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ABSTRACT
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undergraduate Computer Information Systems (CIS) curriculum at a small
liberal arts school. The development of the program was based on the study of
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data: the results of an industry needs survey, data from a needs assessment
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occupational projection until the year 2005, and U.S. Bureau of Labor
Statistics occupational projection until 2005. The task of developing the CIS
program was broken into six phases: (1) performing needs assessment; (2)
defining goals and objectives of the program; (3) identifying CIS curriculum
guidelines and other sources of feedback; (4) planning for human and
equipment resources needed for the program; (5) studying target students; and
(6) developing the curriculum. Details of the curriculum and its
characteristics are presented and compared with other similar curricula.
(Author/AEF)

DEVELOPING A COMPUTER INFORMATION SYSTEMS CURRICULUM BASED ON AN INDUSTRY NEEDS SURVEY

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This paper details our experiences in developing an undergraduate Computer Information Systems (CIS) curriculum at a small liberal arts school. The development of the program was based on the study of needs assessment. Findings were based on the analysis of four sources of data: the result of an industry needs survey, the data from the ICAPP needs assessment project, the Georgia Department of Labor data, and the US Bureau of Labor Statistics. The task of developing the CIS program was broken into six phases namely, performing needs assessment, defining goals and objectives of the program, identifying CIS curriculum guidelines and other sources of feedback, planning for human and equipment resources needed for the program, studying target students, and developing the curriculum. Details of the curriculum and its characteristics are presented and compared with other similar curriculums.

INTRODUCTION

North Georgia College & State University (NGCSU) is a small liberal arts institution. In January 1997 the authors were given the opportunity to develop a CIS curriculum. Frequently, university programs in CIS are offered in the school of business, school of management, or school of applied technology. At our school, the CIS curriculum was to be developed by the authors who are faculty members of the department of mathematics and computer science. In a small college such as NGCSU with limited resources the collaboration between departments in program offerings is necessary. Thus the program is to be offered jointly by our department and the Department of Business Administration and in collaboration with a two-year college in a neighboring community. The task of developing the CIS program was broken into six phases as described below.

The purpose of the first phase was to establish needs for a CIS program at our school. Statistical data that supported the need for a CIS program was needed. These data were provided from four different sources: the result of a survey questionnaire which was sent to a number of private businesses and government agencies, data from the ICAPP needs assessment project of the University System of Georgia, the Georgia Department of Labor occupational projection until the year 2005, and the US Bureau of labor statistics occupational projection until 2005. This data supports the need for CIS graduates both locally and nationally.

After completing a needs analysis, the goals and objectives of the program were defined. Model curriculums and curriculum guidelines were also studied. In developing a Computer Science curriculum, one can use the national standard guidelines ACM/IEEE computing curricula 1991 (Tucker et al., 1991). However, for a Computer Information Systems (CIS) program, also called Management Information Systems (MIS), or Information Systems (IS) no national standard guidelines are available. Excellent efforts to establish a national standard guideline for CIS programs appear in several publications including, Management Information Systems Quarterly, MISQ (Couger et al. 1995), DATABASE (Gorgone et al., 1995), the report of

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the joint ACM/AIS/DPMA Task Force (Longenecker et al., 1996 & 1997), and the Office System Research Journal, OSRJ (Caouette et al. 1996). These articles provided useful information in shaping the curriculum. In addition catalogs and web pages from schools across the country as well as all schools in the state of Georgia that are offering CIS program were reviewed. An additional survey was sent to heads of departments of schools offering CIS programs in the state of Georgia.

The fourth phase of development addressed human and equipment resources needed for the program. For this phase a five year plan has been proposed which includes hiring additional faculty with terminal degrees. Also an assessment of the hardware and software resources needed for the program has been established. The fifth phase focused upon the identification of target students, the sole consumers of the program.

The sixth and final phase of the project resulted in the CIS curriculum which was developed using the goals and projected resources mentioned above. The main characteristics of our curriculum includes a direct relation to industry needs, incorporation of multimedia technology, internship program, application of www in CIS, and use of CASE tools for hands-on applications. Also, the program is designed with enough flexibility to accommodate the non-major course requirements from a CIS curriculum. It is also constructed to attract industry employees who may need to update and enhance their knowledge and skills. In the following sections different phases of the development of the CIS curriculum are explored further.

