8-1-2010

Curriculum Mapping: A Conceptual Framework and Practical Illustration

Alexei G. Matveev
Norfolk State University, agmatveev@nsu.edu

Natasha F. Veltri
The University of Tampa, nveltri@ut.edu

Enrique G. Zapatero
Norfolk State University, egzapatero@nsu.edu

Nuria M. Cuevas
Norfolk State University, ncuevas@nsu.edu

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Enrique G. Zapatero
Norfolk State University
egzapatero@nsu.edu

Nuria M. Cuevas
Norfolk State University
ncuevas@nsu.edu

ABSTRACT

Employers, accreditation and government agencies increasingly call for academic degree programs to ensure and document that their curricula embody coherent courses of study that integrate statements of intended learning outcomes. This paper presents a comprehensive, structured curriculum mapping framework that will assist curriculum and accreditation self-study committees in evaluating how intentionally 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. The application of the framework is demonstrated through an analysis of a MIS baccaluareate program.

Keywords

Curriculum review, MIS curriculum, accreditation, faculty development.

INTRODUCTION

Under the current conditions of labor market uncertainty, economic instability, and rapid technological change, strategies for developing integrated curricula that would provide a dynamic yet coherent educational experience to students and address increasing calls for accountability, efficiency, and transparency become a prominent concern for faculty and administrators. For example, the Accreditation Board for Engineering and Technology (ABET) (2009) stipulates that the program's requirements should be "consistent with its educational objectives and are designed in such a way that each of the program outcomes can be achieved" (p. 3). Similarly, the Association to Advance Collegiate Schools of Business (AACSB) (2007) states that the explicit "alignment of learning goals and curricula is critical. If learning goals are adopted but are not addressed in the curricula, the outcomes assessment process will be worthless" (p. 8). Surprisingly, despite the fundamental focus on systems in the information systems (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 that although "[p]rior research in IS identified the problem of scattered courses in current IS curriculum … there are no published papers in the main IS journal outlets on the creation and implementation of an integrated IS curriculum model" (p. 51).

Curriculum mapping provides a visual tool to capture and study coherence 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 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, Smith, Stein and Swann, 2004; Jones, Dermoudy, Hannan, James, Osborn and Yates, 2007; Robley, Whittle and Murdoch-Eaton, 2005; Sumsion and Goodfellow, 2004; Tariq, Scott, Cochrane, Lee and Ryles, 2004; Willett, 2008). In U.S. higher education, curriculum and course mapping has 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 accreditation agencies in business, engineering, medical, and pharmaceutical education (Harden, 2001; Kelley, McAuley, Wallace and Frank, 2008; Plaza, Draugalis, Slack, Skrepnek and Sauer, 2007; Stivers and Phillips, 2009; Wigal, 2005), as an effective curriculum improvement process (Bloomberg, 2009; Kopera-Frye, Mahaffy and Svare, 2008), or as a faculty development tool (Uchiyama and Radin, 2009). In recent years, several electronic curriculum mapping modules have been developed as part of web-based database-backed assessment and accreditation systems (e.g., WEAVEonline, www.weaveonline.com) or as stand-alone modules (Mazurat and Schonwetter, 2008).

