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# An Analysis of Undergraduate Information Systems Curricula: Adoption of the IS 2010 Curriculum Guidelines

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Abstract:

The *IS 2010: Curriculum Guidelines for Undergraduate Degree Programs in Information Systems* were published as a model to help academic IS programs establish a consistent curriculum that meets the needs of a global information economy. However, to-date, no study has examined the degree to which the IS 2010 model curriculum is being adopted and utilized in contemporary IS curricula. The purpose of this study is to evaluate the level of program adoption of the IS 2010 curriculum guidelines. Curriculum data were collected from 127 AACSB-accredited undergraduate information systems programs across the United States via a direct survey and interviews with department heads and undergraduate program directors. These data were then compared with the IS 2010 recommendations. Results indicate that: (1) IS programs exhibit a wide range of adherence to the IS 2010 core curriculum guidelines; (2) perceived adherence to IS 2010 guidelines among program administrators is higher than calculated adherence; (3) several non-IS 2010 core topics are still included as required components in many IS programs; (4) although few IS programs have formally implemented IS 2010 career tracks, perceptions of career tracks are generally favorable; (5) resource constraints and program enrollments/class sizes are commonly described barriers to developing career tracks.

**Keywords:** IS 2010 curriculum guidelines, career tracks, information systems education

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## I. INTRODUCTION

To survive in an increasingly competitive information-centered economy, today's organizations must constantly assess and update their strategies, techniques, and tools for effective information management. Driven by this need and unprecedented advancements in technology, academic programs in information systems (IS) must also continually rethink their standard concepts and principles, incorporating contemporary concepts and specialized technology into their curriculum. To help guide this effort, IS educators and practitioners have proposed a series of IS model curricula designed to address contemporary industry trends and to define a degree of standardization across the IS discipline [Gorgone, Davis, Valacich, Topi, et al., 2002; Gorgone, Gray, Stohr, Valacich, et al., 2005; Kesner, 2008; Topi, Valachic, Wright, Kaiser, et al., 2010]. The most recent of these model curricula for undergraduate IS programs is *IS 2010: Curriculum Guidelines for Undergraduate Degree Programs in Information Systems* [Topi et al., 2010]. The IS 2010 model supersedes the preceding IS 2002 model curriculum [Gorgone et al., 2002] and is designed to provide greater flexibility by separating the core of the curriculum from career track electives [Topi et al., 2010].

The usefulness of a model curriculum depends on the degree to which it is ultimately adopted and implemented by academic IS programs. Consequently, past studies have attempted to assess the state of IS curriculum as a whole, including its adherence to prior IS curriculum models [Kung, Yang, and Zhang, 2006; Lifer, Parsons, and Miller, 2009; Maier and Gambill, 1996]. Given the nascence of the IS 2010 model and the gradual evolution of most academic programs, one might reasonably expect the IS 2010 model to be in the early adoption stages, particularly with regard to new elements such as career track electives. However, the rapidly changing nature of the IS discipline means that IS programs can ill afford a drawn-out or ponderous change lifecycle if they wish to remain relevant to industry needs. In contrast to programs in more static disciplines, IS programs must nimbly adapt to changes in the marketplace, including timely integration of contemporary curricular recommendations. Thus, although it is still "early in the game," we would anticipate that IS programs have at least begun to incorporate IS 2010 elements into their curricula. However, since the introduction of the IS 2010 model, no study has conducted an assessment of what IS programs are currently teaching, how they are organized, and the degree to which they have begun to adopt IS 2010 curriculum guidelines.

The purpose of this study is to assess the degree to which the IS 2010 model curriculum is being adopted and utilized in contemporary IS curricula. Specifically, our three objectives are to:

1. Explore calculated and perceived adherence to IS 2010 curriculum guidelines, including the presence of recommended core topics, elective courses, capstone courses, and career track electives.
2. Examine career track trends developing in connection with IS 2010 curriculum guidelines, including percentage of IS undergraduate programs offering career tracks, the names and characteristics of the most common career tracks offered, and perceived benefits and limitations of including career tracks in program curriculum.
3. Conduct a comparative analysis of the current level of model curriculum adherence among IS programs with that found in prior studies [Kung et al., 2006; Lifer et al., 2009, Maier and Gambill, 1996].

The research objectives are explored by analyzing data gathered from the Association to Advance Collegiate Schools of Business (AACSB)-accredited undergraduate degree programs in information systems in United States colleges and universities. The goal of our analysis is to stimulate critical examination of curriculum content vis-à-vis IS 2010 curriculum guidelines and highlight emergent trends within IS curricula. We hope that the results will also provide insight to stakeholders responsible for IS curriculum revisions, including the integration of career tracks as a way to customize IS programs and improve the academic experience of students preparing to enter the IS profession.

## II. BACKGROUND AND LITERATURE REVIEW

Academic IS departments face the continual challenge of keeping curricula up-to-date to address evolving business demands. Studies of skills required by IS professionals emphasize the need for continual reassessment of IS educational curriculum and regular updates to curriculum content, concepts, and principles [Athey and Plotnicki, 1991; Brookshire, Hunt, Yin, Crews, 2007; Carlsson, Hedman, and Steen, 2010]. Over the years, IS educators have developed a series of IS model curricula to assist programs with curriculum design and implementation [Davis,

Gorgone, Couger, Feinstein, et al., 1997]. Table 1 summarizes four recent IS curriculum models and shows the evolution in the recommended elements of each model.

**Table 1: Summary of IS 1995, IS 1997, IS 2002, and IS 2010 Model Curriculum Guidelines [Couger, Davis, Dologite, Feinstein, et al., 1995; Davis et al., 1997; Gorgone and Gray, 2002; Topi et al., 2010]**

| Curriculum guidelines | Publication | Motivation for curriculum revision | Recommended elements |
|---|---|---|---|
| IS'95 Guidelines for Undergraduate IS Curriculum | *MIS Quarterly* | Appears to be a precursor to the IS'97 Model Curriculum including same motivations | Identifies 10 courses, (95.1–95.10) |
| IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems | *The DATA BASE for Advances in Information Systems, SIG-MIS Association for Computing Machinery* | Formally identify attributes (i.e., communications), core curriculum areas, resources, and future curriculum updates | • Retains 10 courses from IS'95 Guidelines for Undergraduate Curriculum<br>• Introduces prerequisite (IS'97.PO)<br>• Changes foundation for business knowledge to communications, quantitative and qualitative analysis, and organization functions |
| IS 2002 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems | *The DATA BASE for Advances in Information Systems, SIG-MIS Association for Computing Machinery* | • Advent of the Internet<br>• Changes in student computing literacy<br>• Information accreditation movement | Includes 10 specified required classes by merging IS'97.00 and IS'97.2 and adding IS 2002.2 Electronic Business Strategy, Architecture and Design |
| IS 2010: Curriculum Guidelines for Undergraduate Degree Programs in Information Systems | *Communications of the Association for Information Systems* | • Accommodate IS outside business school context<br>• Address lack of flexibility in IS 2002—Introduce career tracks to avoid a single career objective<br>• Expand input from the global community<br>• Strong focus on deriving the curriculum from outcome expectations<br>• Importance of serving local needs | • Includes required (7 core) and electives options<br>• Introduces career-tracks based on groupings of electives |

As shown in Table 1, the most recent model curriculum for undergraduate IS programs is IS 2010 [Topi et al., 2010]. This model was motivated in part by significant contextual changes in industry and academia that required greater flexibility in the IS curriculum. For example, many IS programs consisting of fewer than ten courses had difficulty implementing the stringent ten-course requirement in the IS 2002 model curriculum [Brookshire et al., 2007; Carlsson et al., 2010; Foltz and Renwick, 2011; Gorgone et al., 2005; Plice and Reinig, 2007; Salisbury, Huber, Piercy, and Elder, 2004; Topi, Valacich, Kaiser, Nunamaker, et al., 2007; Vician, Garfield, Hoffer, Prescott, et al., 2004]. Due to AACSB accreditation standards, the IS 2002 model curriculum ten-course requirement left little room for alternative elective courses within IS programs.



