomes are addressed in the program courses. The model discussed in this paper expands on the existing models by helping faculty and administrators evaluate the extent to which (i) students are explicitly informed or reminded about program outcomes in the course syllabi, (ii) program outcomes follow developmental progression (Introduction, Emphasis, Reinforcement or Application) in the course sequence, and (iii) assessment provides formative and/or summative evidence. In addition, utilization of quantitative indicators helps curriculum planners to capture and document the evolution of program curricula over time, thus providing evidence of continuous quality enhancement in curriculum development. This framework provides a tool to help faculty not only stimulate but, more importantly, organize *collective* thinking about program curricula, thus facilitating continuous organizational learning and improvement, which is an ultimate goal of program reviews. Consequently, this framework promises to be a valuable tool for programs striving to comply with the IS 2010 model and develop coherent curricula.

Mapping exercises also serve as practical activities to effectively address requirements of regional or specialized accreditation agencies such as SACS’s (2010) expectation for degree programs “to embody a coherent course of study that is compatible with its stated purpose” (p. 17) or AACSB’s (2007) expectation that “there should be clear evidence that the work students are doing in one or more classes directly supports student achievement of the learning goals. The more places in a curriculum that support one or more learning goals, the greater the probability of student success” (p. 8).

Last, but not least, curriculum maps provide students with information about the program structure and faculty expectations. Essentially, the maps help students see coherence of program curricula or understand how individual courses relate to overall program outcomes. Thus, the maps develop students as intentional learners, facilitate their decision-making, enhance student-program fit, support efficient student progression throughout the curriculum, and ensure timely graduation.

The proposed curriculum mapping framework provides plentiful avenues for future application and expansion. The quantitative measures used to assess the curriculum can be expanded to include not only indicators of outcome integration, but also indicators measuring alignment of structural components. These ratios could provide additional insights into alignment of intended, designed, communicated, enacted and assessed curricula. Further, this framework could be applied to compare IS programs at multiple institutions with the aim of contrasting various implementations of IS 2010 model curriculum and identifying the most coherent course sequence. The framework can also be applied to analyze various curricular designs to support specializations beyond the core IS major. This tool can be used to measure the depth and breadth of IS program specialization across the range of potential career tracks, which include application developer, business analyst, database administrator, ERP specialist, IT operations manager, IT security and risk manager, network administrator, project manager, or web content manager (Topi et al., 2010). The resulting analysis can be used by researchers and IS curriculum designers to better understand the effects of varying curricular designs to focus on IS specializations and to better prepare IS graduates to work in the dynamically changing field of information technology.

8. ENDNOTES

[1] The model can be further expanded to include student perspective by capturing experienced and learned (e.g., Hatzakis, Lycett and Serrano, 2007; Robley, Whittle and Murdoch-Eaton, 2005) dimensions of curriculum.
[2] Objective in the AACSB terms.

9. REFERENCES

AACSB (Association to Advance Collegiate Schools of Business International) (2007), "AACSB assurance of learning standards: An interpretation." [On-Line]. Retrieved on February 1, 2010 from http://www.aacsb.edu/accreditation/papers/AOLPaper-final-11-20-07.pdf

ABET (2009), "Criteria for accrediting computing programs: Effective for evaluations during the 2010-2011 accreditation cycle." Baltimore, MD: ABET, Inc. [On-Line]. Retrieved on February 1, 2010 from http://www.abet.org/Linked%20Documents-UPDATE/Criteria%20and%20PP/C001%2010-11%20CAC%20Criteria%2011-16-09.pdf

Allen, M.J. (2004), Assessing academic programs in higher education. Anker Publishing, Bolton, MA.

Allen, M.J. (2006), Assessing general education programs. Anker Publishing, Bolton, MA.

Apigian, C.H and Gambill, S. E. (2010), "Are We Teaching the IS 2009* Model Curriculum?" Journal of Information Systems Education.Vol. 21, No. 4, pp. 411-420.

