

# Designing and Implementing an Information Technology Minor at the University of Wisconsin-Superior

Shaun M. Lynch, Ph.D.  
Department of Mathematics and Computer Science  
University of Wisconsin-Superior  
Superior, WI 54880  
slynch@uwsuper.edu

## **Abstract**

Fluctuating market conditions and changing institutional values occasionally warrant a restructuring of academic programs to meet new realities. Although disruptive to students and faculty, a significant curricular change can offer an opportunity to reevaluate a program and transform a curriculum to meet new challenges and appeal to fresh audiences. On August 1, 2006, the Provost at the University of Wisconsin-Superior made the decision to phase-out the Computer Information Systems major. The paper looks at the circumstances leading to the dissolution and the emergence of the new Information Technology minor. Background information is presented that describes the CIS program and factors that contributed to its eventual demise followed by a description of the steps taken to design and implement the new IT minor with specific attention to the curriculum and activities needed to attain approval from governance bodies and lessons learned.

# **1 Introduction**

Fluctuating market conditions and changing institutional values occasionally warrant a restructuring of academic programs to meet new realities. Although disruptive to students and faculty, a significant curricular change can offer an opportunity to reevaluate a program and transform a curriculum to meet new challenges and appeal to fresh audiences. This article looks at one such event at the University of Wisconsin-Superior.

On August 1, 2006, the Provost at the University of Wisconsin-Superior made the decision to phase-out the Computer Information Systems (CIS) program and transfer the faculty and courses from the Department of Business and Economics to the Department of Mathematics and Computer Science. Within two years of the phase-out, a new Information Technology (IT) program emerged that recast the personnel and curricular assets into a program better suited for the University and its mission.

The paper looks at the circumstances leading to the dissolution of the CIS major and the emergence of the IT minor. First, background information is presented that describes the CIS program and factors that contributed to its eventual demise. Next, a description of the steps taken to design and implement the new IT minor with specific attention to the curriculum and activities needed to attain approval from governance bodies. Finally, closing commentary on the nature of the effort and lessons learned.

## **2 The CIS Program**

The CIS major began in the Department of Business and Economics in the early 1980s to provide students with the knowledge, skills, and abilities to leverage information and computing technology as a strategic resource. Interdisciplinary in nature, the CIS curriculum encouraged students to work with and facilitate communication amongst those that use information to achieve an organization's goals and mission. A typical graduate would be expected to understand and apply concepts associated with business and information technology to problems found in the world of practice.

This section characterizes the CIS program and describes conditions leading up to the Provost's decision to phase-out the major. First, a profile of the program is offered that describes its essential characteristics. Next, a brief overview of activities that led to the final configuration of the curriculum. And lastly, a frank discussion of the challenges the program faced and the factors that eventually led to its decline.

### **2.1 Academic Profile**

A CIS program is just one of several different information system type programs offered by universities and four-year colleges. Many, if not most, information system programs are part of business degree program that grant undergraduate and/or graduate degrees.

However, some information systems programs are housed in departments or colleges that have technological or scientific foundations.

Management Information Systems (MIS) is probably the most common and best known type of information systems program available to students seeking a degree in the discipline. MIS programs generally emphasize the strategic use of information in the business enterprise and are often most effective at the graduate level in an MBA program where students seek additional education to enhance managerial careers.

CIS programs are closely related to MIS programs with the distinction of focusing more on the use and management of technology in the enterprise. This type of program is well suited for an undergraduate education since the content concentrates on the operational activities of an organization. Students are prepared for careers that entail developing technological systems that solve business problems. Graduates often work their way into careers as project managers that lead interdisciplinary teams.

The characteristic that differentiates CIS academic programs from other business and technical programs is the number and types of people CIS graduates are expected to work with. It is a common expectation that graduates will work with managers that make business decisions, computer scientists who develop information technology, engineers who design systems, and users who use the technology and processes to achieve their own objectives. This entails a curriculum that encourages students to see beyond their own discipline and to facilitate communication amongst all parties.

## **2.2 Program Configuration**

In 1999, the faculty of the CIS program undertook the challenge of revising the curriculum to improve the quality and competitiveness of graduates in the workplace. The project involved an on-going design and configuration process based initially on the IS 97 [1] and later on the IS2002 Curriculum Model [2] and implemented in two-phases.

The first phase of the project entailed consolidating the Management Information Systems, Decision Sciences, and Information Processes concentrations into a single coherent major. The design concentrated on preparing students to become information technology (IT) project managers. The curriculum was formed around a set of student outcomes and designed to provide students the knowledge, skills, and abilities as listed in Exhibit 1.