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To achieve greater flexibility and meet the changing demands of the IS profession, the task force behind IS 2010 proposed a curriculum model based on two foundational elements: IS core topics and career track electives. Similar to IS 2002, the IS core topics identify the foundational content that every undergraduate information systems program should incorporate [Topi et al., 2010]. However, unlike IS 2002, the core topics do not necessarily map directly to courses. Rather, topics can be combined into one or more courses according to local resources and constraints. In this way, IS programs can adhere to industry standards while simultaneously exercising local innovation and adaptation by tailoring the depth and breadth of their coverage of these topics. Figure 1 shows the seven IS 2010 core topics in their recommended sequence.

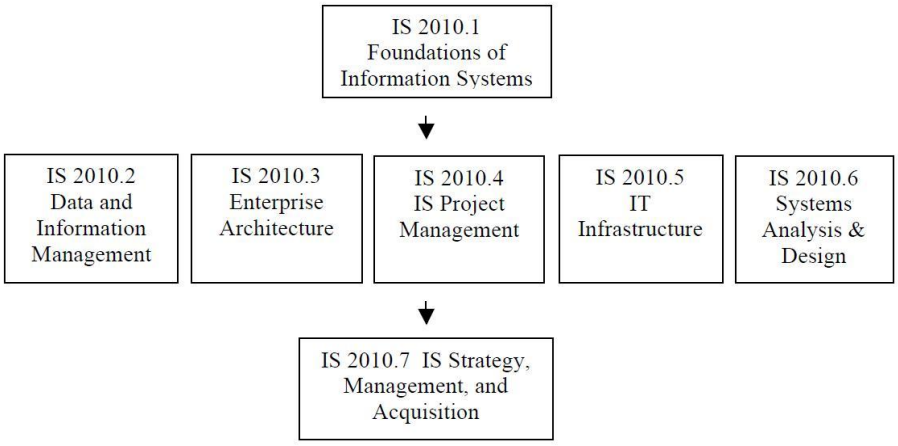


**Figure 1. IS 2010 Core Topics [Topi et al., 2010, p. 384]**

The second IS 2010 foundational element is career track electives. One of the objectives of the IS 2010 task force is to expand the scope of the target IS programs beyond business-school-centric models found in prior IS curricula. The concept of career tracks provides a guiding framework for identifying relevant elective courses and offers greater flexibility for schools implementing the curriculum guidelines [Topi et al., 2010]. IS 2010 does not prescribe specific electives or career tracks; however, to illustrate the career track concept, the task force presents a matrix that matches core and elective topics with prospective career tracks, as seen in Figure 2. This allows for certain topics or courses to be matched with certain career tracks, giving guidance on focal topics that are relevant to specific IS careers [Satzinger, Batra, and Topi, 2007; Topi et al., 2010].

By establishing a framework of identified core topics and career tracks, the IS 2010 model curriculum offers a standard of reference for evaluating the comprehensiveness of any specific IS program, as well as progress of the discipline as a whole. However, such evaluation requires assessment of the extent to which curriculum guidelines are being implemented in IS programs. Recognizing this need, past research has conducted such assessments with respect to prior IS model curricula. For example, Maier and Gambill [1996] surveyed the structure of IS curricula at United States AASCB-accredited institutions, examining the variety of IS courses and programming languages being taught at the time. Ten years later, Kung et al. [2006] conducted a similar study, which included a comparison of the IS courses being taught relative to those suggested by the IS 2002 model curriculum and the Accreditation Board for Engineering and Technology (ABET) IS curriculum standards. Lifer et al. [2009] also examined adherence to IS 2002 model curriculum by examining Accreditation Council for Business Schools and Programs (ACBSP) and AACSB programs. However, to-date, there has been no known study undertaken to ascertain how well IS programs are adopting the IS 2010 model. Given the relative nascense of the IS 2010 model and the comparatively slow evolution of most academic programs, we recognize that broad implementation of the genuinely new components of IS 2010 is improbable at this stage. Nevertheless, we believe that an early assessment of the state of the IS 2010 adoption lifecycle would be useful for several reasons. First, results could reveal an already active or growing level of model curriculum adoption, suggesting that it is rapidly beginning to achieve its simultaneous objectives of representing “consensus from the information systems community” while being “flexible and adaptable to most information systems programs” [Topi et al., 2010, p. 368]. Conversely, results might indicate low or stagnating adoption levels, which could signal (a) IS programs’ unawareness of the curriculum guidelines, (b) lack of compatibility between the guidelines and realities of IS programs, or (c) a combination of the two. In either case, without a current snapshot of the state of contemporary IS curricula, the IS community is limited in its ability to assess its progress, identify widespread curricular deficiencies, or implement prescriptive/corrective measures to guide ongoing curriculum revisions. The present study seeks to overcome this limitation by providing a comprehensive assessment of adoption of IS 2010 curriculum guidelines among contemporary academic IS programs.

Structure of the IS Model Curriculum:Information Systems specific courses

| Career Track: | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Core IS Courses:** | | | | | | | | | | | | | | | | | |
| Foundations of IS | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Enterprise Architecture | ○ | ● | ○ | ○ | ○ | ● | ○ | ○ | ○ | ○ | ● | ○ | ○ | ○ | ● | ○ | ○ |
| IS Strategy, Management and Acquisition | ○ | ● | ○ | ○ | ○ | ● | ○ | ○ | ● | ○ | ● | ○ | ○ | ○ | ● | ○ | ○ |
| Data and Information Management | ● | ○ | ○ | ● | ● | ○ | ○ | ● | ● | ○ | ● | ○ | ● | ○ | ○ | ○ | ○ |
| Systems Analysis & Design | ● | ● | ● | ○ | ○ | ○ | ● | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ● | ● | ● |
| IT Infrastructure | ○ | ○ | ○ | ● | ○ | ○ | ○ | ● | ● | ● | ○ | ○ | ● | ● | ○ | ○ | ○ |
| IT Project Management | ● | ○ | ○ | ○ | ○ | ● | ○ | ○ | ○ | ○ | ● | ○ | ○ | ○ | ● | ● | ● |
| | | | | | | | | | | | | | | | | | |
| **Elective IS Courses:** | | | | | | | | | | | | | | | | | |
| Application Development | ● | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ● | ● |
| Business Process Management | | ● | ● | | | ○ | ○ | ○ | | ○ | ● | | | | ○ | | |
| Collaborative Computing | | | | | | ○ | | | | | | | | ○ | | | ○ |
| Data Mining / Business Intelligence | | ● | | ● | ● | ○ | ○ | ○ | ● | | ○ | ○ | ○ | ○ | ○ | | ○ |
| Enterprise Systems | | ● | ● | ○ | ○ | ○ | ● | ● | ○ | | ● | ● | ○ | ○ | | | |
| Human-Computer Interaction | ● | | | | | ○ | ○ | | | | ○ | | | | | ● | |
| Information Search and Retrieval | | ○ | | ○ | ● | | | | | | | | ○ | | | | ● |
| IT Audit and Controls | ○ | | ● | ○ | ○ | ○ | ○ | ● | | ● | ○ | | ○ | ○ | ○ | | ○ |
| IT Security and Risk Management | ○ | | | ○ | ○ | ○ | ○ | ● | ● | ○ | ○ | | ● | ● | ○ | | ○ |
| Knowledge Management | | ● | | ○ | | ○ | ○ | | | ○ | | | | | | | |
| Social Informatics | | | | | | | | | | | | | ○ | | ○ | | |

| | |
|---|---|
| A = Application Developer | |
| B = Business Analyst | |
| C = Business Process Analyst | |
| D = Database Administrator | |
| E = Database Analyst | |
| F = e-Business Manager | |
| G = ERP Specialist | |
| H = Information Auditing and Compliance Specialist | |
| I = IT Architect | |
| J = IT Asset Manager | |
| K = IT Consultant | |
| L = IT Operations Manager | |
| M = IT Security and Risk Manager | |
| N = Network Administrator | |
| O = Project Manager | |
| P = User Interface Designer | |
| Q = Web Content Manager | |