Bath, D., Smith, C., Stein, S., and Swann, R. (2004), "Beyond mapping and embedding graduate attributes: Bringing together quality assurance and action learning to create a validated and living curriculum." Higher Education Research & Development, Vol. 23, No. 3, pp. 313-338.

Baxter Magolda, M.B., and King, P.M. (2007), "Interview strategies for assessing self-authorship: Constructing conversations to assess meaning making." Journal of College Student Development, Vol. 48, No. 5, pp. 491-508.

Bloomberg, P. (2009), "Maximizing learning through course alignment and experience with different types of knowledge." Innovative Higher Education, Vol. 34, No. 2, pp. 93-103.

Biggs, J.B. (1996), "Enhancing teaching through constructive alignment." Higher Education, Vol. 32, pp. 347-364.

Biggs, J.B., and Tang, C. (2007), "Teaching for quality learning at university: What the student does," 3rd edition. New York: McGraw Hill, SRHE & Open University Press.

Choi, K.S., Ulema, M. and Waldman, M. (2008), "Analyses of compliance with IS 2002 Curriculum." Information Systems Education Journal, Vol. 6, No. 11, pp. 3-9.

Cuevas, N.M., Matveev, A.G., and Feit, M.D. (2009), "Curriculum mapping: An approach to study coherence of program curricula." Department Chair, Vol. 20, No. 1, pp. 23-26.

Daigle, R.J., Longenecker, H.E., Landry, J.P., and Pardue, J.H. (2004), "Using the IS 2002 Model Curriculum for Mapping an IS Curriculum." Information Systems Education Journal, Vol. 2, No. 1, pp. 3-6.

Driscoll, A., and Wood, S. (2007), "Alignment: Making explicit connections between teaching decisions and learning outcomes." In: Driscoll, A., and Wood, S. Developing outcomes-based assessment for learner centered education: A faculty introduction Sterling, VA: Stylus., pp. 156-175.

Eberly, M.B., Newton, S.E., and Wiggins, R.A. (2001), "The syllabus as a tool for student centered learning." Journal of General Education, Vol. 50, No. 1, pp. 56-74.

Ewell, P.T. (1997), "Identifying indicators of curricular quality." In: Gaff, J.G., Ratcliff, J.L., & Associates, Handbook of the undergraduate curriculum: A comprehensive guide to purposes, structures, practices, and changes, San Francisco: Jossey-Bass, pp. 608-627.

Harden, R.M. (2001), "AMEE Guide No. 21: Curriculum mapping: A tool for transparent and authentic teaching and learning." Medical Teacher, Vol. 23, No. 2, pp.123-137.

Hatzakis, T., Lycett, M., and Serrano, A. (2007), "A programme management approach for ensuring curriculum coherence in IS (higher) education." European Journal of Information Systems, Vol. 16, pp.643-657.

Jones, S.M., Dermoudy, J., Hannan, G., James, S., Osborn, J., and Yates, B. (2007), "Designing and mapping a generic attributes curriculum for science undergraduate students: A faculty-wide collaborative project." Proceedings of UniServe Science Symposium, Sydney, Australia, September 27- 28, pp. 40-45.

Kelley, K.A., McAuley, J.W., Wallace, L.J., and Frank, S.G. (2008), "Curricular mapping: Process and product." American Journal of Pharmaceutical Education, Vol. 72, No. 5, pp.1-7.

Kopera-Frye, K., Mahaffy, J., and Svare, G.M. (2008), "The map to curriculum alignment and improvement." In:

Wright, A., Murray, S., and Wilson, M. (Eds.), CELT: Collected essays on learning and teaching, vol 1, Windsor, ON: STLHE, pp. 8-14.

