

Is a Curriculum Management System in Your Future?

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Abstract

K-12 education has changed drastically in the past two decades. Today, state and federally mandated curriculum standards are enforced, and positive outcomes assessment is linked to teacher advancement. Higher education today is faced with challenges that will require a sharper focus on its curriculum development, review, and assessment. A curriculum management system is an automated system that will help support these efforts. Current systems utilized in primary and secondary education, together with ongoing efforts in higher education to define model curricula, help to provide insight into the potential functions of such a system. Specifically, the rich constructs of the IS'97 curriculum model suggest an approach to representing the details of a local curriculum that goes beyond a simple listing of courses and their brief descriptions. Experiences with an automated prototype of the IS'97 model have demonstrated the value that a similar automated system could have for the stakeholders of a local curriculum. To make this happen, however, there are a number of issues peculiar to higher education that must be addressed. The future of higher education may well rest on our ability to address these issues and to put in place the proper procedures and systems that demonstrate that our house is in order.

Keywords: Automated curriculum management, higher education, assessment, limited funding.

1. INTRODUCTION

The foundation of any educational institution is its curriculum. Yet, relatively little attention is paid to developing, analyzing, reviewing, and assessing this foundation in higher education. One possible explanation for this lack of attention is the dearth of available tools, techniques, and systems to support such efforts.

A Curriculum Management System (CMS), in its broadest sense, is an automated system which supports the entire curriculum process from planning to implementation to assessment. As Harden (2001) points out, the curriculum is a sophisticated blend of educational strategies, course content, learning outcomes, educational experiences, and assessment. This broad view of a CMS is derived from the current elementary and secondary education environment that is driven by federal and state mandated course content standards and the need for continual curriculum audits (West 2000). Such systems are starting to find their way into higher education as well, particularly in the field of medicine (CurrMIT, 1999). The focus of this paper, however, is on a somewhat narrower definition of a CMS. *We define a CMS to be an automated system that supports the*

definition, visualization, analysis, and assessment of an educational institution's desired curriculum.

Several efforts have been undertaken in the information systems (IS) arena to develop a model IS curriculum. Most notable of these are IS'97 and its successor models which contain not only a list of suggested IS courses but also other foundational constructs such as learning units, knowledge (Bloom) levels, and knowledge elements. The richness of these models is intended to enhance their usefulness in understanding the details of a desired curriculum. However, this richness adds a level of complexity that makes it difficult for all but the dedicated scholar to understand the intricacies of the model beyond the highest level constructs (courses). Indeed, several authors have recently brought into question the continuing interest in (Landry et al., 2001) and the future value and usefulness of IS'97 (Atchison & Gonsalvez, 2001).

In an effort to make such static curriculum models easier to understand and use, Johnson et al. (2002) describe an interactive IS'97 prototype system that allows users to visualize the various model components from different dimensions and to run queries and reports which answer specific questions of the model. According to the

authors, automating the existing curriculum models adds value by making them easier to understand and analyze. These automated models can also serve as a basis for a CMS where the local curriculum data of an academic organization are incorporated into the system. The apparent users of a CMS include administration, faculty, students, local employers, and accreditation and governmental oversight organizations. This system could be utilized to answer a myriad of curriculum related questions that are frequently posed by these stakeholders.

This paper describes the rationale for, and the concepts surrounding, a CMS in more detail. We first discuss the changing academic environment in higher education and how these changes suggest the need for a CMS. We next look at current curriculum representation approaches and discuss the fact that various stakeholders of an educational program have curriculum questions that cannot easily be answered by current curriculum representations, also suggesting the need for a CMS. We then describe how previous efforts in model curriculum development and existing CMS tools for primary and secondary education can serve as a foundation for a CMS for higher education. Following this we describe the functions of such a system and discuss several issues that potentially stand in the way of successful implementation.

2. THE CHANGING ACADEMIC ENVIRONMENT

The previous two decades have seen considerable change in K-12 education. The reality of low test scores and poorly educated graduates has left the US educational system lagging those of other developed nations. This has drawn considerable political attention and provided a wake up call for primary and secondary educators. Today, federal, state, and local district mandated curriculum standards (see TEKS, 1998 for example), along with strict accountability for success, are the norm.

For the most part, higher education has not yet come under such scrutiny and control, but the “handwriting is on the wall.” The state of Florida, for example, has already mandated a common course numbering system and description for all state run educational institutions. In poor economic times like these, budget shortfalls in state governments are drawing more attention to the high cost of higher education. This has resulted in the cancellation of some programs, reductions in funding, and a general attitude of greater accountability to ensure that available funding is used effectively. Concerns within the IS/business community also point to the need for a more well-defined identity for IS and the need for a more clearly defined curriculum (Watson et al., 2000). Add to this the fact that accrediting bodies are placing increased emphasis on meaningful, competency-based, program assessment and the “words of warning” become clearer.