**Key:**

● = Significant Coverage

○ = Some Coverage

Blank Cell = Not Required

**Figure 2. Sample Career Tracks in the IS 2010 Model Curriculum [Topi et al., 2010, p. 383]**

## III. RESEARCH METHODOLOGY AND DATA COLLECTION

### Population and Sample

The population for this study consisted of undergraduate information systems programs at AACSB-accredited institutions across the United States. This population was selected to facilitate a comparison with past IS curriculum assessments [Kung et al., 2006; Lifer et al., 2009; Maier and Gambill, 1996]. At the time of the study, 488 business/accounting schools in the United States were accredited by AACSB, with an additional 398 schools registered and seeking accreditation in at least one of these two areas. Of the AACSB-accredited schools, 286 offered accredited programs in information systems [AACSB, 2011]. To calculate an appropriate representative sample size, we used Yamane's [1967] formula based on a desired confidence interval of 90 percent to 95 percent. This calculation yielded a minimum sample size of seventy-four programs. In anticipation of possible data unavailability for some programs, we randomly selected one half (143) of the 286 programs as the sampling frame for this study.

### Data Collection Procedures

Data for this study were collected over three months in the Fall of 2011, approximately 1.5 years after the official publication of the IS 2010 model [Topi et al., 2010]. Data collection occurred in two phases. The first phase employed a direct survey [Datar, Garvin, and Cullen, 2010; Kung et al., 2006; Miller and Crain, 2007] to collect data on undergraduate IS programs directly from university websites and course catalogs. A direct survey has the advantage of focusing on a specific program of interest (i.e., undergraduate), allowing systematic collection and quantification of data. The survey instrument (see Appendix) was developed from a review of literature and interviews with IS faculty members, and consisted of items relating to core and elective courses taught, course curriculum prerequisites and sequencing, and career tracks offered. For each program curriculum, the survey attempted to address the following questions: (a) What does the program offer in terms of the core topic categories (see Figure 1), (b) What explicit career track options does the program offer (see Figure 2), and (c) Does the course curriculum sequencing (see Figure 1) adhere to IS 2010 curriculum guidelines? Because the publication of course catalogs sometimes lags actual changes in degree requirements, if there was a difference between the degree requirements shown in the catalog and those shown on the department's website, the study used the degree requirements posted on the department's website. The appropriateness of this heuristic was confirmed by follow-up interviews with department heads (described further below). Prior to commencing data collection, the survey instrument was reviewed by several IS faculty at a large research university in the United States to ensure that survey items were comprehensive and appropriate. The survey was then administered to the aforementioned sample of 143 academic IS programs. However, it was discovered that five of these programs offered only an IS graduate degree, with no undergraduate degree. Because the scope of this study was limited to undergraduate IS

programs, these five institutions were excluded. Thus of the original 143 programs targeted, data for 138 programs (96.5 percent) were collected from department websites and course catalogs. In the process of data collection, we furthered narrowed the sample to include only programs offering a major in the field (typically 20+ credit hours). Programs that offered IS as merely an emphasis, concentration, or minor were excluded from the analysis under the rationale that these programs would be unlikely to fully implement the IS 2010 curriculum. This process yielded a total of 127 programs that were used in the analyses.

The second phase of data collection consisted of follow-up telephone interviews with department heads and/or directors of undergraduate programs. The purpose of these interviews was to collect perceptual data regarding the advantages and disadvantages of the IS 2010 curriculum model, as well as subjective perceptions about the extent to which the participant's program had adopted the IS 2010 model in its own curriculum. Additionally, the interviews served for verification, clarification, and confirmation of the data gathered from university websites and course catalogs, including (a) required core topics not discovered in the catalog of required courses but possibly offered elsewhere, such as an elective, and (b) any career track offerings not discovered in the curriculum but possibly labeled outside of evolving nomenclature.

One of the objectives of collecting subjective adherence data from program administrators was to statistically compare perceived levels of adoption with an objectively calculated adherence metric. An a priori power analysis anticipating a medium to large effect size (d = .65) revealed a minimum group sample size (two-tailed hypothesis) of thirty-nine. To account for anticipated non-response, we randomly selected seventy-two schools and invited the department head and/or director of undergraduate programs to participate in the interview. Of these, fifty participated in the interviews, offering adequate statistical power to detect medium- to large-effect size differences in perceived versus calculated IS 2010 adherence levels.

The follow-up telephone interviews were semi-structured, conducted by telephone, and recoded via audiocassette tape from the private work office of one of the researchers. Prior to commencement of the interview, the researcher reminded the interviewee of the previously sent e-mail and letter of consent/information from the university Institutional Review Board (IRB) and requested to record the phone interview. All but two of the fifty interviews were recorded to audiocassette tape. Two department faculty members requested that the interview not be recorded; thus, these interviews were conducted at a slower rate and transcribed while the interview took place. Minor adjustments to the direct survey data (less than 1 percent of the total number of data points) were made based on clarification obtained during the interviews.

## IV. DATA ANALYSIS AND RESULTS

### Objective 1

Explore calculated and perceived adherence to IS 2010 curriculum guidelines, including the presence of recommended core topics, elective courses, capstone courses, and career track electives.

#### Calculated Adherence

The IS 2010 Model Curriculum prescribes that undergraduate IS curricula offer coverage of the seven core topics related to IS-specific knowledge and skills. In addition, curricula should include a capstone course in the final year and a selection of elective topics supporting career track(s) offered by the institution [Topi et al., 2010]. In our assessment of the 127 IS programs, we verified the presence or lack thereof for ten key variables, giving each IS program 10 percent credit for the presence of each variable. The first seven of these variables reflected whether each of the seven core topics was present in the curriculum. The eighth variable assessed whether or not a senior-level capstone course was required. The ninth and tenth variables concerned the degree to which career tracks were integrated into the curriculum. A program received credit for the ninth variable if they identified possible career tracks but did not list specific recommended courses for each track. Credit was awarded on the tenth variable if the program identified specific career tracks and recommended elective courses for these career tracks (similar to Figure 2). To determine whether each variable was present, course descriptions were reviewed and paired with the relevant elements of the IS 2010 model. These course descriptions were obtained from the university and IS program websites and confirmed in the university course catalogs. As shown in Table 2, if an IS program had each of the variables present in its curriculum, it was deemed 100 percent adherent to the IS 2010 guidelines. Likewise, if a program had nine of the ten, it was deemed 90 percent adherent, and so forth.

