The 2010 CIS Baccalaureate Degree Compared with IS 2010 Guidelines

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The redesigned Computer Information Systems degree is compared with the work of the Joint IS 2010 curriculum task force published as the IS 2010: Curriculum Guidelines for Undergraduate Degree Programs in Information Systems and sponsored by The Association for Computing Machinery and The Association for Information Systems. A historical review is made available which demonstrates the curriculum from 1984 as well as a demographic review of the students declaring the major at this small, but technologically gifted university. Are the efforts enough for the major to be a focal point once again of the interests of the undergraduate student population?

A BRAND NEW DAY

The South Dakota Legislature gave Dakota State University (then College) a new emphasis in 1984: computer and information systems. Through a mandate and mission change the existing education and health services programs would not merely remain, as several academic programs were purged at that time, but would be integrated and redesigned to include the benefits of the information processing revolution. (DSC, 1984)

Fast forward twenty-seven (27) academic years and Dakota State University (DSU) is recognized regionally and nationally as a leader in the integration of technology in the learning experiences of all our students. According to DSU President Douglas Knowlton, "It is truly a unique university where students are surrounded by an information technology rich environment." (DSU, 2010)

CURRICULUM: THEN AND NOW

The inaugural Information Systems undergraduate degree was delivered via the 128 semester credit Bachelors of Business Administration (BBA). Along with 41 semester credits of general education electives, the course selections were divided into Lower division, Upper division, Support, and a Specialization. The class lists are found in the following tables. (DSC, 1984)

TABLE 1
LOWER DIVISION – 28 CR.

INFS 100 Computer Concepts
INFS 111 PL/I Application Programming I
INFS 181 PL/I Application Programming I Lab
INFS 112 PL/I Application Programming II
INFS 182 PL/I Application Programming II Lab
INFS 208 Information Systems Specializations
INFS 221 COBOL I
INFS 281 COBOL I Lab
INFS 222 COBOL II
INFS 282 COBOL II Lab
INFS 234 Assembler I
INFS 267 Systems Design I
INFS 277 OS Interfaces and Utilities

TABLE 2
UPPER DIVISION – 20 CR.

INFS 303 Operating Systems
BUS 329 Business Statistics
INFS 371 Data Base App Programming
INFS 387 Data Base App Programming Lab
INFS 377 On-Line Applications
INFS 393 On-Line Applications Lab
INFS 408 Computer Law
INFS 478 Senior Project

TABLE 3
SUPPORT COURSES – 18 CR.

MATH 195 Reasoning and Logic
ENGL 208 Documentation and Presentation
ACTG 210 Principles of Accounting
BUS 215 Business Operations Management
ACTG 211 Principles of Accounting II
BUS 268 Inventory Control

TABLE 4
SPECIALIZATIONS - 21 CR.

#1 Telecommunications and Networking
#2 Data Base and Data Administration
#3 Systems Programming
#4 Systems Analysis and Project Management
#5 Management

One of these 7 course specializations from Table 4 was chosen in order to complete degree requirements.

Architectural Design of the Network

The 1984 architectural design, as evidenced in tables 1 and 2, was server-based with the server being a mainframe computer. (Dennis, Wixom, & Roth, 2009) The original curriculum was designed for this computing environment. One classroom of terminals was used for all of the lab classes. In effect, the

student took two classes to complete the requirements of one programming class. This is the same delivery model that the natural science curriculum employs.

The advent of the Internet, microcomputers, and local area networks hastened curriculum changes in the Computer Information Systems (CIS) program. The client-based architecture proved to be a very cost-effective alternative to the mainframe-based system that the university originally used. Additional classrooms were dedicated as computer labs and rooms full of desktop computer systems populated the university landscape as the technology majors saw tremendous growth in the decade of the 1990's.

802.11X and Wireless Computing

During the fall of 2001 undergraduate students from the Center of Excellence in Computer Information Systems completed site survey work to build a wireless infrastructure. The staff of Computing Services and students from the Center pulled the cable and mounted access points during the spring of 2002 and wireless computing was a reality. Over the past eight years there has been continued refinement of the network. It exists today as a testament of the engineering capabilities of those students in 2001.

In 2004 Dakota State University became a tablet university with all undergraduate full-time degree seeking students using a mobile computing device. From that point on, every classroom, every residence hall room, and all buildings on campus became a computer lab.

In part, these technology enhancements were completed to further fulfill the technology mission of the university. Also in part, the enhancements were completed in an attempt to reverse the declining trend of technology majors including the CIS major. As evidenced in Figure 1, the enhancements have been only partially successful.

Information Systems Curriculum - 2010

The undergraduate curriculum of the Computer Information Systems (CIS) degree had been somewhat ignored by the College over the last five (5) years. The college was extremely busy creating three masters degrees as well as a Doctor of Science in Information Systems degree. In addition the college also created baccalaureate degrees in Computer Network Security, Computer Game Design, and Network System Administration.