The second phase of the project consisted of revising the curriculum to modularize and partition course content. Approved in Fall of 2001, the changes focused on streamlining course offerings, eliminating redundancy, and strengthening the technological side of the curriculum to complement the very strong business background students in CIS draw upon. Final changes were implemented in the 2002-2004 catalog [3] as shown Exhibit 2.

In general, computer information system student should:

- Understand the underlying computer information system concepts and principles and apply them to problems found in business and industry.
- Communicate with professionals in business, engineering, and computer science, as well as, to other project team members.
- Interact and negotiate with clients with regard to project scope, expectations, and outcomes.
- Analyze system structure and behavior using systematic decomposition.
- Create requirements that address the specific needs of clients.
- Design solutions based on the requirements that are economically justified and provide value to clients.
- Implement solutions in a systematic manner that utilizes the techniques of project management to include resource management, budgets, and schedules.
- Work in a team environment and encourage cooperation between individuals.
- Promote open channels of communication and maintain ongoing dialogs between project team members and clients.
- Think critically, innovate, and manage ambiguity and uncertainty.

### Exhibit 1: Student outcomes for the CIS major.

#### Computer Information Systems Major (Comprehensive, 70 Credits)

CIS 108	Business Computer Applications	3 credits
MATH 151	Calculus for Business, Life, and Social Sciences	3 credits
ACCT 200	Financial Accounting	4 credits
ACCT 201	Managerial Accounting	3 credits
ECON 250	Principles of Microeconomics	3 credits
ECON 251	Principles of Macroeconomics	3 credits
BUS 211	Business Law I	3 credits
BUS 270	Business Statistics	3 credits
CSCI 201	Introduction to Programming	3 credits
CSCI 202	Object-Oriented Programming	3 credits
CIS 224	Introduction to Computer Information Systems	3 credits
ENGL 209	Business and Professional Writing	3 credits
FIN 320	Principles of Finance	3 credits
CIS 347	Database Systems	3 credits
CIS 355	System Abstraction and Modeling	3 credits
CIS 360	Data Network Systems	3 credits
BUS 306	Quantitative Models for Production and Operations	3 credits
BUS 370	Principles of Marketing	3 credits
BUS 380	Principles of Management	3 credits
BUS 430	International Business	3 credits
CIS 455	Systems Development	3 credits
CIS 456	Project Management (Capstone)	3 credits

And at least one of the following:

CIS 453	Advanced Topics in Computer Information Systems	3 credits
CIS 457	Seminar in Computer Information Systems	3 credits

### Exhibit 2: Course list for the CIS major.

## 2.3 Program Challenges

Like many technology related programs, enrollment coincides with economic conditions but generally lags industry trends by a couple of years given the time it takes students to complete their plan of study. Although the period from 2000 to 2002 saw peak enrollments for the program, there were a number of factors that made it increasingly difficult to attract students to the program early in the decade.

To begin with, the dot-com crash of 2000-2001 and the trend to outsource information technology services discouraged students from considering information system related careers. Many students at UWS were motivated to pursue the CIS program given the prospect of landing a high quality job that drew on their skills and offered competitive salaries. As the recession wore on, competition for the few remaining positions increased and news of displaced IT workers stigmatized the discipline squelching student interest and prompting students to search for more attractive career paths.

Second, the number of courses and prerequisites in the major made it difficult for students to complete in a timely manner. Part of the problem stemmed from the hybrid nature of the program and the need to be proficient across technology and business subject areas. Required coursework from both disciplines introduced many prerequisites leading to a curriculum that was rigid and inflexible. Limited staff and course offerings exacerbated the problem making it difficult for majors to schedule classes and preventing non-majors from picking up courses out of interest.

Third, increasing cost of college (i.e. tuition, books, and room and board) in combination with decreasing scholarship and financial aid packages compounded the problem. As financial resources decreased, students worked longer hours to make ends meet cutting into the time needed to prepare for and attend class. In addition, cut-backs in tuition packages for international students made UWS less attractive to foreign students seeking degrees that are eligible for 401-B visa sponsorship.

Fourth, the University undertook a systemic review of majors to reduce program proliferation and align offerings with the new public liberal arts mission adopted in 2001. Historically, the CIS program was part of a number of thriving professional degree programs. When the mission changed, the program moved to the edge of the niche the University sought to obtain. The issue came to a head after the 2004 NCA review team recommended that UWS address the issue of degree proliferation and to review the existing program array. The combination of timing and economics made the CIS program a candidate for downsizing.