Figure 3 shows the distribution of the IS 2010 adherence scores for the programs sampled. The histogram illustrates the bulk of IS program adherence percentages fall around the center of the roughly normal distribution, with a mean of 48.35 percent adherence and a standard deviation of 14.41 percent. Table 3 shows descriptive statistics for each adherence category.

| Table 2: Ten Variables Assessed for IS Program Adherence to IS 2010 Curriculum Guidelines | |
|---|---|
| Program requirements by IS 2010 Curriculum Guidelines | Yes/no (10/0) |
| IS 2010.1: Foundations of Information Systems | 10 |
| IS 2010.2: Data and Information Management | 10 |
| IS 2010.3: Enterprise Architecture | 10 |
| IS 2010.4: IS Project Management | 10 |
| IS 2010.5: IT Infrastructure | 10 |
| IS 2010.6: Systems Analysis and Design | 10 |
| IS 2010.7: IS Strategy, Management, and Acquisition | 10 |
| Capstone course required during a student's final year | 10 |
| Identify career tracks | 10 |
| Defined career track options with the recommended courses listed | 10 |
| Percentage adherence to IS 2010 Curriculum Guidelines: | 100% |

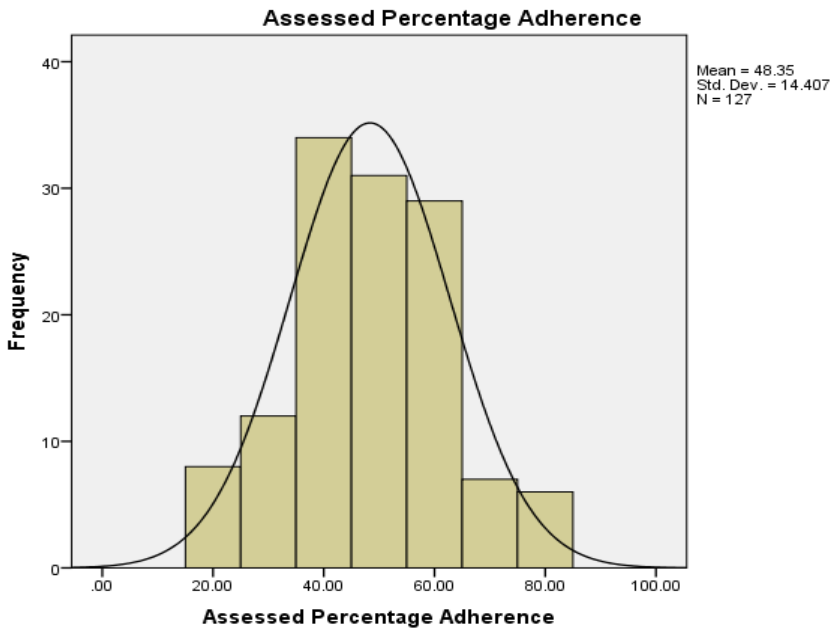


**Figure 3. Overall Calculated Adherence to IS 2010 Guidelines**

| Table 3: Overall Calculated Adherence to IS 2010 Guidelines | | | | |
|---|---|---|---|---|
| Percentage adherence categories | Percentage adherence by frequency (n = 127) | Percentage adherence by percentage (n = 127) | Mean (n = 127) | SD |
| 0% | 0 | 0.0% | — | — |
| 10% | 0 | 0.0% | — | — |
| 20% | 8 | 7.0% | .070 | .26 |
| 30% | 12 | 9.4% | .094 | .29 |
| 40% | 34 | 26.6% | .266 | .44 |
| 50% | 31 | 24.4% | .242 | .43 |
| 60% | 29 | 22.7% | .227 | .42 |
| 70% | 7 | 5.5% | .055 | .23 |
| 80% | 6 | 4.7% | .047 | .21 |
| 90% | 0 | 0.0% | — | — |
| 100% | 0 | 0.0% | — | — |

We also calculated overall adherence to the IS 2010 guidelines based only on the presence of recommended core topics and the capstone course in the final year (i.e., excluding career tracks). Figure 4 shows the resulting distribution of adherence scores. The histogram shows an increased mean adherence of 58.07 percent and a standard deviation of 16.78 percent. Table 4 shows descriptive statistics for each adherence category.



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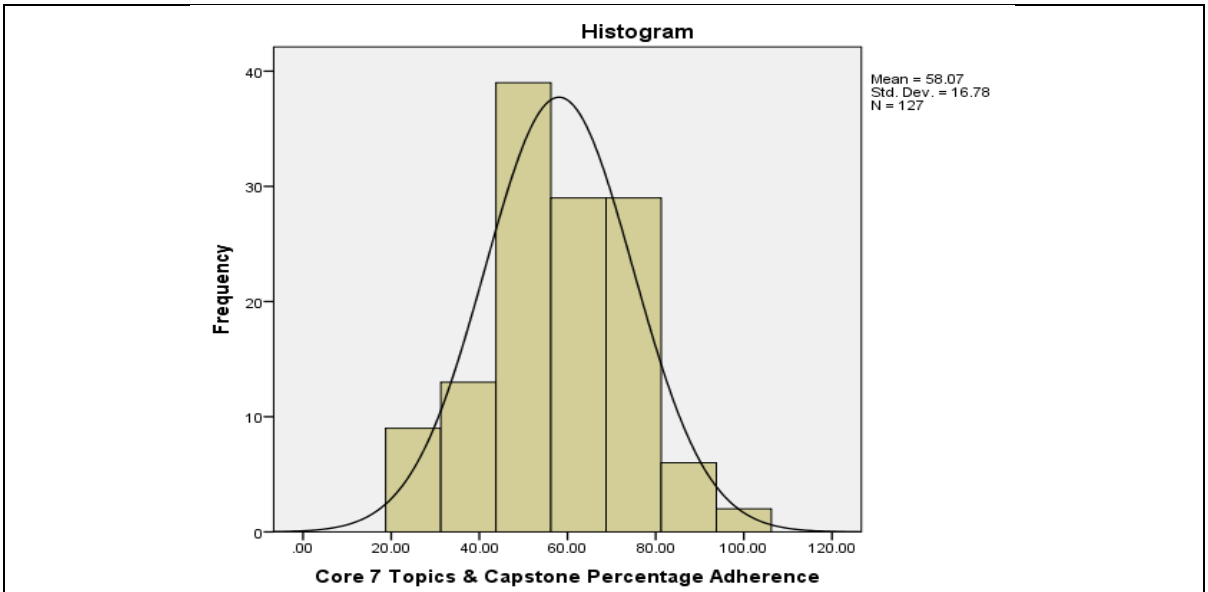


**Figure 4. Overall Calculated Adherence to IS 2010 Seven Core Topics and Capstone**

**Table 4: Overall Calculated Adherence to IS 2010 Seven Core Topics and Capstone**

| Percentage adherence categories | Percentage adherence by frequency (n = 127) | Percentage adherence by percentage (n = 127) | Mean (n = 127) | SD |
|---|---|---|---|---|
| 25% | 8 | 6.3% | .063 | .24 |
| 37.5% | 12 | 9.4% | .094 | .29 |
| 50% | 41 | 32.3% | .323 | .47 |
| 62.5% | 29 | 22.8% | .228 | .42 |
| 75% | 29 | 22.8% | .228 | .42 |
| 87.5% | 6 | 4.7% | .047 | .21 |
| 100% | 2 | 1.6% | .016 | .12 |

### Adherence to IS 2010 Recommended Courses

Figure 3 and Table 3 show the overall level of adherence to IS 2010 curriculum guidelines (including career tracks), but they do not indicate which specific curriculum components are commonly included in or excluded from IS curricula. To address this question, we tabulated the number of programs that implemented each of the ten curriculum components identified above. We first focus on the recommended core topics, the results for which are shown in Table 5. For the purposes of our analysis, we included only courses specifically listed as core (non-optional); "select one of the following" courses were excluded on the grounds that students could conceivably complete their degree without taking the course. For instance, one program included three required courses (i.e., Introduction to MIS, Database Fundamentals, and Systems Analysis and Design) and a choice of one of three additional courses. In this case, only the three required courses were counted as core courses. Notably, we found that only four of the IS 2010 curriculum core courses (IS 2010.1: Foundations of IS; IS 2010.2: Data and Info Mgmt; IS 2010.5: IT Infrastructure; and IS 2010.6: Sys. Analysis/Design) were implemented in over 50 percent of the IS programs surveyed.