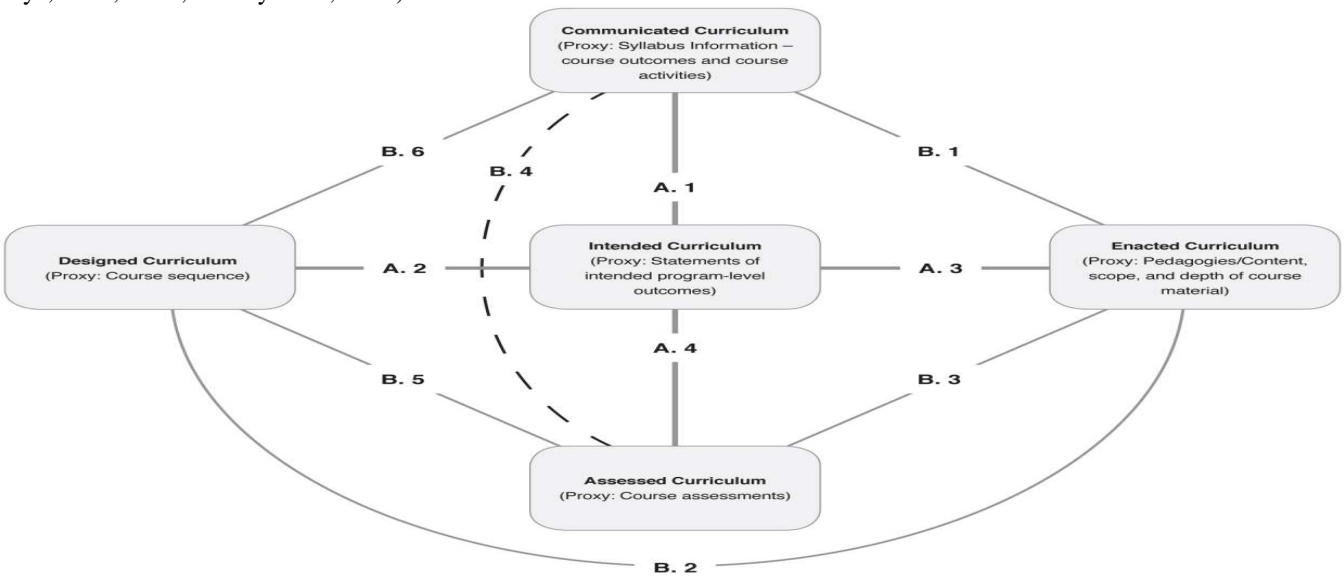
Visual depiction of the curricular structure is not a new approach to curriculum review in IS education (Swanson, Hatch, Lane and Sondack, 1979). However, published studies based on formal curriculum mapping exercises in IS are a relatively recent phenomenon (Daigle, Longenecker, Landry and Pardue, 2004; Landry, Daigle, Longenecker and Pardue, 2009; White and McCarthy, 2007). In fact, Daigle et al., mapping pioneers in the IS field, while discussing the IS 2002 model curriculum, noted 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).

The purpose of this paper is two-fold. The first objective is to introduce a generic curriculum mapping framework deliberately designed to study coherence of academic program curricula. The second objective is to illustrate the utility of the mapping for program review by analyzing a curriculum map of a baccalaureate Management Information Systems (MIS) program in an Urban University (UU) located in a Southeastern U.S. state. UU is a comprehensive university offering undergraduate and graduate programs to over 6,000 students. Students majoring in MIS are required to complete at least 124 hours of undergraduate courses and are awarded the Bachelor of Science degree. UU recently underwent a comprehensive curriculum redesign of its undergraduate MIS program based on the model IS 2008 curriculum. Program learning outcomes were updated to reflect the changes in the MIS field and the general direction of the model curriculum. The core curriculum was significantly modified in consultation with the industry advisory board and currently consists of seven required courses and two electives.

CONCEPTUAL FRAMEWORK

Development of the generic 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 and is intentionally designed to capture the degree of curriculum coherence by systematically exploring relationships between and among five major curriculum components – intended outcomes, course sequence, syllabi, instructional activities, and assessment of learning – through the double lens of outcomes integration and alignment between curriculum components.

There is a consensus in the curriculum development literature that programs "may have multiple curricula in place … that have little to do with one another in content, coverage, or effectiveness" (Ewell, 1997, p. 612). Increasingly, curriculum committes are called 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 framework discussed in this paper elaborates on Cuevas, Matveev and Feit's (2009) model and is built on the assumption that, *from an instructor's perspective*[1], there might be at least five different conceptions of curriculum – intended, designed, communicated, enacted, and assessed (Figure 1) (cf., Ewell, 1997; Harden, 2001; Hatzakis et al., 2007; Kopera-Frye, et al., 2008; Robley et al., 2005).



[1] Exploration of the curriculum from the *student's* perspective (e.g., expected, experienced, and learned dimensions of curriculum) is beyond the scope of this paper.

Figure 1. Conceptual Framework

Statements of intended program outcomes express collective faculty expectations about the program curriculum, serve as a conceptual anchor for the mapping exercises, and reflect the *intended* curriculum. The *designed* curriculum is presented 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 actually 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.