Fifth, internal departmental political factors lead to conditions where programs were no longer supported. In the years 2002-2006, budget reductions in Wisconsin's system of higher education from created an environment in which academic programs battled for dwindling resources. Faculty and staff positions were often left open or cut entirely to satisfy fiscal constraints. This led to program cannibalization that created a politically charged, dysfunctional environment that polarized department members against one another in hopes of reallocating scarce resources.

This combination of factors led to a perfect storm for the CIS program. Students were no longer attracted to a profession that lacked career opportunities and suffered from a tarnished image. Rigorous, high-credit programs that demanded time and attention ran in conflict with the ability to earn a living in a financially constrained environment. A decline in financial incentives forced international students to look elsewhere for more affordable schooling. External support declined as administrative pressure mounted to align academic programs with the University's mission. And finally, internal support collapsed as the political environment deteriorated into bedlam. All of these factors contributed to the challenges faced by the CIS program and lead to its eventual decline.

### **3 Designing and Implementing the IT Program**

Elimination of the CIS major left an academic void at UWS. The program was unique in that it integrated managerial and technical perspectives in a single major. Students learned to use and leverage information technology as a means to solve problems found in business and industry. Although students could still pursue a degree in Business Administration to learn about management, there would no longer be a program that offered students insight into information technology and its applications in the world of practice.

This section examines the steps taken to design and implement the IT program. It begins with the underlying concepts and alternatives that created the foundation for the plan. Next, discussion leads into the rational and guidelines used to design the curriculum. And finally, a brief overview of the techniques used to navigate governance processed needed to approve the curriculum.

#### **3.1 Concepts and Alternatives**

On September 6, 2006 at the request of the Department Chair, the CIS-CSCI Integration Subcommittee was formed with the charge to create a plan to smoothly phase-out the Computer Information Systems major, maintain relationships with the Department of Business and Economics, and chart the future course of the program. The report and recommendations were presented to the Department in December 2006 [4].

Among other things, the report presented three alternatives for consideration by the department. These alternatives included,

1. Do Nothing—Keep the existing Computer Science curriculum and course offerings the way they are currently established,
2. Add a CIS Minor—Simply repackage the courses in the CIS to fit a minor offering in the Computer Science curriculum, or
3. Reorganize the Computer Science Curriculum—Create a single curriculum that includes a computer science concentration, a complimentary concentration in either information systems or information technology, and a suite of service classes offered to the University as a whole.

Choosing the appropriate alternative revolved around four conditions that were unknown at the time. These conditions included: 1) weighing the benefit against the effort needed to achieve the alternative, 2) the potential to expand student interest and grow enrollment, 3) departmental political stability, and 4) administrative support.

However, the decision was complicated by uncertainty surrounding the long-term employment of tenure-track faculty member transferred in the process. Retaining faculty resources was required to integrate the CIS curriculum effectively. As discussions ensued into the Spring of 2007, the initial plan offered a degree of justification (among other factors) that the faculty member was necessary. As a result, negotiations between the department and administration were resolved and appropriate staffing was left in place.

In the interim, a fresh concept evolved from the initial plan to recast the content embedded in the CIS curriculum into a new IT minor. The program would complement the existing Computer Science degree offerings and address factors that led to the decline of the CIS major. Specifically, the IT minor would target students across campus pursuing arts and sciences programs and professional studies wishing to enhance their career opportunities. The program would emphasize choice and allow students to select from a range of topics applicable to their discipline or that stimulated their interest.

On July 24, 2007, the Department of Mathematics and Computer Science held a strategic retreat to discuss and consider various programmatic alternatives. A portion of the meeting was dedicated to considering what action the Department would like to take regarding how the faculty and curriculum of the CIS major should be utilized. The Department wholeheartedly supported a growth strategy that included the creation of an IT minor that would appeal to a broad range of students and utilize the strengths of contributing faculty members.

## **3.2 Curriculum Design**

Design of the IT minor was based on recommendations from the Computing Curricula 2005 [5] and Computing Curricula: Information Technology Volume 2005 [6]. The latter reference organizes the information technology body of knowledge into 12 areas for an undergraduate program that include: information technology fundamentals, human computer interaction, information assurance and security, information management, integrative programming and technologies, networking, programming fundamentals, platform technologies, systems administration and maintenance, system integration and architecture, social and professional issues, and web systems and technologies.