We also tabulated the total number and percentage of core and elective courses offered by the IS programs surveyed. Figure 5 shows a somewhat leptokurtic distribution of the number of core topics required, with a mean of 7.21 core topics required and 68 percent of IS programs requiring between 5.3 and 9.1 core topics. Corresponding descriptive statistics are shown in Table 6. Figure 6 and Table 7 show the distribution and descriptive statistics of elective courses, with a mean of 11.01 elective courses offered.

Finally, we examined courses that were not considered part of the IS 2010 recommended core but were commonly included in core program curricula. Table 8 shows the most common of these courses. The most frequent non-IS 2010 required course is programming/application development, which is required in 81 percent of programs. This observation is comparable to that of Lifer et al. [2009] and Kung et al. [2006], who found required programming classes in 78 percent and 88 percent of programs studied, respectively. Twenty-three programs included at least two programming classes in the required core.

| Table 5: Presence of IS 2010 Core Topics by Number and Percentage | | | | |
|---|---|---|---|---|
| IS 2010 Guideline Categories | Frequency (n = 127) | Percentage (n = 127) | Mean (n = 127) | SD |
| IS 2010.1: Foundations of IS | 111 | 87% | .874 | .33 |
| IS 2010.2: Data and Info Mgmt | 123 | 97% | .978 | .18 |
| IS 2010.3: Enterprise Architecture | 22 | 17% | .173 | .38 |
| IS 2010.4: IS Project Management | 48 | 38% | .378 | .49 |
| IS 2010.5: IT Infrastructure | 89 | 70% | .693 | .46 |
| IS 2010.6: Sys. Analysis/Design | 107 | 84% | .843 | .37 |
| IS 2010.7: IS Strat, Mgmt, and Acq | 37 | 29% | .291 | .46 |
| Capstone in final year | 56 | 44% | .441 | .50 |

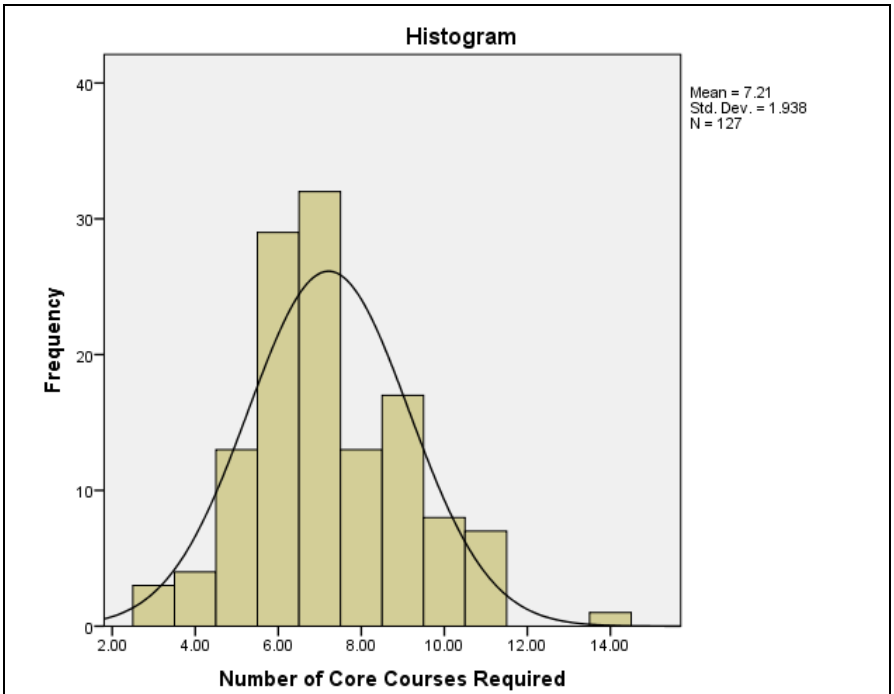


**Figure 5. IS Programs' Number of Courses Required**

| Table 6: IS Programs' Number of Courses Required | | |
|---|---|---|
| Number of courses required | Number of IS programs with specified # of courses required (n = 127) | Percentage of IS programs with specified # of courses required (n = 127) |
| 3 | 3 | 2.5% |
| 4 | 3 | 3% |
| 5 | 13 | 10% |
| 6 | 29 | 23% |
| 7 | 32 | 25% |
| 8 | 13 | 10% |
| 9 | 17 | 13.5% |
| 10 | 8 | 6.5% |
| 11 | 7 | 5.5% |
| 14 | 1 | 1% |



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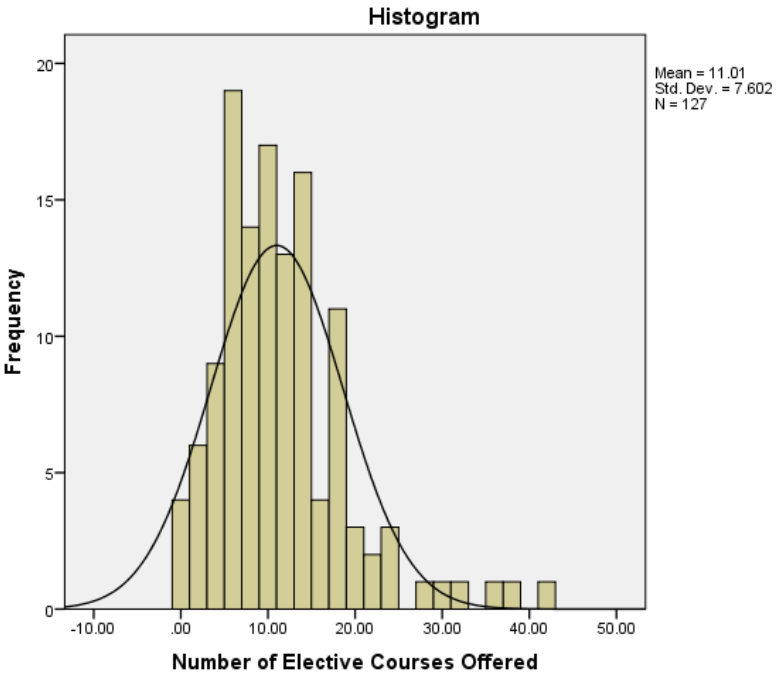


**Figure 6. IS Programs' Number of Elective Courses Offered**

**Table 7: IS Programs' Number of Elective Courses Offered**

| Number of elective courses offered | Number of IS programs offering specified # of elective courses (n = 127) | Percentage of IS programs offering specified # of elective courses (n = 127) |
|---|---|---|
| 2 | 2 | 1.5% |
| 3 | 6 | 4.5% |
| 4 | 3 | 2.5% |
| 5 | 10 | 8.0% |
| 6 | 9 | 7.0% |
| 7 | 9 | 7.0% |
| 8 | 5 | 4.0% |
| 9 | 11 | 9.0% |
| 10 | 6 | 5.0% |
| 11 | 7 | 5.5% |
| 12 | 6 | 5.0% |
| 13 | 10 | 8.0% |
| 14 | 6 | 5.0% |
| 15 | 2 | 1.5% |
| 16 | 2 | 1.5% |
| 17 | 5 | 4.0% |
| 18 | 6 | 4.5% |
| 19+ | 14 | 16.5% |

**Table 8: Core Requirements Not Part of the IS 2010 Model Curriculum**

| Core requirements not part of IS 2010 Model Curriculum | N = 127 | % |
|---|---|---|
| Programming/Application Development | 103 | 81% |
| Web Development | 24 | 19% |
| Microcomputer Applications | 23 | 18% |
| Electronic Commerce | 18 | 14% |
| Operations Management | 12 | 9% |
| IS Security | 10 | 8% |
| Decision Support and Expert Systems | 8 | 6% |
| Business Intelligence and Analytics | 7 | 6% |
| Global Information Systems | 5 | 4% |

## Perceived Adherence

In addition to computing an objective IS 2010 adherence score for each program, we also assessed perceived adherence levels among IS program administrators. Perceived adherence was obtained during the interviews with fifty IS department heads/undergraduate program directors and was measured via the first interview question shown in the Appendix. Of the fifty IS program administrators interviewed, none reported a perceived adherence score of 0 percent, and only three indicated 100 percent adherence. The remaining respondents reported adherence levels no lower than 50 percent, with a mean and mode of 80 percent (SD = 11.34 percent).