Finally, as we progress from the information age to the knowledge age, the requirement for higher education to transfer its tacit label knowledge to explicit label knowledge becomes more critical. All of these changes portend the need for a meaningful CMS.

3. CURRENT MECHANISMS FOR CURRICULUM DEVELOPMENT AND REPRESENTATION

Current approaches to curriculum development typically revolve around curriculum committees. A department’s curriculum committee typically begins the process by considering input from a number of sources as shown in Figure 1.

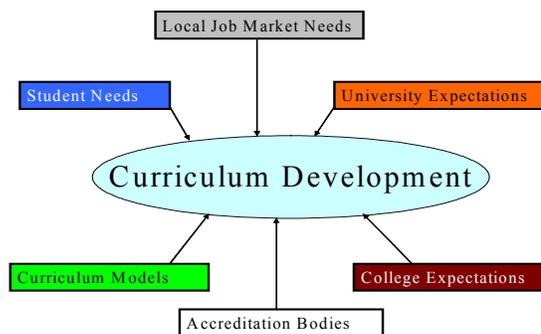


Figure 1: Inputs into Curriculum Development

These sources, however, are usually only considered at a high level of abstraction based on the committee members’ tacit understanding of the discipline. The results, after numerous committee meetings and email communications, are then represented as one or more courses comprised of a title, a brief description (30 words or less), and a list of prerequisites. The reason for this representation is easily understood considering that is exactly what is needed by the educational institution for publishing in its catalog and on its web site. In most cases, a more detailed representation of a course is left up to each instructor when a class syllabus is prepared. Typically, however, class syllabi are only available to the students at the time they enter a class. Others who wish to understand the curriculum in more detail must extract what they can from the lean content in the catalog or on the web. As a case in point, Johnson et al. (2002) reviewed descriptions for a CIS database course obtained from the web sites of five universities in the California state system. Based on the keywords they extracted, very little overlap in any of the courses was observed.

The thesis of this paper is that this cursory approach to curriculum development and representation will not be sufficient in the future. Rather, a more comprehensive approach requiring correspondingly increased amounts of detail is needed. This approach becomes feasible by using an automated CMS to help manage the data. Accordingly, this more thorough approach better facilitates our ability to respond to the changing academic

environment described in the previous section and more fully meets the expanding needs and demands of the curriculum's stakeholders.

4. THE CURRICULUM'S STAKEHOLDERS

The mission statement for our department states that our courses and services are to be "responsive to the needs of our stakeholders." Whether written or unwritten, this is probably the goal of most IS departments as well. As Johnson et al. (2002) point out, many of the concerns of these stakeholders revolve around their need to understand the details of how a local curriculum is defined and their need to be assured that the classes presented actually reflect the required curriculum. The changes in education discussed earlier only tend to exacerbate these concerns as students are faced with unrelenting tuition increases, as administrators struggle with ever dwindling budgets, and as IT professionals in local businesses that employ our students are asked to take larger rolls as members of IS advisory committees. In short, what these stakeholders require now and will require in the future is a more rational, business-like approach to curriculum management supported by a CMS.

5. BUILDING ON MODEL CURRICULUM EFFORTS

Model curricula have been part of the Information Systems arena since the beginning. Every new profession experiences the problem of establishing the legitimacy of their discipline. Information Systems, as a profession, has not been exempt from this endeavor. The initial purpose served by IS'97 and other model curricula was to establish a validated body of knowledge for Information Systems (Johnson et al., 2002).

The second purpose served by model curricula has been to help maintain consistency in Information Systems programs on a broad scale. In an academic discipline where the content is in a constant state of flux due to the introduction of new technology, it is sometimes difficult to know what should be taught. One thing that has become clear with the passing of time is that there are underlying principles that should be taught which apply regardless of the particular technology we use as the vehicle for teaching them. Thus, it may be less important which database product we are using in our classes than the fact that we are teaching the principles that apply to all databases. These principles are again reflected in the model curricula. The framers of the most recent revision

of the IS model curriculum have indicated that the models are only intended as guidelines for curriculum and are not intended to be implemented directly (Gorgone et al., 2002).

