Integration of the Cisco Networking Academy in a Four-Year Curriculum

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Abstract – The adaptation of industry curriculum as a component of academic courses provides a framework to build standards-based industry-centric curriculum. This paper details the process experienced by a four-year university to integrate the Cisco Networking Academy Program (CNAP) networking curriculum, supporting associate degree and professional level industry certifications, into an information technology program.

Keywords: Information Technology, Networking, Cisco Academy, CNAP

BACKGROUND

The Information Technology (IT) program at The University of Southern Mississippi began as a transfer option for community college students majoring in computer programming technology. When implemented this option satisfied resource constraints of space, funding, and faculty. For the first two years, the option worked in that the degree offered was interdisciplinary with major courses provided by computer science and business. The only expenditure was faculty advisor time for less than fifty majors. This degree option might have continued, but a program accreditation visit required curriculum changes and the need for a separate degree program. An application for a new degree program was approved in 1997. The concept was to offer the degree as an interdisciplinary program with most of the required courses taken from different academic units within the university, e.g. computer science and business.

The interdisciplinary program would have been implemented; however, a proposal to establish an articulated degree program was approved by the National Science Foundation (NSF). The concept of the articulated program was to define a group of courses taught at Mississippi community colleges and have these courses applied toward a four-year degree program without any loss of academic credit. Because of budget constraints and the difficulty of having a new degree program approved by the state governing board, university administration decided to utilize the approved interdisciplinary program to develop the new degree program. As a subcontract of NSF grant number DUE-9950085, the university received funds to develop a four-year articulated curriculum in computer networking. This funding provided the justification to acquire laboratory space, faculty, and equipment that would not have been available otherwise.

PROGRAM DEVELOPMENT

To articulate the community college curriculum, a faculty committee compared published course outcomes to develop equivalent courses offered by the university. Table 1 shows the original list of courses identified as transferable into the four-year degree. Of the 15 courses, nine had academic equivalents already in place leaving six courses to be created. The content areas for these courses were system maintenance, data communications, network components, network planning & design, project management, and operating platforms. These courses were approved along with 17 other courses to complete the four-year curriculum.

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Table 1
Community College Transfer Courses

Course Description	Hrs
English Composition I	3
English Composition II	3
College Algebra	3
Political Science	3
Speech	3
Physics	3
Internet Concepts	3
System Maintenance	3
Operating Platforms	3
Novell Server	4
Visual Basic	4
Fund. of Data Communication	4
Network Components	4
Network Planning & Design	4
Project Management	4
	51

Collectively, the courses offer a two-course sequence in computer architecture & maintenance, a four-course sequence in local area networking, a four-course sequence in wide area networking, a four-course sequence in information security, a five-course sequence in Windows client-server networking, a two-course sequence in open source client-server networking, and a two-course senior capstone sequence.

Vendor Neutral vs. Vendor Specific Curriculum

One consideration that must be evaluated is the decision to offer a vendor neutral or vender specific curriculum. A vendor neutral curriculum will not rely on a single vendor or vendors for curriculum content. An example would be to present a foundations course in data communication without referencing a specific vendor. Another example might be to discuss computer architecture without referencing a manufacturer such as INTEL. While this approach allows each student to develop their own decision about the best operating environment etc.., it does limit curriculum resources. The final decision regarding which approach is best will be a program's local industrial advisory committee. Simply stated, if a program does not provide graduates that will be hired by these companies then students will be less likely to enroll in them.

For the four-year program being discussed, the decision of a vendor specific curriculum was predetermined because the community college partner adopted the Cisco CNAP program for coverage of the local area networking curriculum. A second focus of the two-year curriculum was coverage of a second industry operating system (Novell). These decisions were dictated by a state-wide community-college curriculum committee to make certain two-year graduates could be employed by Mississippi industries.

To meet articulation requirements, a four-course sequence was developed by the university to accommodate the CNAP program. The faculty committee decided to offer four additional courses modeled after the second level of Cisco industry certification, Cisco Certified Network Professional (CCNP). To expand on a vendor specific curriculum, a five-course sequence utilizing the Windows operating system was also implemented. These sequences provide students with three of the most popular industry certification tracks available if they want to pursue them. These decisions were not made without input from the Industry Advisory Committee (IAC). The IAC

stated that the Windows operating system should be part of the curriculum for a four-year information technology graduate.

Industry Certification

A second area of consideration involved individuals that might enter the four-year program with Cisco Certified Network Associate (CCNA) certification. The faculty committee determined that anyone with a certification would be allowed to enter the CCNP curriculum, but each person would be counseled regarding this decision. To date, no one with CCNA certification has completed the CCNP course sequence without first completing the CCNA course sequence.