One of our objectives in gathering perceived IS 2010 adherence scores was to compare them with our calculated adherence scores to see if there were correlations and/or significant differences between the two. To conduct this comparison, we first recomputed the mean calculated adherence score based on only the fifty programs that participated in the interviews. Calculated adherence scores ranged between 10 percent and 80 percent, with a slightly higher mean adherence score of 50.00 percent (SD = 14.71 percent) compared to 48.35 percent (SD = 14.41 percent) calculated for the larger sample of 127. Figure 7 and Table 9 compare the distribution of calculated and perceived adherence scores.

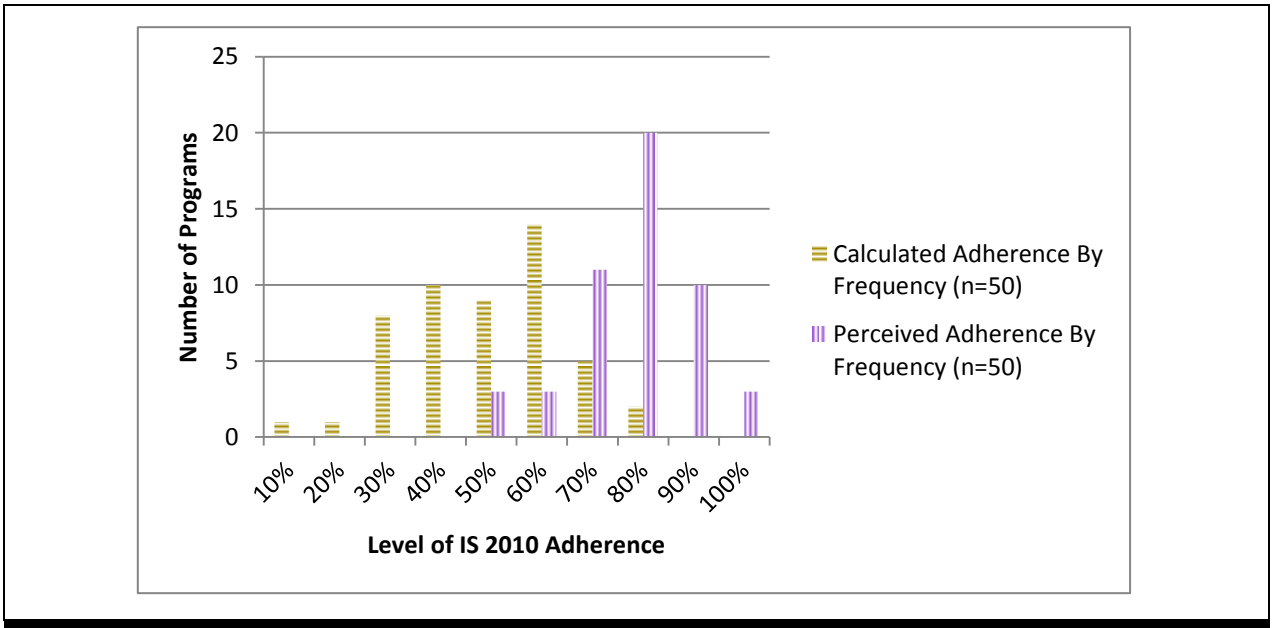


**Figure 7. Calculated Versus Perceived Adherence to IS 2010 Guidelines (Interview Subsample Only)**

**Table 9: Calculated Versus Perceived Adherence to IS 2010 Guidelines (Interview Subsample Only)**

| Percentage adherence categories | Calculated adherence by frequency (n = 50) | Perceived adherence by frequency (n = 50) | Calculated adherence by percentage (n = 50) | Perceived adherence by percentage (n = 50) |
|---|---|---|---|---|
| 0% | 0 | 0 | 0% | 0% |
| 10% | 1 | 0 | 2% | 0% |
| 20% | 1 | 0 | 2% | 0% |
| 30% | 8 | 0 | 16% | 0% |
| 40% | 10 | 0 | 20% | 0% |
| 50% | 9 | 3 | 18% | 6% |
| 60% | 14 | 3 | 28% | 6% |
| 70% | 5 | 11 | 10% | 22% |
| 80% | 2 | 20 | 4% | 40% |
| 90% | 0 | 10 | 0% | 20% |
| 100% | 0 | 3 | 0% | 6% |

To see whether the perceived and calculated adherence scores were related, we calculated correlation coefficients for each pair of scores. Due to potential issues of non-normality, correlation was assessed using both the Pearson r (parametric) and Spearman rho (non-parametric) coefficients. Results are shown in Table 10 and 11. Both coeffients indicate a positive correlation between perceived and calculated adherence scores.



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| Table 10: IS 2010 Curriculum—Calculated to Perceived Adherence Correlation (Pearson *r*) | | | | | |
|---|---|---|---|---|---|
| Variable | Mean | *SD* | N | *r* | Significance |
| Perceived Adherence | 80.00 | 11.33893 | 50 | .367 | .009 |
| Calculated Adherence | 50.00 | 14.70804 | | | |

| Table 11: IS 2010 Curriculum—Calculated to Perceived Adherence Correlation (Spearman rho) | | | | | |
|---|---|---|---|---|---|
| Variable | Mean | *SD* | N | *R* | Significance |
| Perceived Adherence | 80.00 | 11.33893 | 50 | .282 | .048 |
| Calculated Adherence | 50.00 | 14.70804 | | | |

Of perhaps even greater interest than the correlation between perceived and calculated adherence scores is the difference between the two. A cursory glance at the data suggests a marked contrast between perceived adherence (M = 80.00) and calculated adherence scores (M = 50.00). To test this difference, we conducted a paired samples *t*-test. Results of this test, shown in Table 12, confirm that perceived adherence scores are significantly higher than calculated adherence scores.

| Table 12: IS 2010 Curriculum—Calculated to Perceived Adherence Difference (Paired Samples *t*-test) | | | | | |
|---|---|---|---|---|---|
| Variable | Mean | *SD* | Test Statistic (*t*) | Df | Significance |
| Perceived Adherence | 80.00 | 11.33893 | 14.233 | 49 | .0001 |
| Calculated Adherence | 50.00 | 14.70804 | | | |

Finally, to show the magnitude of the discovered difference, an effect size (ES) was computed using the paired-samples *t*-test difference statistic, together with the mean and standard deviation of both the calculated and perceived adherence scores (Table 13). The effect size was very large (d = 2.01) according to Cohen's [1988] criteria, confirming the magnitude of the difference between the two scores.

| Table 13: IS 2010 Curriculum—Calculated to Perceived Adherence Difference (Effect Size) | | | | | |
|---|---|---|---|---|---|
| Variable | Mean | *SD* | Mean difference | *r* | ES |
| Perceived Adherence | 80.00 | 11.33893 | 30.00 | .367 | 2.011268 |
| Calculated Adherence | 50.00 | 14.70804 | | | |

## Objective 2

Examine career track trends developing in connection with IS 2010 curriculum guidelines, including percentage of IS undergraduate programs offering career tracks, the names and characteristics of the most common career tracks offered, and perceived benefits and limitations of including career tracks in department curriculum.