MAPPING STEPS

A curriculum matrix is a two-dimensional data recording tool that facilitates the assignment of selected intended program outcomes (in columns; proxy indicator of *intended* curriculum) to core program courses listed in the order that a "typical student" would follow (in rows; proxy indicator of *designed* curriculum) while identifying the level at which the outcomes are addressed in each course (at the intersection of columns and rows) (see example in Figure 2). There are three sub-columns in each outcome column. These three sub-columns 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 is "Outcomes Statement." In this sub-column, faculty indicate 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. Finally, the third sub-column, "Feedback/Assessment," indicates whether the students in the given course are provided with feedback on their performance in the given outcome area.

Reliability of curriculum mapping refers to the ability of program faculty to make consistent judgments. This requires that participants are very clear about the reasons for the mapping exercise, the conceptual framework of the mapping exercise, program learning outcomes, descriptors of the labels, and the structure of the analysis (cf., Biggs & Tang, 2007, p. 188-189). The described curriculum mapping process was intentionally designed to incorporate the following characteristics of an effective mapping approach identified by Tariq et al. (2004): be well-structured and straightforward to use; require a minimum of background reading in order to be completed; cover the core program learning outcomes (re: Step 1); indicate whether explicit learner support is provided (re: Steps 2 and 3); provide the facility to demonstrate students' progression in outcomes attainment over time (re: Step 4); and indicate whether the outcome is assessed (re: Step 5) (pp. 71-72).

Step 1: Intended Curriculum

Statements of intended program outcomes provide a coherent starting place to begin examining program curricula (Palomba and Banta, 1999, p. 274). Practice shows that six to eight outcomes is an optimal number of outcomes for program mapping exercises. Six to eight program outcomes effectively reflect the nature of the program and demonstrate its scope and, at the same time, keep the mapping process manageable. UU's MIS program selected to map seven program outcomes out of ten outcomes articulated and approved by program faculty. The statements of intended program outcomes are listed in the top horizontal row of the matrix.

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. In UU's case, the MIS curriculum map is based on seven required courses as well as the three most popular electives. The courses are 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.

Step 3: Communicated Curriculum

This step involves analysis of each course listed in the matrix to determine whether each *program* outcome is explicitly or implicitly mentioned among the *course* outcomes on the syllabus. An e*X*plicit statement of intended outcome indicates that a program outcome is fully and directly expressed or referenced in a course syllabus. *An* i*M*plicit statement of intended outcome indicates that the program outcome is indirectly expressed or referenced in a course syllabus. The appropriate code is entered in the first sub-column for the given outcome.

Step 4: Enacted Curriculum

Faculty reflect on the level of course content delivery, make professional judgments, and indicate whether each *program* outcome is *I*ntroduced, *E*mphasized, *R*einforced, or *A*dvanced 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 (program outcomes) that are expected to be taught and learned in a course and "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, first, a quantitative accrual of the components of a task [intended outcome], which then become qualitatively restructured" (Biggs, 1996, p. 350). Summary description of the labels for the developmental levels of content delivery is presented in the map legend (Figure 2) (Biggs and Tang, 2007; Brabrand and Dahl, 2009).

Step 5: Assessed Curriculum

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). If students are asked to demonstrate their learning on the given outcome through homework, projects, tests, etc. and are provided formal feedback, then the faculty member would indicate "F" (Feedback) for that course in the third sub-column for the outcome.

Step 6: Key Quantitative Indicators (optional)

The *outcome communication score* is calculated by summing up scores in the first sub column; each X (explicit) is equal to "2" and each M (implicit) is equal to "1." To calculate the *outcome saturation score*, the program coordinator sums up scores in the second sub column; each I (introduced) is equal to "1," E (emphasized) – "2," R (reinforced) – "3," and A (advanced) – "4." The *assessment score* for a given program outcome is calculated by summing scores in the third sub column; each F (feedback) is equal to "1."