The historical success of the CIS degree could be construed as its Achilles heel, as it has gone from being the flagship program to one of five main undergraduate technology majors offered at DSU. Much of this expansion has come during times of limited budgets, limited staff, and a move to distance delivery of coursework.

The publishing of IS 2010: Curriculum Guidelines for Undergraduate Degree Programs in Information Systems (Topi, et al., 2010) was the ideal time to review the curriculum offerings of the CIS degree. The table that follows illustrates the work by the CIS faculty. There were no changes to the thirty (30) credit system-wide general education requirements or the eleven (11) credit Institutional graduation requirement. The curriculum is divided into Required and Specializations categories where each student must complete a minimum of 1 specialization along with the required coursework. (DSU, 2010)

TABLE 5
REQUIRED COURSES

CIS 251 Business Application Programming
CIS 332 Systems Analysis & Design
CIS 338 Project Management
CIS 350 Computer Hardware
CIS 361 Adv. Programming for Business Apps
CIS 427 IS Planning and Management
CIS 484 Database Management Systems
INFS 281 COBOL I Lab
CIS 494 Internship

Or
CIS 498 Senior Project
BADM 220 Business Statistics
BADM 360 Organization and Management
BADM 370 Marketing

Specializations consist of 27 semester credits and are listed in the tables 6 through 10.

TABLE 6
SOFTWARE DEVELOPMENT

CIS 275 Web Programming I
CIS 277 OS Interfaces & Utilities
CIS 330 COBOL I
CIS 331 COBOL II
CIS 375 Web Application Programming II
CIS 424 Internet & E-Commerce
CIS 487 Database Programming
BADM 344 Managerial Communications
MATH 201 Intro to Discrete Math

TABLE 7
WEB DEVELOPMENT

CIS 275 Web Programming I
CIS 328 Operating Environments
CIS 375 Web Application Programming II
CIS 383 Networking I
CIS 385 Networking II
CIS 424 Internet & E-Commerce
CIS 487 Database Programming
BADM 344 Managerial Communications
MATH 201 Intro to Discrete Math

TABLE 8
BUSINESS ANALYSIS

ACCT 210 Principles of Accounting I
ACCT 211 Principles of Accounting II
BADM 310 Business Finance
BADM 321 Business Statistics II
BADM 344 Managerial Communications
BADM 350 Legal Environment
BADM 435 Mgmt of Technology & Innovation
CIS   424   Internet & E-Commerce
ECON 202 Principles of Macroeconomics

TABLE 9
INFRASTRUCTURE ANALYSIS

CIS 245 Information Security Fundamentals
CIS 328 Operating Environments
CIS 383 Networking I
CIS 384 Decision Support Systems
CIS 385 Networking II
CIS 460 Windows Administration
CIS 462 Unix/Linux Administration
BADM 344 Managerial Communications
ECON 202 Principles of Macroeconomics

TABLE 10
CHANGE MANAGEMENT

CIS 245 Information Security Fundamentals
CIS 325 Management Information Systems
CIS 384 Decision Support Systems
BADM 344 Managerial Communications
BADM 435 Mgmt of Technology & Innovation
BADM 457 Business Ethics
BADM 460 Human Resource Management
ECON 202 Principles of Macroeconomics
SOC 285   Information Society

In addition to the aforementioned curriculum, the major also contains 19 credits of electives. Overall the major looks as follows: (DSU, 2010)

System Wide General Education credits	31
Institutional Graduation Requirements	11
Required curriculum credits	33
Specialization curriculum credits	27
Electives	19
Total credits	120

The large number of electives is in keeping with the desires of the South Dakota Board of Regents and with proper advising the student will be able to complete more than 1 specialization.

By decreasing the total credits needed for graduation from 128 to 120, and by providing great flexibility with 19 credits of electives while at the same time providing a technologically strong group of required courses, the CIS degree unveiled in the fall of 2010 at Dakota State University addresses many of the desires of the IS 2010 model curricula. Paramount among these characteristics is that of reversing the trend of declining enrollment in the major.


PROGRAM ENROLLMENT AS A METRIC

An old saying in the English vernacular is that "misery loves company". This was taken one step further by Henry David Thoreau when he stated, "If misery loves company, misery has company enough." (Frank, 2001, p. 512)

One of the purposes of the IS 2010 Curriculum Guidelines was to address the steep drop in student enrollment. (Topi, et al., 2010) Student enrollment within the CIS degree at DSU has been of concern for a number of years. From its beginning in 1984, encapsulated within the BBA program, the CIS degree has

resided within the domain of the business discipline. It was not until 2008 that a group of IS faculty members took a more active role in the management of the program. By this time, the Computer and Network Security major had taken firm footing within the college. In addition a Computer Game Design major and a Network System Administration major were introduced. These additional academic choices for the technologically savvy student also curtailed the number of students choosing or being retained in the CIS major.