Landry, J.P., Daigle, R.J., Longenecker, H.E., and Pardue, H. (2009), "IS 2002 and ABET accreditation: Meeting the ABET program outcome criteria." Proceedings of the ISECON 2009, Vol. 26, Washington, DC., p. 1534,

Maki, P.L. (2004), "Beginning with dialogue about teaching and learning." In: Maki, P.L., Assessing for learning: Building a sustainable commitment across the institution, Sterling, VA: Stylus/AAHE, pp. 31-57.

Martz, B., and Cata, T. (2008), "Students' perception of IS academic programs, IS careers, and outsourcing." Journal of Education for Business, Vol. 84, No. 2, pp. 118-125.

McGann, S.T., Frost, R.D., Matta, V., and Huang, W. (2007), "Meeting the challenge of IS curriculum modernization: A guide to overhaul, integration, and continuous improvement." Journal of Information Systems Education, Vol. 18, No. 1, pp. 49-61.

Palomba, C.A. and Banta, T.W. (1999), Assessment essentials: Planning, implementing, and improving assessment in higher education. Jossey-Bass, San Francisco.

Parkes, J., Fix, T.K., and Harris, M.B. (2003), "What syllabi communicate about assessment in college classrooms." Journal of Excellence in College Teaching, Vol. 14, No. 1, pp. 61-83.

Plaza, C.M., Draugalis, J.R., Slack, M.K., Skrepnek, G.H., and Sauer, K.A. (2007), "Curriculum mapping in program assessment and evaluation." American Journal of Pharmaceutical Education, Vol. 71, No. 2, pp. 1-8.

Plice, R.K., and Reinig, B.A. (2007), "Aligning the Information Systems curriculum with the needs of industry and graduates." Journal of Computer Information Systems, Vol. 48, No. 1, pp. 22-30.

Robley, W., Whittle, S., and Murdoch-Eaton, D. (2005), "Mapping generic skills curricula: A recommended methodology." Journal of Further and Higher Education, Vol. 29, pp. 221-231.

Rogers, G. (2003), "Lessons Learned: Things I Wish I had Known…" Communications Link: The ABET News Source, pp. 6-7.

SACS (Southern Association of Colleges and Schools) (2010), Principles of accreditation: Foundations for quality enhancement, 4th edition. SACS-COC, Decatur, GA.

SACS (Southern Association of Colleges and Schools) (2005), Resource manual for the Principles of accreditation: Foundations for quality enhancement. SACS-COC, Decatur, GA.

Slattery, J.M., and Carlson, J.F. (2005), "Preparing an effective syllabus: Current best practices." College Teaching, Vol. 53, No. 4, pp. 159-164.

Stivers, B., and Phillips, J. (2009), "Assessment of student learning: A fast track experience." Journal of Education for Business, Vol. 84, No. 5, pp. 258-262.

Sumsion, J., and Goodfellow, J. (2004), "Identifying generic skills through curriculum mapping: A critical evaluation." Higher Education Research & Development, Vol. 23, No. 3, pp. 329-346.

Surendra, N.C., and Denton, J.W. (2009), "Designing IS curricula for practical relevance: Applying baseball's "moneyball" theory." Journal of Information Systems Education, Vol. 20, No. 1, pp. 77-85.

Swanson, T., Hatch, R., Lane, L., and Sondak, N. (1979), "Curriculum development in information systems." ACM SIGCSE Bulletin, Vol. 11, No. 1, pp. 202-206.

Tariq, V.N., Scott, E.M., Cochrane, A.C., Lee, M., and Ryles, L. (2004), "Auditing and mapping key skills within university curricula." Quality Assurance in Education, Vol. 12, No. 22, pp. 70-81.

Taylor, K., and Haynes, C. (2008), "A framework for intentionally fostering student learning." About Campus, Vol. 13, No. 5, pp. 2-11.