In our minds, model curricula have played a vital role in both establishing IS as a discipline and guiding its development in many diverse environments. While IS'97 and other model curricula give valuable insight into the appropriate content and structure of the IS curriculum, they do not by themselves constitute a CMS. The purpose of our work is to build on the architectural constructs described in the model curricula by developing an interactive CMS that can be used to manage the specific curriculum for a college or university. We believe that such a system would provide the following capabilities as a starting point:

- Make it easier for faculty to design a class for a particular subject area.
- Make it easier for department heads and other administrators to assess the content of all courses in a program looking both for holes in the curriculum (i.e. topics considered essential to the learner but not being adequately covered) and redundancy in the curriculum (i.e. topics unnecessarily being covered in more than one place).
- Make it easier for students to know what topics to expect in a course.
- Make it easier to determine if what is being done in the classroom is actually what needs to be done to meet the goals of the curriculum.
- Make it easier to adjust course content as technology and requirements change.
- Make it easier to assess the suitability of textbooks by comparing the desired detailed learning outcomes to the material covered in the textbook.
- Make it easier to assess the learning obtained by students in courses by appropriately assessing the knowledge obtained for each of the detailed learning outcomes.

6. FUNCTIONS OF A CURRICULUM MANAGEMENT SYSTEM

There are at least three critical areas a CMS needs to address. These are: what is currently being taught (as represented in class syllabi), what we want to teach (the desired curriculum), and what was learned from our teaching (assessment).

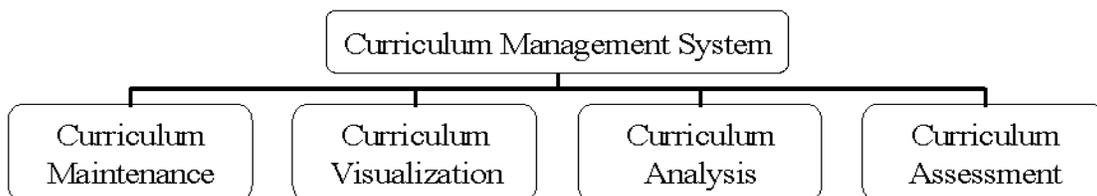


Figure 2: Functions of a Curriculum Management

The current practice in most institutions with which we are familiar is to manage curriculum at the course level. This means that the most information available about course content consists of a catalog description of 30 words or so and possibly a course syllabus which is usually in the hands of the instructor. The syllabus typically contains one or more learning objectives, a course calendar and other information. With a CMS, more information would be easily accessible to help in syllabus development and curriculum management. The functions of the CMS are shown in Figure 2.

The **Curriculum Maintenance** function is the primary mechanism for data entry and maintenance of the curriculum database. Appropriate forms are used for this purpose. The key components of the database include higher level entities such as college, school, department, degree program, and course (i.e. data found in the catalog), along with lower level (more detailed) entities such as learning units, course objectives, and desired competencies or learning outcomes.

A department typically begins the curriculum development process by considering inputs from various stakeholders as shown in Figure 1. Rather than beginning with course descriptions, however, the key difference when using a CMS is that the process begins by specifying a set of expected competencies to be achieved by students completing a degree program. The exact makeup of these competencies may range from a multi-level hierarchy (similar to IS'97 knowledge elements) to a more simplified enumeration of the competencies that one usually sees in state mandated secondary education curriculum standards (TEKS, 1998).

In addition to discipline related competencies, general educational and school/college specific competencies (e.g. Business competencies) are also defined. As Snoke and Underwood (2002) indicate, these general competencies are normally not expressly enumerated in model curricula such as IS'97; rather, they are contained within the discipline related competencies. Accrediting organizations such as AACSB, however, place a high degree of importance on having general and school related competencies specifically enumerated.

After defining the expected competencies for the program, the department turns its attention to developing appropriate courses or analyzing existing courses where students acquire the necessary knowledge and skills. For each course, a set of learning units with specific

objectives is defined in a manner similar to IS'97. A crucial feature of the Curriculum Maintenance function is the ability to link each learning unit to one or more competencies at a specific knowledge level (similar to Bloom's taxonomy). These links are then used in the Curriculum Analysis function to show appropriate progression of learning across the curriculum.

The purpose of **Curriculum Visualization** is to provide various views of the curriculum database to the stakeholders. Traversal of the curriculum is accomplished in a point-and-click mode. Johnson et al. (2002) suggest various approaches to this in their interactive prototype for IS'97. Figure 3 shows one possible way of presenting discipline specific competencies in an expandable/contractible format.