To calculate the relative contribution of individual courses to the curriculum as a whole, faculty review horizontal rows for each course. The indicator of *course breadth* or scope in the context of specified program outcomes is determined by a simple count of the number of outcomes addressed by each course at I, E, R, or A levels. Course *depth* or intensity in the context of program outcomes is calculated by summing up scores in the second sub column for each outcome addressed by the given course; each I (introduced) is equal to "1," E (emphasized)–"2," R (reinforced)–"3," and A (advanced)–"4." While developing and analyzing quantitative indicators, it is important to keep in mind Porter's (2002) warning about quantitative indicators in curriculum alignment studies, "Although one can say that the larger the value of the index, the better the alignment, there is still no easy way to think about how big the alignment index must be to be considered 'good'" (p. 6).

ANALYSIS OF CURRICULUM MAPS: SUMMARY OF FINDINGS AND DISCUSSION

Johnson and Ratcliff (2004) keenly pointed out that curriculum coherence can be defined "as the extent to which students and faculty find meaning in the curriculum" (p. 93). Indeed, from a consequential validity perspective (Messick), the validity of curriculum mapping is a matter of meaningful interpretation and practical uses to which the results of analysis are applied (cf., Biggs and Tang, 2007, p. 189). However, Anderson (2002) pointed out that "relatively few analytical frameworks exist for making sense of the data collected from curricular alignment studies" such as mapping exercises (p. 257).

The presented curriculum mapping framework provides faculty with a methodology to engage in a structured study of curriculum coherence by analyzing the degree of program outcomes integration and the extent to which structural components of the curriculum are aligned. Table 1 reflects the conceptual framework (Figure 1) and serves as a guide for a comprehensive interpretation of curriculum maps. Indicators (A1-A4 and B1-B6) are essentially analytical lenses to address specific scholarship of curriculum questions, accreditation requirements, or administrative issues related to curriculum coherence. The following discussion presents the analysis of the MIS curriculum map at UU (Figure 2).

Indicators of Program Outcomes Integration

Each of the seven program outcomes is explicitly addressed in the course syllabi for at least three out of ten courses (*re: A 1*). Outcome 3 is reflected on the syllabi of every single course, albeit not always explicitly. Although all program outcomes appear on the syllabi, it is evident that an MIS major reading the syllabi is likely to see that the faculty assign differentiated value to the program outcomes. While Outcomes 3, 4, and 5 are clearly communicated as important for the program, Outcomes 1 and 7 are largely off the radar for the students. For students to develop all program outcomes and become intentional learners, faculty need to communicate clearly and consistently what program outcomes students need to develop to become successful professionals.

ACADEMIC YEAR:	**2009-2010**
UNIT RESPONSIBLE:	**MIS DEPARTMENT**
DEGREE:	**Bachelor of Science Management Information Systems Major (MIS)**

PROGRAM *SPECIFIC* CORE COURSES FOR A "*TYPICAL*" MIS STUDENT	**SELECTED PROGRAM LEARNING OUTCOMES -- The Program Graduates Will Be Able To:** 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 projects.			***COURSE* BREADTH AND DEPTH SCORES**	
	[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	Breadth	Depth
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	*I*	F				X	*I*	F							*3*	4
IS 270 "IT Infrastructure"							X	*E*	F	X	*I*	F	X	*E*	F	X	*E*	F				*4*	7
IS 310 "Systems Analysis, Design & Project Management"							X	*R*	F	X	*E*	F	X	*I*	F				X	*I*	F	*4*	7
IS 410 "Data and Information Management"				X	*R*	F	M	*E*	F	X	*R*	F										*3*	8
IS 370 "Advanced Application Development" (Elective)	X	*A*	F				M	*E*	F				X	*E*	F							*3*	8
IS 360 "IS Security & Risk Management" (Elective)							M	*E*	F										X	*R*	F	*2*	5
IS 420 "Global IS Management"							X	*E*	F	X	*E*	F				X	*I*	F				*3*	5
IS 430 "Business Intelligence & Analytics" (Elective)				X	*A*	F	X	*E*	F	X	*E*	F	X	*E*	F							*4*	10
IS 450 "Enterprise Architecture & Systems Design"	X	*R*	F	X	*R*	F	X	*A*	F	X	*A*	F	X	*R*	F	X	*R*	F	X	*E*	F	*7*	22
***OUTCOME* (i) COMMUNICATION, (ii) SATURATION AND (iii) ASSESSMENT SCORES**	6	*9*	3	8	*11*	4	17	*21*	10	14	*15*	7	12	*11*	6	8	*7*	4	6	*6*	3		

LEGEND

[I] OUTCOME STATEMENT: The program outcome is *(X)* ***EXPLICITLY*** *(score of 2)* or *(M)* ***IMPLICITLY*** *(score 1)* reflected in the course syllabus as being a learning outcome for this course.