CONSIDERATIONS OF A VENDOR SPECIFIC NETWORKING CURRICULUM

In the case of the Cisco CNAP program, faculty are provided a complete online curriculum, online testing, online course evaluations, and curriculum updates. This reduces the time needed for course development and allows faculty more time in the classroom and laboratory. To participate in the Cisco CNAP program, faculty must be certified in order to have access to these resources. CCNA certification indicates a foundation in and apprentice knowledge of networking. CCNP certification indicates advanced or journeyman knowledge of networks.

In addition to industry certification(s), faculty are also required to have additional instructor certification. Cisco Certified Academy Instructor (CCAI) status denotes a proficiency in delivering the instruction required to support the diverse needs of the CNAP program. To meet CCAI requirements faculty must complete the Cisco Networking Academy Instructor Orientation Course, complete all curriculum course training (including final exams, skills tests, and demonstration of pedagogical skills), maintain the requirements for recognized industry certification, and teach each course in the curriculum. They must also participate in additional training when the online curriculum is updated which are termed “bridge” courses. If these are not successfully completed, the faculty member will lose access to the online resources.

Faculty Training & Certification

In order to offer the CCNP curriculum at Southern Miss, two faculty participated in the certification process. The rationale being that one would serve in a backup capacity. Each faculty member required $36,000 in institutional support to complete CCNA, CCNP, and CCAI certifications. This cost reflects a two-week workshop registration fee for each course and travel cost to attend training. It does not include faculty salary or adjunct pay while faculty attended training. The cost for faculty training may appear high; however, one should consider that the approved training location for faculty was located in Texas. In addition to the initial training and certification costs, faculty must maintain industry certification by retesting every 2-3 years.

Because of continuing education requirements for faculty, any institution considering this type of program must make allowances for faculty pursuing tenure. If the institution has a required research component as part of its tenure criteria, most faculty will not be successful in obtaining tenure or promotion if allowances are not made for faculty teaching in the CNAP program. If tenure allowances are not feasible, an institution could use different criteria for annual faculty evaluation, have a dual-system (research track or teaching track) for faculty evaluation or classify faculty differently such as instructor or senior lecturer.

Lecture/Laboratory Space

To establish and maintain a lecture/laboratory space, two costs must be considered. These are one-time startup costs and recurring operational costs. Figure 1 depicts the initial configuration of a 20 workstation arrangement with five additional workstations for network experiments. One-time costs in the amount of $25,000 for computer equipment and $100,000 for network hardware were expended to establish this space. Operating costs average $18,000 per year and include software license renewals, required Cisco maintenance contracts, student labor, laboratory supplies and computer workstation repairs. To maintain current computer technology for students, the laboratory is on a three-year replacement cycle for computer equipment. During the last upgrade, computer workstations averaged $1000 per unit which translates into a recurring $25,000 expense. Recurring costs are supported by a student laboratory fee which generates annual revenue of $30,000.

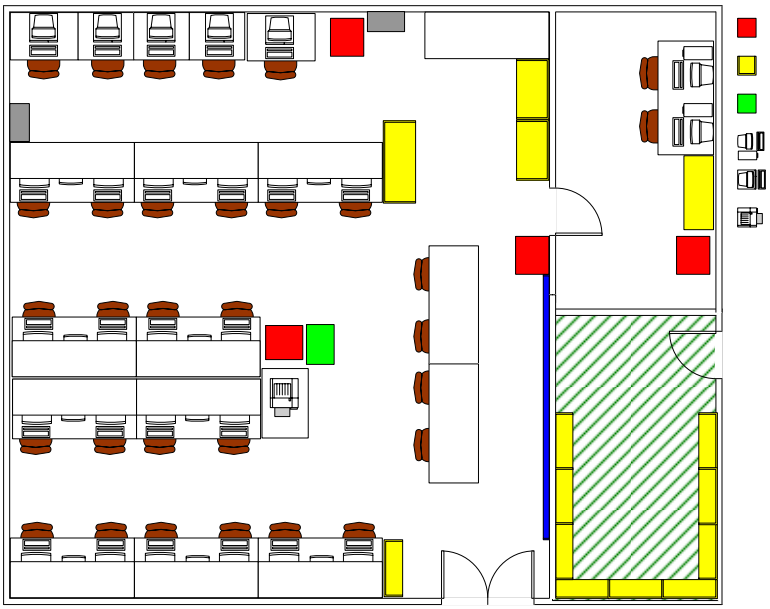

Figure 1. Laboratory layout. The classroom layout provided one multi-purpose computer laboratory with 20 student PCs and five separate PCs for network experiments.