Competency#	Title
1	IS Theory, Concepts, and Business Use
2	IT Architecture
3	Programming
4	Database Management
5	IS Development Process, Methods, Tools, Techniques
	Title
6	Systems Development Life Cycle (SDLC)
7	Alternatives to theSDLC
8	IS Project Management
9	Systems Analysis / Requirements Determination
	Level 3
	Title
1	Fact Finding Approaches
2	Interviewing Process
3	Systems Modeling Approaches
4	Object-Oriented Modeling Approach
5	Structured Modeling Approach
6	Event Table
7	Entity-Relationship Diagrams
8	Data Flow Diagrams
9	Class Diagrams
10	Use Case Diagrams
11	Sequence Diagrams
12	Collaboration Diagrams
13	State Chart Diagrams
14	Requirements Summary Document
15	Requirements Summary Presentation
0	
10	Systems Design
11	Systems Construction
12	Systems Testing
13	Systems Implementation
14	Systems Maintenance
15	CASE Tools
	umber)
6	Application Development Environments

Figure 3: Discipline Specific Competencies in an Expandable/Contractible Format

Future visualizations might include graphics (for courses and prerequisites), colors for associations, and even sound and video to help users better understand both the high-level and low-level aspects of the department's curriculum.

Curriculum Analysis provides additional query and reporting capabilities allowing the user to analyze the curriculum for completeness and consistency. Summary and statistical reports are provided for all aspects of the curriculum. In addition, the user can enter a keyword (such as Distributed Database) and see if the topic builds appropriately across the courses (see Figure 4) addressing this subject. Beyond a set of pre-defined queries and reports, an expert user can write his/her own queries, reports, or special programs for specific analysis requirements not available in the system.

Moving to such a system involves a cultural change for faculty, and like all change, there will have to be some reason for making the change other than “it is a good idea.” Both faculty and the administration will need to believe in the potential benefits to be obtained from using the system. Our belief is that faculty who are interested in providing a quality learning experience for students will realize such benefits. This cultural change was a major problem for a high school principal who was responsible for implementing a CMS in his school (---, 2002), and we believe the same problem may be encountered in higher education.

KE_Num1	KE_Description	Course # & Name	LU_Name	KE_Level
▶ 1.6.8	Distributed databases, repositories	02 - Personal Productivity with IS Technology	Accessing/Retrieving/Storing Data	1
1.6.8	Distributed databases, repositories	03 - Information Systems Theory and Practice	Systems, Work-Flow, Organizational Systems	1
1.6.8	Distributed databases, repositories	04 - Networking and Telecommunications	Telecom Central/Distributed Systems	2
*				

Figure 4: Courses Containing the Topic: “Distributed Database”

CMS Curriculum Assessment allows the department to make visible its assessment mechanisms that demonstrate the degree to which its graduating students have achieved the expected competencies. Each element of assessment links to one or more of the competencies (Johnson, 2000). The CMS, therefore, allows each assessment approach to be specified and linked to the course where it is administered and the competencies that it addresses. Analysis of results can then be linked back to the specific courses where the competencies are taught and the necessary adjustments made to the curriculum. Most likely the CMS would not specify any particular assessment approach, but would provide the capability to show how an assessment approach links to the other CMS entities.

7. SOME ISSUES RAISED BY A CURRICULUM MANAGEMENT SYSTEM

As with all proposed change, there will be issues that need to be addressed. The first, defining and classifying the detailed list of learning outcomes, is a major task. Some help on this issue as it relates specifically to Information Systems comes from the model curricula. But even with the work that has already been done, adapting these curricula to local needs is still a significant task. An even greater task awaits those who do not have access to a resource like a model curriculum.

A second issue concerns academic freedom and the traditional university environment for faculty. At least concerning the content to be included in classes, a CMS would limit the faculty member’s ability to pick and choose what was to be taught. Arguments can be made on both sides of this concern, some of which have been presented elsewhere in this paper. At least, insofar as Information Systems is concerned, we believe there needs to be more quality control applied to what is taught in the classroom.

A problem of continuity also exists with such a system. Who would be responsible for maintaining and updating the system? Who would insist that the system is used? This was a concern of one administrator in a high school where it was mandated that curriculum management software would be used (---, 2002).

A final concern is where an institution might acquire a CMS. The systems the authors identified while writing this paper were developed for either K-12 or medical education. This appears to leave three options open to the interested institution. One, develop your own system. This is the option the authors are proceeding on at the present. We plan to report our experiences with this issue in a future paper. Second, wait for some company to develop and market a system, and three, hope that vendors of Enterprise Resource Planning (ERP) systems for higher education will see a need to incorporate a CMS into their products.

8. CONCLUSION

Higher education is undergoing changes much like primary and secondary education has in the past. We in academia must learn from the K-12 experiences and place an increased focus on our curriculum and the results of our labors, namely, well-educated students. This will require changes in the way we operate and in the tools that we use. A curriculum management system, the concepts and functions of which we have described in this paper, will most likely be one of the tools we will use. As we more fully learn from the K-12 experience, the work done with model curricula, and as more research is focused on this area, vendors will, in the not too distant future, be rolling out CMS products for higher education. Will you be a customer?

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