[II] LEVEL OF INSTRUCTION:

(I) INTRODUCED - 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 (or a few) aspect of a complex program outcome is addressed in the given course *(score of 1)*.

(E) EMPHASIZED - 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 *(score of 2)*.

(R) REINFORCED - Students are expected to possess a strong foundation in the knowledge, skill, or competency at the collegiate level. Instructional and learning activities continue to build upon previous competencies with increased complexity. All components of the outcome are addressed in integrative contexts *(score of 3)*.

(A) ADVANCED - 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 *(score of 4)*.

[III] FEEDBACK ON STUDENT PERFORMANCE / ASSESSMENT: *(F)* Students are asked to demonstrate their learning on the outcome through homework, projects, tests, etc. and are provided formal Feedback *(score of 1)*.

Figure 2. Sample Curriculum Map

	Indicators	***Guiding Questions***	***Measures***
Outcomes Integration	A1= Discourse	How explicitly is each intended program outcome communicated to students in individual courses?	• Number of courses explicitly and implicitly reflecting the given program outcome on the syllabus ("Outcome Communication" score)
	A2= Coverage a. Outcome Scope b. Course Breadth	a. In how many courses is each program outcome addressed? b. How many program outcomes are addressed in each course?	• Number of courses addressing each program outcome ("Outcome Scope" score) • Number of program outcomes addressed by each course ("Course Breadth" score)
	A3= Weight a. Outcome Saturation b. Course Depth	a. How comprehensively is each program outcome addressed in the program curriculum? b. What is the level of content delivery in the given course in the context of program outcomes?	• Sum of I, E, R, A scores for the given program outcome ("Outcome Saturation" score) • Sum of I, E, R, A scores for the given course ("Course Depth" score)
	A4= Outcomes Assessment	a. How many assessment points for each program outcome are provided in the curriculum? b. Are students provided with diagnostic, formative, and summative feedback?	• Number of courses integrating assessment of the given program outcome ("Assessment Points" score) • Number of courses integrating assessment of the given program outcome at I (diagnostic), E/R (formative), and A (summative) levels
Alignment of Structural Components	B1= Syllabus/Course Activities Alignment	Do we teach what we tell students we will?	• Ratio of the number of times a given program outcome was mentioned on the syllabi to the number of times it was actually addressed in the courses
	B2=Course Sequence/Course Activities Alignment	a. Is each program outcome addressed at each developmental level of content delivery? b. Does program course progression provide developmental scaffolding to students?	• Number of courses addressing a given program outcome at I level, E level, R level, and A level • Developmental progression (logical order) in the level of content delivery for the given program outcome (I is followed by E, E is followed by R, R is followed by A)
	B3=Course Activities/ Assessment Alignment	Do we teach what we assess? Do we assess what we teach?	• Ratio of the number of times a given program outcome was addressed in the curriculum to the number of times it was assessed
	B4= Syllabus/Assessment Alignment	Do we assess what we tell students we will?	• Ratio of the number of times a given program outcome was mentioned on the syllabi to the number of times it was assessed in the curriculum.
	B5= Program Outcomes / Course Assessment Alignment	Do individual courses provide sufficient feedback on student performance on program outcomes?	• Number of program outcome assessment points in the given course ("Course Assessment Focus" score).
	B6= Program Outcomes /Course Syllabus Alignment	Do individual courses explicitly communicate program outcomes that will be addressed in the course?	• Number of times program outcomes were mentioned explicitly or implicitly in the syllabus of the given course