PROGRAM CONSIDERATIONS

Program accreditation

A part of any program evaluation or continuous improvement plan should be to model the program after specific accreditation program criteria if available and satisfy all requirements to seek program accreditation. This serves as a minimum standard when comparing academic or technical programs at different institutions. It allows arguments to be made to obtain additional resources from the university administration, and it addresses student concerns about lack of program accreditation. On more than one occasion, the authors have explained why information technology is "not accredited."

Several different organizations were interested in establishing accreditation criteria for the Information Technology (IT) discipline. It appears that the Computing Accreditation Commission (CAC) of the Accrediting Board for Engineering and Technology (ABET) will be the approved accrediting body for information technology programs. This is based upon the finding that program outcomes have been approved by the ABET executive board and that pilot program accreditation visits for information technology programs will be conducted in 2004-05.

Program outcomes provide the foundation to compare similarly named programs. These outcomes are broadly stated to allow for individual program differences, but narrow enough in scope so that IT graduates share a common knowledge base. The program outcomes published in the ABET 2005-06 CAC program guide for undergraduate programs in information technology state that information technology graduates should have the ability to:

(a) Use and apply current technical concepts and practices in the core information technologies

(b) Analyze, identify, and define the requirements that must be satisfied to address problems or opportunities faced by organizations or individuals

(c) Design effective and usable IT-based solutions and integrate them into the user environment

(d) Assist in the creation of an effective project plan;

(e) Identify and evaluate current and emerging technologies and assess their applicability to address the users' needs

(f) Analyze the impact of information technology on individuals, organizations and society, including ethical, legal and policy issues

(g) Demonstrate an understanding of best practices and standards and their application

(h) Demonstrate independent critical thinking and problem solving skills

(i) Collaborate in teams to accomplish a common goal by integrating personal initiative and group cooperation

(j) Communicate effectively and efficiently with clients, users and peers both verbally and in writing, using appropriate terminology

(k) Recognize the need for continued learning throughout their career

Student evaluation

Student evaluation is determined from a number of different sources with only a portion of a student's grade being determined by online assessment. A typical student evaluation matrix is shown in Table 3. Percentage distributions will vary depending upon course content, but in no case will the online component exceed 25% of the total student evaluation. Since this is a technical program, individuals might consider there is little or no communications required in the degree. While not listed, the courses in the major require written and oral reports as part of all the student course evaluations. In addition, the university has a four course requirement for writing-intensive courses as part of all degree programs.

Table 3
Student Evaluation Matrix

	Weight (%)
Online chapter test	20
Class participation	05
Homework	05
Engineering Journal	10
Oral Presentations	10
Written mid-term Exam	10
Written final exam	10
Laboratory Exercises	10
Hands-on skills final	20

Status

Table 4 illustrates enrollment and graduation trends in the information technology program at Southern Miss since it began. These trends to some degree follow enrollment trends at the community college feeder programs. When the articulation agreement was implemented, the job market was very good so many community college graduates entered the IT workforce. Beginning in 2000, a significant increase in majors in the Southern Miss IT program

occurred, which coincided with an economic decline in the IT industry. Enrollment at the community college IT feeder programs also declined. Feedback from community college faculty indicated that the decline was due to poor job placement. Enrollment has stabilized at the community colleges and the faculty indicate that current majors plan to transfer to Southern Miss to complete a four-year degree. For future planning, this should translate into an average enrollment of 200 majors and 50 graduates per year.

Table 4
Southern Miss Information Technology Enrollment and Graduation Data

Year	Enrollment	Graduates
1997	50	0
1998	66	0
1999	82	6
2000	153	10
2001	219	13
2002	262	35
2003	260	40
2004	211	56

CONCLUSIONS

The growth in the information technology discipline and the constantly changing technology makes it difficult to choose current topics and incorporate them into a static curriculum. The result is a constantly evolving curriculum that is driven by current technology and industry-best practices. Institutions that utilize vendor specific curriculum must be prepared to manage the costs associated with implementing and maintaining the program. If the Cisco CNAP program is considered, then faculty teaching in the program must be given special consideration for tenure and promotion if the institution is to retain them.

Program accreditation, if available, is vital for any new discipline. It offers minimum standards when potential students and their parents are considering which institution to attend. Accreditation also provides a framework that faculty can utilize when requesting new or replacement resources for their program.

Southern Miss would not have been able to establish the current IT program without the external funds that were received. These funds purchased all equipment for the program and provided one of two faculty positions needed to establish the program. These funds also allowed the program to demonstrate to university administration that information technology was a "real" discipline and that sustained enrollment was possible after the funding period ended. Enrollment remains strong and the authors consider the program to be successful.

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