Figure 1: Total Number of Enrolled Students illustrates the raw number of actual CIS declared majors from 1985 to present day of the major. In contrast also illustrated is the total number of technology majors within the college.

FIGURE 1
TOTAL NUMBER OF ENROLLED STUDENTS
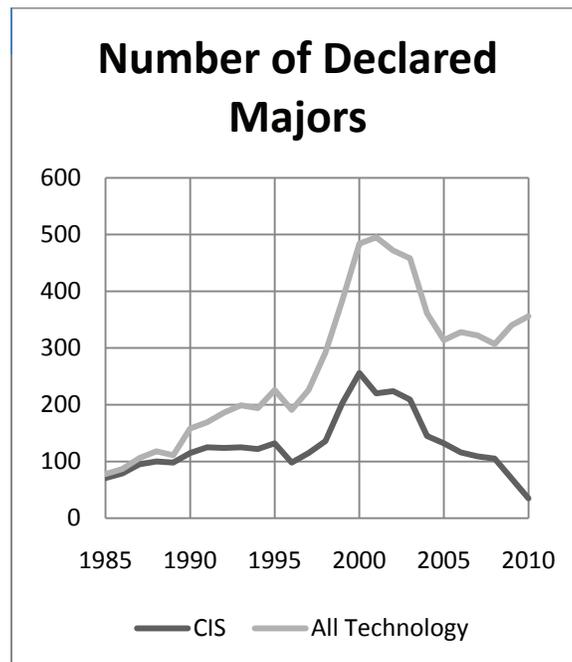
The CIS degree had peak enrollment in 2000 when 256 out of a total technology enrollment of 484 (53% of the student population) had a CIS declared major. The downward enrollment trend followed the overall student trend closely until 2005. At that point as Figure 1 indicates, the number of students declaring the CIS major dropped off steeply while overall enrollment of technology majors began to increase. At the beginning of the 2010 – 2011 academic year the CIS degree accounts for 10% of all technology majors within the college. The year by year enrolled CIS majors as a percentage of total technology major enrollments are found in Figure 2.

Appendix A found at the end of this paper contains all the raw data from the enrollment records for the CIS major and for all technology majors within the College of Business Information Systems (BIS) at DSU.

FIGURE 2
CIS AS A PERCENTAGE OF TECHNOLOGY MAJORS
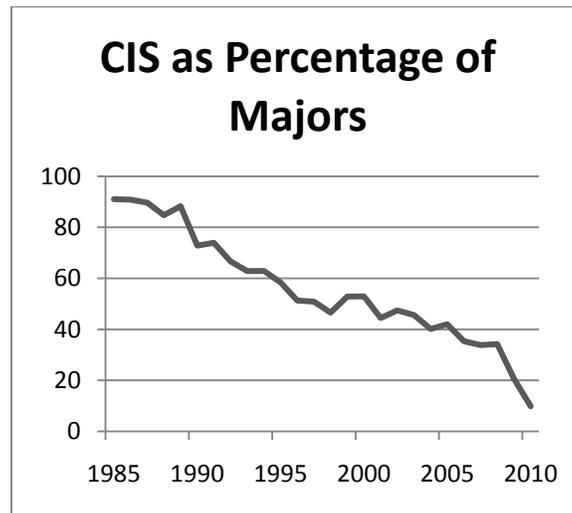
IS 2010

According to the authors of IS 2010, it "is the latest in a series of model curricula for undergraduate degrees in Information Systems." (Topi, et al., 2010) This is the 3rd collaborative effort between The Association for Computing Machinery (ACM) and The Association for Information Systems (AIS) and is a major revision which includes four significant characteristics which are new from previous models. The characteristics are: Curriculum reach, Outcome expectations, Structure of curriculum, and Flexibility of curriculum design. Each of these are addressed individually.

Curriculum Reach

Information Systems specifically and technology in general exists in a broad variety of career tracks. The term used for this is ubiquitous. The IS 2010 committee identified this as one of the four key characteristics that was revised in the new model curricula. (Topi, et al., 2010)

The Information Systems major in not just for business schools any longer. It will continue however to be a large demographic for the undergraduate major student population. Dakota State University recognized this and the revised CIS baccalaureate degree has increased its reach by adding specializations in Infrastructure Analysis and Change Management. The graduate programs developed specializations in Decision Support, Information Assurance, and Healthcare for its Dr. of Science in IS degree. (DSU, 2009) Dennis, Wixom, and Roth (2009) discuss the fact that an information system introduces change to all organizations and their employee base. A wide ranging set of skills are needed to deal with this change, they include technical, business, analytical, interpersonal, management, and ethical.