Table 1. Guide for Interpretation of Curriculum Maps

The map demonstrates that not all program outcomes are given equal emphasis in terms of outcome coverage (*re: A 2a*). For example, Outcomes 4, 5, and, especially, 3 are emphasized throughout the entire curriculum. While critical thinking skills (Outcome 3) are not always explicit in the syllabi, the students are expected to exhibit critical thinking skills in each course. In contrast, Outcome 7 is only addressed in two required courses – IS 310 and 450 – and one elective course – IS 360. Outcome 1 is also only represented in three courses, one of which is an elective. Such misbalances in outcome coverage need to be discussed in the context of the gaps between faculty priorities, industry needs, and student perceptions (Martz and Cata, 2008; Plice and Reinig, 2007).

In terms of course coverage (*re: A 2b*), all courses, except two, address three or four learning outcomes and thus do not vary much on breadth. IS 360 is a popular elective course intentionally designed to have a narrow focus on two program outcomes – 3 and 7. The course that addresses all seven program outcomes (IS 450) is a capstone course that students take in their final year. By structuring a relatively broad, yet manageable, scope of most program courses (three to four program outcomes per course) and by implementing a required capstone course, UU's MIS program appears to contribute to the development of integrative thinkers "who can see connections in seemingly disparate information and draw on a wide range of knowledge to make decisions" (AACU, 2002, p. 21).

Significant misbalance in program outcome scope (*A 2a*) is further reflected in the relative weights of program outcomes and courses in the curriculum. For example, after examining outcome saturation scores *(re: A 3a)* (middle sub-columns in the bottom row), it becomes evident that Outcome 3 (score of 21) is emphasized in the curriculum at a significantly higher level than Outcome 7 (score of 6). In fact Outcome 7 appears to be the most neglected area of the curriculum. Although it is addressed in three courses similar to Outcome 1, its saturation score (a sum of I, R, and E) is only 6 compared to 9 for Outcome 1.

Baxter Magolda and King (2007) argued that an important step that educators need to take to effectively help students to achieve intended learning outcomes "is to understand the developmental foundation that makes achievement of these outcomes possible" (p. 491). Overall, the UU's MIS course sequence appears to reflect the developmental pattern of student cognitive development. Courses tend to be arranged progressively by the course depth scores *(re: A 3b)*. However, program faculty might wish to enhance IS 360 and IS 420 courses or move them closer to the beginning of the sequence in order to fit these courses into the developmental pattern based on their depth scores.

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" (p. 81; quoted from Taylor and Haynes, 2008, p. 4). Each program outcome has at least three assessment points in the curriculum (*re: A 4*). Nevertheless, it is clear that the abovementioned misbalance in outcomes coverage is reflected and, consequently, reinforced, by assessment practices. Thus, different program outcomes have different assessment values. To ensure that the curriculum is supported by a comprehensive assessment program, faculty might need to take a closer look at Outcomes 5–7. Students are not provided with opportunities to demonstrate their achievement of these outcomes at the Advanced (A) level. Therefore, summative assessments in IS 450 (capstone course) might lack validity, since they do not assess student achievement of the full range of knowledge, skills, abilities, and dispositions associated with the program outcomes.

Indicators of Alignment of Curriculum Components

UU's MIS curriculum appears to be relatively well-aligned. For example, Outcome 6 is mentioned in the syllabi of four courses, taught in four courses, and assessed in four courses. Similarly, the syllabus for IS 250 specifies several course outcomes dealing with various application programming competencies: variables, algorithm structures, data arrays, text files, etc. The course involves a series of projects each focusing on a specific programming competency and gradually building up from more basic to more advanced competencies. Student performance is graded for each project and the student receives feedback in the form of a grading rubric based on the intended outcomes.

Indeed, all ratio measures for indicators B1, B3, and B4 are equal to 1. Ratios of less or more than 1 would indicate misalignment and would be reflective of such red flags as: program outcome is referenced in the syllabus, but not taught in the course (*re: B 1*); or a program outcome is covered in the course, but students are not provided with feedback on their performance on the outcome (*re: B 3*); or program outcome is referenced in the syllabus, but students are not provided with feedback on their performance on the outcome (*re: B 4*). Atypically high levels of alignment on B 1, 3, and 4 for the UU MIS program curriculum might be attributable to the revisions made as a result of the focused program/course objectives mapping exercise that was recently conducted by the program faculty.