NEEDS ASSESSMENT FOR A CIS PROGRAM

The needs assessment findings were based on the analysis of four sources of information: the result of an industry needs survey, the data from the ICAPP needs assessment project, the Georgia Department of Labor data, and the US Bureau of Labor Statistics. These four different sources of data are described in the following subsections.

Needs Assessment Survey

In March 1997 we conducted a needs assessment survey locally in the mountain and metropolitan Atlanta area. The survey questionnaire was sent to 400 private businesses and government agencies. Of these, 87 percent were private businesses and 13 percent were government agencies. Approximately 20 percent of the companies surveyed responded. The survey questions were carefully designed to serve two purposes. First, to identify the needs for the establishment of the CIS program at NGCSU. Second, to provide technical data that will be used for the development of the curriculum. The result of the survey reveals that over 50 percent of the respondents need CIS graduates. Also over 21 percent indicated that their current CIS staff need additional technical training. Table 1 shows the total number of CIS graduates needed in the area of our survey.

TABLE 1

NUMBER OF CIS GRADUATES NEEDED FOR THE AREAS OF OUR SURVEY

Period Of time	Total demand	Total supply	Unmet need
in 2 years	289	140	149
in 5 years	1043	350	693
in 10 years	1448	700	748

ICAPP Needs Assessment Project

The March 1997 Supply-Demand Analysis of the University System of Georgia under an ICAAP needs assessment project reported a number of interesting data. The report indicates that the largest cluster of occupations with unmet needs, are computer related professionals. Table 2 shows the degree of needs for CIS related graduates.

Georgia Department of Labor Occupational Projection

The occupational supply and demand data contained in the occupational projection until 2005 that has been prepared by the Georgia Department of Labor shows the annual need for the CIS related graduates. These data appear in table 3.

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TABLE 2

DATA FROM ICAAP NEEDS ASSESSMENT PROJECT OF THE UNIVERSITY SYSTEM OF GEORGIA, UNTIL THE YEAR 2005

Specialization	Annual demand	Total supply	Unmet need
Systems Analysts	1,010	733	277
Computer Programmers	700	101	599
Computer Engineers	373	110	263
Computer Programmer Aids	138	22	116

TABLE 3

GEORGIA DEPARTMENT OF LABOR OCCUPATIONAL PROJECTION

Occupational Title	1994	2005	Total change	Percent change
Systems Analyst	11,720	27,650	15,930	135.9
Database Administrators	750	1,630	880	117.3
Computer Support Specialists	1,580	3,360	1,780	112.7
Computer Programmers	12,980	18,200	5,220	40.2
Computer Programmer Aids	3,180	3,890	710	22.3
Programmers: Numerical Tool	80	90	10	12.5
All other Computer Scientists	1,930	5,240	3,310	171.5

This data indicates that in 1994 over 32,200 jobs were available in computer and information science occupations in the State of Georgia. By 2005, this number is estimated to grow to over 60,000. The Georgia Department of Labor reports that systems analyst is currently the second fastest growing occupation in Georgia.

US Bureau of Labor Statistics

Our needs assessment findings were consistent with the US Bureau of Labor Statistics forecast for occupational growth (Couger et al. 1995). This data is shown in table 4 below :

TABLE 4

BUREAU OF LABOR OCCUPATIONAL FORECAST

Area of specialization	Percentage of growth
Computer Engineers and Scientists	112%
Systems Analysis	110%
Physical Therapists	88%
Special Education Teachers	74%

The data indicates that there is a great demand for CIS graduates both within the state and nationally. Once we were convinced that the CIS program was needed, we proceeded with other phases of developing the CIS program. These are the subject of the following sections.

GOALS AND OBJECTIVES

The motivation for the development of the CIS program was twofold. The first was a concerted effort to reallocate resources and restructure programs to better meet the needs of both students and industry. A second factor was the projected employment opportunities for CIS graduates. Based on the needs analysis, it is expected that students with a degree in CIS will have greater employment opportunities than students with a major in business management.