Outcome Expectations

The IS 2010 Curriculum Guidelines provide a series of levels of expectations that have been evaluated as part of this review process. Initially the high-level IS capabilities are evaluated. The high-level outcome expectations include:

- Improving organizational processes
- Exploiting opportunities created by technology innovations
- Understanding and addressing information requirements
- Designing and managing enterprise architecture
- Indentifying and evaluating solution and sourcing alternatives

- Securing data and infrastructure
- Understanding, managing and controlling IT risks

The above mentioned outcomes are then placed within three knowledge and skills categories:

1. IS specific knowledge and skills: skills included in this high-level capability are design, development, management, and implementation of information systems.
2. Foundational knowledge and skills: skills included in this high-level capability are leadership, collaboration, communication, the art of negotiation along with critical thinking skills including mathematical foundations and analytics.
3. Domain skills: skills included in this third high-level capability as outlined by IS 2010 include general models, key specializations and the ability to evaluate performance. (Topi, et al., 2010)

Structure of Curriculum

A clear division of core courses from those in specialization tracks to support the concept of career tracks for interested students was implemented in accordance with IS 2010. The committee identified seven core courses which serve as the general knowledge courses leading to the specific skill sets that the specializations in table 6 through 10 illustrate. The category from IS 2010 and the corresponding curriculum offering from DSU follow.

1. Foundation of Information System corresponds with CIS 494, Internship as well as from the breadth of the other core course offerings.
2. Data and Information Management corresponds with CIS 484, Database Management Systems.
3. Enterprise Architecture corresponds with CIS 350, Computer Hardware.
4. IS Project Management corresponds with CIS 338, Project Management.
5. IT Infrastructure corresponds with CIS 350, Computer Hardware.
6. Systems Analysis and Design corresponds with CIS 332, Systems Analysis & Design.
7. IS Strategy, Management, and Acquisition corresponds with CIS 427, Information Systems Planning and Management. (DSU, 2010) (Topi, et al., 2010)

The DSU curriculum differs from the IS 2010 model in that a 3 course sequence in programming CIS 130, CIS 251, and CIS 361 is required in the core. CIS 130 is not reflected in the major due to the fact that it is an Institutional Graduation Requirement of all students to take an introductory programming course.

Flexibility of Curriculum Design

IS 2010 guidelines mention that there should be sufficient flexibility within the curriculum to allow for its adoption in multiple circumstances. The DSU curriculum contains 19 credits of free electives. This freedom of choice grants the students flexibility in determining career tracks as well as enticing students from other disciplines to consider the CIS major in addition to their primary major choice. The electives also allow students to select multiple specializations without completing more than the 120 credits needed for graduation.

PROMOTION

Dennis, Wixom, and Roth (2009) would declare the redesign on the CIS major as a Business Process Improvement (BPI). The term means that basic business requirements target moderate changes to the organization's operations.

In the situation at DSU, the redesigned CIS degree requires some moderate changes to its operation. The curriculum as outlined in the paper was approved in late summer 2010. To date the following promotional and operational mechanisms have been instituted:

> To kick off the redesigned major, the Center of Excellence in Computer Information Systems hosted a symposium with speakers from the alumni ranks. Multiple marketing / advertising promotional events and collateral materials have been created / held and used in support of this new streamlined curriculum.

In addition, the College of BIS is in the planning stages of offering a joint CIS / MSIS program where a student could secure their CIS undergraduate degree and a Masters in Information Systems in five years. Approval for this 4 plus 1 program should be obtained shortly. Authors note: Approval to offer this program was obtained on August 12, 2010.

CONCLUSION

As documented by the enrollment data provided, this major was once the flagship major for technology programs at DSU. It has a rich history with successful alumni throughout the state, region, and nation.

Over the past five (5) years as total declared technology majors within the College of BIS have started to increase, the CIS major has continued a downward trend in enrollment numbers. The IS 2010 Curriculum Guidelines as evidenced by the curriculum of the CIS major at DSU have been embraced. The question that remains to be answered is have the changes been made soon enough to breathe new life into this once robust major?

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APPENDIX A
ACTUAL STUDENT COUNTS

Number of declared majors

Year	CIS	All Technology	CIS %
1985	71	78	91
	79	87	91
	95	106	90
	100	118	85
	98	111	88
1990	115	158	73
	125	169	74
	124	186	67
	125	199	63
	122	194	63
1995	132	226	58
	98	191	51
	115	226	51
	136	292	47
	203	384	53
2000	256	484	53
	220	495	44
	224	472	47
	209	458	46
	145	361	40
2005	132	314	42
	116	328	35
	109	322	34
	105	307	34
	70	340	21
2010	35	356	10