### Percentage of IS Undergraduate Programs Offering Career Tracks

As shown in Table 14, only ten (8 percent) of the 127 IS programs sampled offer formalized career tracks with corresponding elective courses. Within these ten programs, the number of career tracks offered ranges from two to five with an average number of 3.5. Table 15 shows the distribution of the number of career tracks offered.

| Table 14: Presence of IS 2010 Career Tracks by Number and Percentage | | | | |
|---|---|---|---|---|
| IS 2010 Guideline Categories | Frequency (n = 127) | Percentage (n = 127) | Mean (n = 127) | SD |
| Formalized career tracks with recommended courses | 10 | 8% | .08 | .27 |

| Table 15: IS Programs Offering Career Tracks | | |
|---|---|---|
| Number of career tracks (CTs) offered | Number of IS programs offering specified # of CTs (n = 127) | Percentage of IS programs offering specified # of CTs (n = 127) |
| 0 | 117 | 92.0% |
| 2 | 2 | 1.6% |
| 3 | 4 | 3.2% |
| 4 | 1 | 0.8% |
| 5 | 3 | 2.4% |

## Career Tracks Offered

The career tracks offered by the ten identified IS programs are listed in Table 16. As shown in the table, career tracks include traditional IS-related careers (e.g., application development, network administration, systems analysis and design) as well as less common tracks that are more specialized (e.g., e-learning manager, healthcare informatics). In all, nineteen unique career tracks were identified from the ten IS programs offering career tracks. Table 17 shows these career tracks in descending order of popularity.

**Table 16: IS Program Career Track Offerings**

| Program ID # | IS program career track options |
|---|---|
| 5 | Application Development<br>Business Analysis<br>Information and Communications Technology |
| 6 | Web Development/E-Commerce<br>Programmer/Analyst<br>Global IS/Spatial Systems<br>Telecommunications and Computer Networks |
| 19 | e-Business and Multimedia<br>Network and Enterprise Management<br>Applications Development |
| 20 | Networking Specialist<br>Organizational Information Systems |
| 35 | Applications Developer<br>Enterprise Resource Planning<br>Enterprise Systems |
| 37 | Computer Security<br>PC/LAN Support<br>Software Engineering/Programming<br>Web Development Specialist<br>Information Analyst |
| 41 | Web Developer<br>DBA (Database Administrator)<br>Project Manager<br>IT Consultant/Business Analyst<br>E-learning Manager |
| 43 | Systems Analysis<br>Business Analysis |
| 72 | Analyst/Project Manager<br>Database Technologies<br>IT Infrastructure<br>IT Consulting<br>IT Audit and Compliance |
| 104 | Business Application Development<br>Information Systems Management<br>Health Informatics (HIT) |

## Perceptions of Career Tracks Among IS Program Administrators

During the interviews, IS program administrators were also asked about their perceptions of the IS 2010 career track recommendations (see interview question #4 in the Appendix). Of the fifty interviewees, forty-eight provided feedback related to career tracks (96 percent response rate). A majority (30) of the responses regarding career tracks were positive, citing benefits such as taking advantage of regional company demands, preparing students to enter the job market in a specialized area, and encouraging students to find a targeted focus that would improve marketability and be listed on their resume. There were approximately fifteen neutral responses that described career tracks as beneficial for some programs but detrimental for others. Only three of the responses were identified as negative, including concerns about moving toward a trade school or training model instead of a broad-based university experience. Examples of positive, neutral, and negative perceptions are provided in Table 18.

Nearly half of the respondents, regardless of perception, mentioned departmental resources, low enrollments, and small class sizes as barriers to implementing career tracks into their curricula. As an alternative to career tracks, some offer concentrations (e.g., technical or managerial) or emphasize a targeted area (e.g., human–computer interaction) as an entire department. Table 19 includes a list of advantages and concerns related to career tracks.



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| Table 17: IS Program Common Career Track Options | |
|---|---|
| Career track | # of programs offering career track |
| Application Development | 4 |
| Business Analysis | 4 |
| Telecommunications and Computer Networks Management | 4 |
| Web Development Specialist | 4 |
| Information Systems Technology Management | 3 |
| e-Commerce/e-Business | 3 |
| Software Engineering/Programmer | 3 |
| Information Systems Analysis | 3 |
| IT Consultant | 2 |
| Project Manager | 2 |
| Database Administrator/Technologies | 2 |
| E-learning Manager | 1 |
| Enterprise Resource Planning | 1 |
| Enterprise Systems | 1 |
| Computer Security | 1 |
| Global IS/Spatial Systems | 1 |
| IT Infrastructure | 1 |
| IT Audit and Compliance | 1 |
| Health Informatics (HIT) | 1 |

## Objective 3

Conduct a comparative analysis of the current level of model curriculum adherence among IS programs with that found in prior studies [Kung et al., 2006; Lifer et al., 2009; Maier and Gambill, 1996].

### Comparison to 2009, 2006, and 1996 Model Adherence

To compare our adherence results to those observed in the studies conducted by Lifer et al. [2009], Kung et al. [2006], and Maier and Gambill [1996], we first identified curricular elements that were common across all four curriculum models. These topic areas include IS 2010.1 (Foundations in Information Systems), IS 2010.2 (Data and Information Management), IS 2010.5 (IT Infrastructure), and IS 2010.6 (Systems Analysis/Design).

To explore trends in each of these curricular elements, we conducted a one-sample *t*-test to compare the percentages of IS courses and topics currently being offered to those reported by Lifer et al. [2009], Kung et al. [2006], and Maier and Gambill [1996]. Table 20 shows the results of these comparisons. As shown in the table, the number of IS programs currently incorporating each of the identified elements was significantly greater than the corresponding number of programs reported by Maier and Gambill [1996]. However, more variation was observed with respect to the adherence levels reported by Lifer et al. [2009] and Kung et al. [2006]. Specifically, our results indicate a significant growth in the percentage of IS programs that teach IS 2010.1, an increase of 26 percent from 2006 and 44 percent from 2009. Similarly, the percentage of programs teaching IS 2010.2 has increased, although at a more modest rate of 5 percent since 2006 and 10 percent since 2009. No significant difference was found for the percentage of IS programs teaching IS 2010.5 since 2006 or 2009. Finally, there has been a significant *decrease* in the percentage of IS programs teaching IS 2010.6 (-10 percent) in their core curriculum since 2006, but no significant change since 2009. Figure 8 shows a graphical representation of the trends observed for the four elements common to all these studies.

## V. DISCUSSION

Model curriculum guidelines provide a framework for stakeholders interested in designing and updating IS programs. This investigation was undertaken to determine adoption of IS 2010 curriculum guidelines among United States undergraduate IS programs. Our results offer several interesting insights into the current status of IS 2010 adoption. Implications of our findings, along with recommendations for future research and limitations, are discussed below.