The goal and objective of the CIS program was defined as "preparing graduates who are capable of using information technology for data acquisition, communication, coordination, analysis and decision support." Additional objectives of our program included fulfilling the general course requirement of our school and maintaining enough flexibility to accommodate the non-major course requirements from the CIS curriculum. The program needed to be attractive to students desiring CIS as their minor and to students in both the Mathematics/Computer Science and Business Administration departments of our school. It was also important to make the program attractive to industry

employees for the purpose of enhancing their knowledge and skills. Although the program is aimed for local businesses, there is no guarantee that graduates will not accept jobs in other parts of the country. For this reason, we designed the curriculum to be consistent with employment needs across the country.

CURRICULUM GUIDELINES

In the development of the curriculum several curriculum guidelines were used, these include:

* Nationally published curricula guidelines such as ACM, AIS, DPMA, OSRA, DATABASE, MISQ. These guidelines provided excellent sources of input and were useful in shaping a more global view of the CIS curriculum. They served as a foundation for the CIS curriculum and were adapted to meet our needs and resources. They also, we hope, will convince our administration to obtain adequate human and equipment resources for the program.

* The technical data gathered from the industry needs survey.

* The results of another survey questionnaire sent to the department chairs of some schools offering CIS programs were used to identify strengths and weaknesses of other programs.

* Catalogs of twenty-four schools in the state of Georgia offering a Bachelors or an Associate degree in CIS, as well as, catalogs from some reputed CIS programs nationwide were used to provide information about curricular requirements of other programs.

* Web pages of some schools offering a CIS program specifically helped us review course syllabi and course contents. These data were helpful for preparing the course contents for our program.

* Feedback received through electronic mail from our colleagues at other schools with similar program in the state of Georgia were also useful.

RESOURCES

To offer a successful program it is necessary to provide adequate human and equipment resources to support the program. Since the computer industry is progressive and changing rapidly, it is necessary to remain competitive through use of up-to-date technology and resources. A five year plan has been established for the program, starting Fall 1998. The schedule for the number of students entering the CIS program is shown in Figure 1.

FIGURE 1

PROJECTED NUMBER OF STUDENTS ENTERING THE CIS PROGRAM

Year	Number of Students				Total
First	20				20
Second	20	20			40
Third	20	20	20		60
Fourth	20	20	20	20	80

The result of our needs assessment also indicated a strong need for minors in CIS. On average if we expect to have ten minors per year then the total number of students for each CIS class would be twenty-five to thirty.

Human Resources

Following MISQ recommendation (Couger et al. 1995) the number of full-time faculty needed by a program is influenced by many factors such as number of students in the program, the number of required courses, the number of service courses and elective courses offered, and the teaching load of the faculty. Currently, faculty teaching load at NGCSU is 15 quarter hours. During the Fall of 1998 when the CIS program is planned to start, the teaching load is expected to be 12 credit hours per semester. The total number of additional faculty needed for this program is anticipated to be four. These faculty need to be hired one per year, starting Fall 1998 and some positions may be obtained through redirection of existing faculty from mathematics or business. Over the five year period of 1998-2002 a total of four faculty with terminal degree in Computer Information systems will be required. In addition it is predicted that a technical lab assistant for hardware maintenance and support will be needed.

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Equipment Resources

To remain competitive a program must use up-to-date technology consistent with industry needs. Over a five year period, the equipment requirements for the program, based on the analysis of needs assessment, is listed below.

* state-of-the-art labs with sufficient number of Pentium computers or workstations running both Unix[1] and Windows based Network.
* Classrooms equipped with multimedia technology, sound system, and group support systems.
* CASE tools for object_oriented and structured systems.
* Graphical User Interface (GUI) environment.
* Visual Programming Languages.
* DBMS application software running on Microcomputers and for Workstations.
* A five year plan to upgrade equipment.

TARGET STUDENTS

It is important to identify the target students, the major consumers of the program. In this study the target students are students who are interested in application of computers in business. These students come from different backgrounds and, generally, are interested in computers, business administration, or both disciplines. Students entering the program can expect to pursue careers that are both challenging and rewarding. Although the job market should remain lucrative for the information industry, it is also demanding in time and study resources of those who decide to follow this career path. These issues are important and should be addressed in classes. It helps to make students aware of the relation of the subject area and industry demands. Because

of the high employment forecast for CIS graduates, we are also anticipating to attract students from such majors as physics.