Sequencing (*re: B 2*) refers to the extent to which individual courses are organized in a logical temporal order to effectively address a particular program outcome. The course sequence of UU's MIS program appears to be moderately aligned with the levels of content delivery in individual courses. Instruction related to program outcomes tends to be first delivered to students

at an introductory level and gradually builds up to the "emphasis", "reinforcement" and "advanced" level. However, it is important to note that Outcome 1 is missing the Introductory (I) level and Outcomes 5-7 are missing the Advanced (A) level. These findings pose important questions – such as, Where do students acquire basic knowledge and skills related to computer programming? Are we graduating students who have not fully achieved our intended outcomes? – and have serious implications for student retention and employability of program graduates.

Although, overall, program outcomes are presented in the logical order (I is followed by E, E is followed by R, and R is followed by A), the clear developmental pattern is not always evident. For example, Outcomes 3-5 are only emphasized in the upper level IS 430 course, Outcome 6 is introduced in another upper level course (IS 420), and Outcome 7 is emphasized, rather than reinforced or advanced, in the capstone (*sic*) IS 450 course. Further, there appears to be a duplication of the "emphasized" level for Outcome 3 – six courses emphasize this outcome while it is reinforced and advanced only by one course.

In terms of course assessment focus (*re: B 5*), most of UU's MIS courses assess student progress in achieving three or four program learning outcomes; one course assesses only two program outcomes and one course (IS 450) assesses all seven program outcomes. IS 220 and 250 courses appear to be well positioned to serve as the program platform for diagnostic assessment. IS 450 is clearly a capstone course used for program summative assessment. Formative assessment appears to be appropriately distributed across courses emphasizing and reinforcing program outcomes. However, as it was noted above, for IS 450 to become a true capstone course, it needs to be enhanced to ensure that not only assessment (certification exam) but also instruction for Outcomes 5-7 are at the advanced (A) level.

Finally, program faculty members determine whether students can see relevancy of the given course in the context of program outcomes by analyzing how well course-level outcomes listed in their syllabi are aligned with the program outcomes (*re: B 6*). A simple count of "Xs" for each course serves as evidence that faculty members make certain program outcomes understandable and relevant for students taking their individual courses. This step also helps reviewers see how the program faculty's collective expectations (i.e., program outcomes) are operationally defined at the course level thus providing "a thumbnail sketch of how a particular faculty member idiosyncratically approaches a course" from the overall program perspective (Slattery and Carlson, 2005, p.161).

CONCLUSION

Surendra and Denton (2009) pointed out that "a basic task for educators and administrators in MIS 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, 2008) attempt to answer this question and provide a good foundation for IS curriculum design. However, it was found that the IS 2002 model does not "specifically address issues such as: what essential links and relationships exist between the suggested courses, and how to integrate those courses" (McGann et al., 2007, p. 50). As a result, because of the lack of a comprehensive curriculum structure review framework in the MIS field, many institutions fail to fully adopt the IS model curricula (Choi, Ulema and Waldman, 2008), by taking idiosyncratic, and unfortunately often myopic – course-focused rather than program-wide – approaches to curriculum development.

The generic mapping framework presented in this paper, builds on best practices from a variety of disciplines and provides a comprehensive, objective approach to capture and review the structure of program curricula by analyzing relationships between and among curriculum components. Mapping also serves as a practical tool to effectively address requirements of regional or specialized accreditation agencies such as the Southern Association of Colleges and School's (SACS, 2008) expectation for degree programs "to embody a coherent course of study that is compatible with its stated purpose" 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" (p. 8).

This comprehensive, yet clearly structured, framework promises to be a valuable methodology for programs striving to effectively and efficiently implement the IS 2008 model and develop coherent curricula. It is a practical tool to help faculty not only stimulate but, more importantly, systematically organize *collective* thinking about program curricula thus facilitating organizational learning and improvement, which is an ultimate goal of program reviews.

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