Since the target curriculum was a minor and not a full-fledged major, practical limitations existed on what would and would not be included in the course array. Questions that helped narrow the pool of knowledge categories included: Could the topic be presented to a broad audience? Can the course be offered without prerequisites? Is there a similar course in the CIS curriculum that could be utilized?

In addition, it was important to select courses that would complement a student’s major and satisfy degree requirements for the minor. This meant balancing the number of freshman and sophomore level courses with courses aimed at a junior level audience. In general, course numbers were assigned using the following principles: 100-level designation for introductory concepts and skills, 200-level designation for fundamentals, and 300-level designation for topic areas.

Nine of the twelve knowledge areas were selected as candidate topics for the IT minor as shown in Exhibit 3. Integrative Programming and Technologies, Platform Technologies, and System Administration and Maintenance were not included in the course array since the content seemed more appropriately suited for 400-level courses in a full-fledged major.

Knowledge Area	Designated Course
Information Technology Fundamentals	CSCI 230 Introduction to Information Technology
Human Computer Interaction	CSCI 364 Multimedia and Digital Entertainment
Information Assurance and Security	CSCI 370 Information Assurance and Security
Information Management	CSCI 346 Database Management
Networking	CSCI 350 Networking and Communications
Programming Fundamentals	CSCI 211 Visual Programming Fundamentals
System Integration and Architecture	CSCI 380 Enterprise and E-Business Systems
Social and Professional Issues	CSCI 360 Computer Law, Ethics, and Intellectual Property
Web Systems and Technologies	CSCI 335 Web Page Authoring

Exhibit 3: Knowledge areas and designated courses.

In addition, the minor would also include a course in computer literacy (CSCI 148 Computer Applications for Productivity) that would expose students to basic computer applications as a means to improve personal productivity. Although not associated with any particular knowledge area, it was included as a service to help fulfill the strategic goal of providing a computer literacy course as described in a draft of the campus strategic plan for 2016 [7].

Content for five of the courses proposed for the IT minor were drawn from existing courses in the CIS curriculum as shown in Exhibit 4. Three courses from the Computer Science curriculum were recast to form CSCI 211 Visual Programming Fundamentals, CSCI 370 Information Assurance and Security, and CSCI 380 Enterprise and E-Business Systems. Therefore, only two courses—CSCI 360 Computer Law, Ethics, and Intellectual Property and CSCI 364 Multimedia and Digital Entertainment—were truly “new” to the curriculum being proposed.

In the end, the final curriculum consisted of 12 courses. The required and programming courses would be offered annually, while the elective courses would be offered once every other year. The complete course array for the minor submitted in the proposal [8] is shown in Exhibit 5.

IT Curriculum	CIS Curriculum
CSCI 148 Computer Applications for Productivity	CIS 108 Business Computer Applications
CSCI 230 Introduction to Information Technology	CIS 224 Introduction to Computer Information Systems
CSCI 335 Web Page Authoring	CIS 453 Advanced Topics in Computer Information Systems (Topic: Web Design and Development)
CSCI 346 Database Management	CIS 347 Database Systems
CSCI 350 Networking and Communications	CIS 360 Data Network Systems

Exhibit 4: Content transfer (at least in part) to IT curriculum from CIS curriculum.

Information Technology Minor (21 Credits)

Required courses:

CSCI 148	Computer Applications for Productivity	3 credits
CSCI 230	Introduction to Information Technology	3 credits

Choose one from the following programming courses:

CSCI 201	Introduction to Programming	3 credits
CSCI 211	Visual Programming Fundamentals	3 credits
CSCI 250	Internet Programming	3 credits

Plus a minimum of 12 credits from the following elective courses:

CSCI 335	Web Page Authoring	3 credits
CSCI 346	Database Management	3 credits
CSCI 350	Networking and Communications	3 credits
CSCI 360	Computer Law, Ethics, and Intellectual Property	3 credits
CSCI 364	Multimedia and Digital Entertainment	3 credits
CSCI 370	Information Assurance and Security	3 credits
CSCI 380	Enterprise and E-Business Systems	3 credits

Exhibit 5: Curriculum for the IT minor.

### 3.3 Governance and Administrative Approval

Fortunately, approving a new academic minor can be accomplished within governance and administrative structures of the University. The proposal must be first approved by the department housing the program, then by Undergraduate Academic Affair Council, then by Faculty Senate, then on to administration where the final decision is made. Regardless, all new programs are stringently reviewed and must support the mission of the University, fill a substantive need, and demonstrate the availability of adequate resources.