CURRICULUM

In this section we present the CIS curriculum for both the major and the minor. The major is designed to foster the development of graduates who have the ability to analyze, design, and develop business oriented systems, while the minor is designed for students who wish to combine CIS expertise with another major. The industry demand for CIS graduates was a strong factor in shaping our curriculum. It includes a variety of courses for students in many disciplines. CIS majors must elect courses from both Math/Computer Science and Business Administration. Thus, we believe, the CIS program has a strong foundation in both Business Administration and Computer Science. A list of the courses in our CIS program is given below. The first 44 credit hours are general college requirements that every students must take regardless of major. The courses specific to our major are listed in table 5.

CIS Major Requirements

The course requirements for CIS major are listed in table 5.

Students can choose 15-18 credit hours from other disciplines as a minor and the remainder from elective courses listed above to add up to 24 credit hours.

CIS Minor Requirements

Students who elect to take a minor in CIS must take all six courses listed under Courses Appropriate in Major Field listed above, plus four additional courses from the CIS Major Degree Core Courses numbered 3000 and above.

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TABLE 5

CIS MAJOR COURSE REQUIREMENTS

Course name	Brief description	Suggested year
Computer Science I & II	Computer Concepts & Object Oriented Programming (OOP)	Freshman & sophomore
Object Oriented Systems	Advanced OO Analysis and Design	Sophomore
Principles of Macroeconomics	Intro. To American capitalism, employment theory, fiscal policy, money & banking	Sophomore
Principles of Financial Accounting	Theory and application of managerial accounting concepts	Sophomore
Business Information Systems	Application of word processing, electronic spreadsheet, and database management principles	Sophomore
Systems Analysis & Design	Analysis and design of technical, informational and organizational systems	Junior Core course
Data Structures	A Study of various types of data structures & their applications	Sophomore Core course
Database Systems	Theoretical and practical aspects of business database systems	Senior Core course
Visual Programming	Syntax, semantics and application of a visual programming language	Sophomore Core course
Data Communications	Intro. To LAN & WAN, communication protocols and security	Senior Core course
CIS Internship	One semester in industry or another institution with CIS	Senior Core course
Principle of Microeconomics	A study of the structure and performance of market economy	Junior Core course
Principles of Managerial Accounting	Financial statements for usefulness in decision making	Junior Core course
Intermediate Accounting I & II	A study of accounting principles for assets, liabilities, equity, revenues and expenses	Junior Core course
Business Communications	Practice of writing business letters and reports	Junior Core course
Applications of WWW in CIS	Development of web-based data base systems and application for technical information via the web and other interfaces	Elective Senior
Advanced Topics in Database	Theoretical and practical issues such as concurrency, distributed database systems and security	Elective Senior
Networking	Advanced topics in networking and Network structures and layers	Elective Senior
Quantitative Method I & II	Statistical methods with special reference to economics and business applications	Elective Senior
Principles of Finance	Financial concepts with emphasis on understanding how the principles of financial management can be used to enhance the value of a firm	Elective Junior
Principles of Marketing	A functional study of market organization designed to introduce basic theories in the field of marketing	Elective Junior

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CONCLUSIONS

The curriculum we have developed has a solid foundation both in Computer Science and Business Administration and is designed to meet industry needs for CIS graduates. It is based on the industry needs survey conducted in May 1997. The program incorporates use of CASE tools and a visual programming course which will enable students to create Graphical User Interfaces for enhancing data visualization and performances. The application of resources from the WWW in a CIS program is a new and interesting feature of the program that makes use of rapid changes in the field that cannot be equaled using traditional textbooks. Finally, the internship is designed to make a link with industry and to assist students in learning more about the application aspect of their knowledge as well as helping them to explore the possibility of future jobs. This collaboration with industry will also provide opportunities for program assessment. Through continuous feedback we will be able to modify and reshape the curriculum to meet the needs of students and industry in the information age.

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ENDNOTE

1. Unix is a Trademark of Bell Lab.

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