Topi, H., Valachich, J.S., Wright, R.T., Kaiser, K.M,, Nunamaker, J.F., Jr., Sipior, J.C., and de Vreede, G.J. (2010), IS 2010 Curriculum Guidelines for Undergraduate Degree Programs in Information Systems. Association for Computing Machinery and Association for Information Systems, retrieved February 2, 2011 from http://www.acm.org/education/curricula/IS%202010%20ACM%20final.pdf

Uchiyama, K.P., and Radin, J.L. (2009), "Curriculum mapping in higher education: A vehicle for collaboration." Innovative Higher Education, Vol. 33, pp. 271-280.

White, B.A., and McCarthy, R.V. (2007), "The development of a comprehensive assessment plan: One campus' experience." Information Systems Education Journal, Vol. 5, No. 35, pp. 3-16.

Wigal, C.M. (2005), "Managing and aligning assessment knowledge." Proceedings of the 35th ASEE/IEEE Frontiers in Education Conference, T3C-13. October, Indianapolis, IN.

Willett, T.G. (2008), "Current status of curriculum mapping in Canada and the UK." Medical Education, Vol. 42, pp. 786-793.

AUTHOR BIOGRAPHIES

Natasha F. Veltri is an Assistant Professor of Information and Technology Management in the John H. Sykes College of Business at the University of Tampa. She completed her MBA and Ph.D. in Management Information Systems at the University of Central Florida. Her research interests include Information Systems sourcing and governance, adoption of information systems and societal impacts of IT. Her current research efforts are focused on social networking, gender issues in IT and IT-enabled interorganizational collaboration. She has presented at national and international conferences and her research appeared in California Management Review, International Journal of Human-Computer Interaction and DATABASE for Advances in Information Systems. Dr. Veltri is a founding board member of the GETSMART (Getting Everyone To Study Math and Related Technologies), which promotes interest in Information Technology among middle- and high-school girls.

Harold W. Webb is an Associate Professor and Chair of the Information and Technology Management Department at The University of Tampa. He received his MBA and Ph.D. in management information systems from Texas Tech University. His research interests include the effects of information technology on learning, teaching enterprise systems, behavioral aspects of software testing, and electronic commerce. His work experience includes the development of advanced systems requirements for the United States Army. His publications include articles in Journal of Information Systems Education, Communications of the ACM, Decision Sciences Journal of Innovative Education, and the Journal of Enterprise Information Management.

Alexei G. Matveev is Director of the office of Quality Enhancement & Critical Thinking Studies at Norfolk State University, Norfolk, VA. He earned a Ph.D. in Higher Education Administration from the College of William and Mary, a M.Ed. in Educational Administration/Organization Development from Kent State University, and a M.A. in Economic Sociology from Lancaster University (UK) / Central European University (Poland/Hungary). Dr. Matveev taught in Udmurt State University (Russia) and the College of William and Mary. Dr. Matveev has been published in several professional journals and has presented at numerous national and international conferences on topics of assessment, accreditation, and student retention. His current research interests are analysis of quality enhancement initiatives in universities and colleges, role of faculty in accreditation and assessment projects, and curriculum mapping and alignment studies. Dr. Matveev serves as an accreditation peer reviewer for the Commission on Colleges of the Southern Association of Colleges and Schools (SACS-COC).

Enrique G. Zapatero earned a Ph.D. in Operations Research at Virginia Commonwealth University in Richmond, VA in 1994. Currently he is an associate professor of management information systems at Norfolk State University in Norfolk, VA. He has several publications in the areas of e-commerce, virtual learning environments, and multi-attribute decision support systems. Dr. Zapatero is the director of the Center for the Enhancement of Teaching, Learning, and Advising (CETLA). He serves the university in his role as chair of the General Education Council, member of the executive board of the Quality Enhancement Plan Implementation Committee, co-chair of the School of Business Assurance of Learning and Curriculum Committee, and member of the Travel Budget Committee at the School of Business. His professional service is evidenced by his role as president of the Norfolk State University Chapter of Beta Gamma Sigma Honor Society. He serves also as a MIS-track reviewer for the American Society of Business and Behavioral Sciences annual conferences.

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