Any proposal that requests a new academic program must state how that program will support the mission of the University. In 2001, UWS adopted a new public liberal arts mission that emphasized arts and science programs and professional programs that satisfied regional needs. Reasons for the shift is beyond the scope of this discussion, however, it is important to recognize that a program in information technology would

best serve the University in a supporting role and not as a central program. This was accomplished in the proposal with the following language in the proposal [8],

*The proposed Information Technology (IT) minor offers to fill this void [absence of an information technology program] while extending the benefits to the breadth of arts and sciences programs and professional programs offered at UWS. The curriculum is designed to complement existing programs by providing students with the knowledge, skills, and abilities to use information technology in their field of interest. It is tailored for the student with an interest in information technology who wishes to enhance their career opportunities. The program emphasizes choice and allows students to select from a range of topics applicable to their discipline or that pique their curiosity.*

Demonstrating the proposed information technology program would satisfy a substantive need required a two pronged approach. First, it was important to ensure that governance and administrative bodies recognize the importance of information technology and its application in a modern world. That without some knowledge of these systems, programs and students at UWS would be lacking in an essential way. Although this is realized by most at some level, faculty and administrators recognize that their graduates can be more competitive in the world of practice with some exposure to information technology than without.

Second, it is important that departments participate in the university community through the programs they offer as well as attracting students to increase or at least maintain enrollment levels. In a coincidence of timing, the Department had just been reviewed by the Program Review and Planning Council which independently stated need on May 9, 2007 [9]. Portions of the report and the Department's response were included in the proposal as evidence that the proposed IT minor would help satisfy this need.

Finally, the proposal needed to demonstrate that adequate resources were available to implement and sustain the IT program into the foreseeable future. From a curricular standpoint, the courses proposed for the new minor would replace courses being phased-out from the CIS major making it nearly an even exchange. From a budget perspective, the department received additional support in the program transfer which would adequately cover existing costs. From a personnel perspective, since both faculty members were retained from the CIS program with the appropriate qualification there would be sufficient staff to coordinate the program and cover the courses offered.

In the end, the proposal to create the IT minor received considerable support from colleagues, governance bodies, and administration. First, the Department of Mathematics and Computer Science unanimously approved the proposal on October 9, 2007 [10]. Next, the Undergraduate Academic Affairs Council approved the proposal on October 16, 2007 [11] without revisions. And finally, Faculty Senate approved the proposal on October 23, 2007 [12] moving it forward to administration. All steps were completed prior to the catalog deadline and the course list for the IT minor was published in the 2008-2010 catalog [13]. The program commenced fall semester 2008.

## 4 Lessons Learned and Summary

Designing and implementing new academic programs requires as much art as science to achieve successfully. Although guidelines are available to assist faculty as they design academic programs, it is the ability to tailor a program to an institution in creative ways that requires thought and insight.

The author learned three important lessons in this exercise. First, adjust to the transition before committing to a new design. Adjusting to a new environment takes time and allows for the mental transition from “what was” to “what can be”. Being open to new ideas often means letting go of what we think we know for certain. Taking time also allows creativity to take root and offers room to experiment with new ideas.

Second, guidelines are only the starting point. Published guidelines are a true service to the profession, but they only capture thoughts and practices that could be agreed upon or were known about at the time. Innovation takes one step past a guideline to find that unique solution that solves a particular problem. Often this means thinking about the problem in a very different light.

Third, downsizing is not so bad. Coordinating a primary program is a lot of work and consumes a tremendous amount of time and effort. Downsizing frees up more time to pursue other interesting activities a university has to offer. Faculty governance, administrative roles, department pursuits, and special projects become feasible as time commitments change. This allows a broader perspective of the university mission and opens new opportunities for personal and professional development.

Why is this topic important? Because student and institutional needs change and faculty are ultimately responsible to ensure academic programs satisfy those needs. Curriculum is the underlying framework that enables the dissemination of knowledge and student learning. This framework is dynamic and periodically needs adjusting to ensure it is aligned with the university’s mission.

Topics for further investigation include the non-academic challenges associated with designing and implementing curriculum. The impetus for change may stem from factors beyond the control of individual faculty members and may cause considerable strain on their personal and professional lives. A physical relocation or adapting to the social norms of a new department are not benign and influence individual perceptions of the academic process and one’s role in it. Colleagues and administrators familiar with these issues can facilitate smooth transitions and help individuals focus and maintain forward momentum to achieve organizational goals.

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