1) *IS programs exhibit a wide range of adherence to the IS 2010 core curriculum guidelines, with an overall calculated adherence mean of 48.35 percent (including all curriculum components) or 58.07 percent (including core and capstone courses only).*

First, using our calculated adherence metric, our investigation identified a wide range of adherence to the IS 2010 curriculum guidelines, with a mean of 48.35 percent and no program that was either 100 percent or 0 percent

**Table 18: Selected Quotations for Positive, Neutral, and Negative Perceptions of Career Tracks**

| | | Select quotations |
|---|---|---|
| Perception | Positive (30) | "I think that the career tracks give you a lot of flexibility because you have the modularity aspect to it, but I also think it allows you to better match your students up with what the job markets are and what the school requirements are."<br><br>"With a career track it gives them an organizational thing where they can say, 'Oh, yeah, that's what I want to do,' and they don't have to think too much about what electives they take. Their program is predefined and that's what they want to go into. I think it's also something they can put on their resume that says this is the way I'm trying to brand and sell myself, without having to do that on an individual one-by-one basis." |
| | Neutral (15) | "There are always advantages to specializing, in that a particular company looking for a certain job, then the specialized person would be better qualified to take the position. But given an undergrad program, we just want to prepare students with a broad overview of information systems and not limit them at this point."<br><br>"Depending geographically where you are, if there is a likely progression for the students that could not be afforded by a standard MIS degree, it would make sense. It is just whether that brings out a superior potential to the students in terms of employment. I have seen various career tracks that are very topical for a particular period or set of years, and then they fade away. I just don't think that they may be wise for the students because by the time that they complete them, that particular fad may have expired." |
| | Negative (3) | "We do not plan to develop any career tracks; there is no room in curriculum for them. By the time you pile on all of the undergraduate core, and business required core, and what we consider as core classes to get a job in MIS, you don't have anything left. There is no room for tracks per se, like that. I don't know what kind of assumptions were made by the development committee, but most undergraduate required education [and business core] is a lot bigger than it used to be; ours is 50 hours."<br><br>"We encourage students to find their way themselves. Example, we do not have pre-requisites, they take whatever they want. We encourage and recommend background courses but no requirements. For us to be prescriptive is not how it is around here. We feel that being too prescriptive limits them and it just doesn't fit with our culture." |

**Table 19: Select Advantages and Concerns Related to Career Tracks**

| | | Select Supporting Statements |
|---|---|---|
| Career Track Advantages and Concerns | Advantages | • "allows students to be more specialized"<br>• "gives students a way to focus"<br>• "gives them a way to articulate curriculum related to [an] area"<br>• "to meet regional demands"<br>• "prepares students to go directly into IT situations"<br>• "gives a choice of the direction they want to go"<br>• "gives them additional options"<br>• "improves marketability of the program"<br>• "positive, as long as we make sure they are current with industry"<br>• "better to have the option to specialize"<br>• "gives you a lot of flexibility because you have the modularity aspect to it"<br>• "allows you to better match your students up with what the job markets are"<br>• "regional institutions have specific employer relationships that have a tendency to make it more attractive for them to tailor technology or specific skills"<br>• "good when lined up with local industry and faculty skill set"<br>• "something they can put on their resumes" |
| | Concerns | • "runs the risk of producing something closer to training than education"<br>• "narrowing their experience with the discipline by focusing too much on a particular career path"<br>• "difficulty is the sustainability, can you support four different tracks?"<br>• "by breaking into career options, we'd be fragmented"<br>• "too small to offer any specializations"<br>• "we would create a lot of classes with five students in them, and it isn't feasible to do that"<br>• "we are resource-bound"<br>• "constrained by limited resources that prevent us from offering enough classes to structure some career tracks"<br>• "how much [do we want to] become like a trade school as opposed to a university?"<br>• "it just narrows what we can possibly expose them to in their courses" |



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| Table 20: IS 2010 Current Adherence Comparison to 2009, 2006, and 1996 Adherence (*t*-test) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| IS topic | Current study % (n = 127) | 2009 study % (n = 100) | Δ (Present -2009) | *t* statistic (p-value) | 2006 study % (n = 232) | Δ (Present -2006) | *t* statistic (p-value) | 1996 study % (n = 108) | Δ (Present -1996) | *t* statistic (p-value) |
| *IS 2010.1:* Foundations of IS | 87% | 43% | 44% | 15.020 (< 0.001) | 61% | 26% | 8.931 (< 0.001) | 60% | 27% | 9.269 (< 0.001) |
| *IS 2010.2:* Data and Info Mgmt | 97% | 87% | 10% | 6.331 (< 0.001) | 92% | 5% | 3.117 (0.002) | 12% | 85% | 54.533 (< 0.001) |
| *IS 2010.5:* IT Infrastructure | 70% | 70% | 0% | 0.019 (0.985) | 71% | -1% | -0.226 (0.822) | 5% | 65% | 15.953 (< 0.001) |
| *IS 2010.6:* Sys. Analysis/ Design | 84% | 81% | 3% | 1.002 (0.318) | 94% | -10% | -3.004 (0.003) | 19% | 65% | 20.108 (< 0.001) |

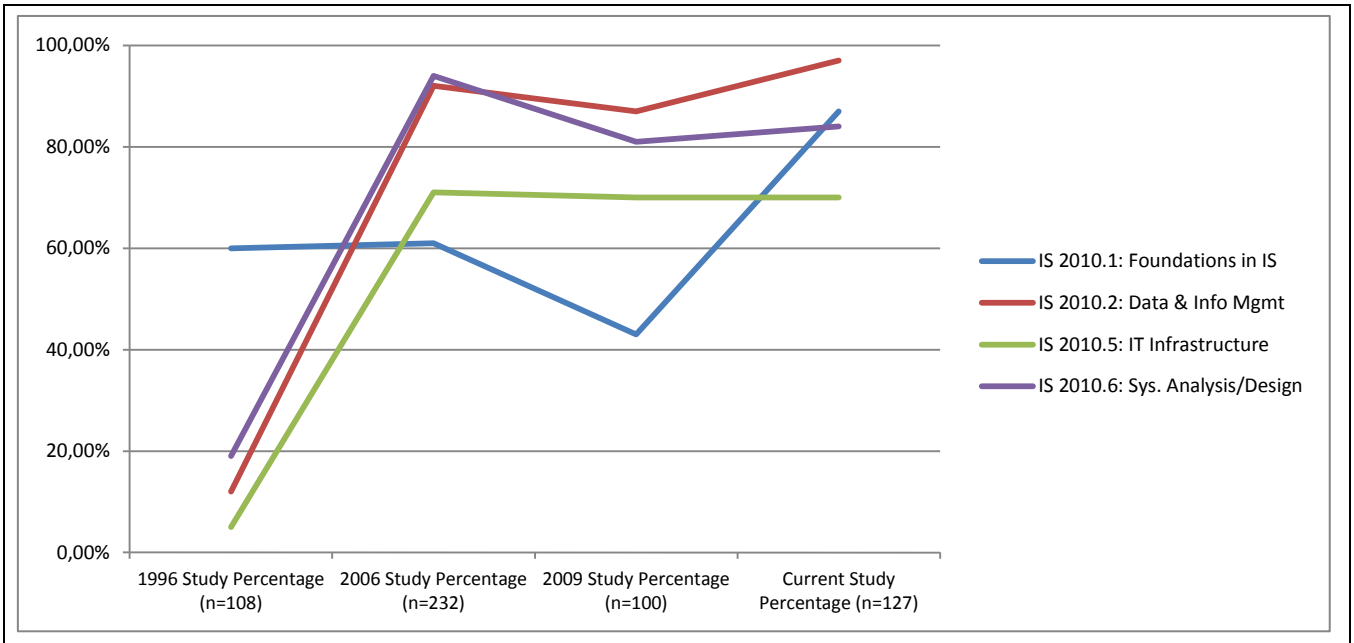


**Figure 8. IS 2010 Current Adherence Comparison to 1996, 2006, and 2009 Adherence**

compliant. Specifically among the IS topic areas examined, IS 2010.2—Data and Information Management—is the most common IS 2010 course, required in 97 percent of programs surveyed. Three other courses (IS 2010.1—Foundations of Information Systems, IS 2010.5—IT Infrastructure, and IS 2010.6—Systems Analysis and Design) were also widely offered in over 50 percent of programs as elements in the core curriculum. This result is not particularly surprising, given that these topics were all present in the IS 2002 Model Curriculum [Gorgone et al., 2002], and have been a staple in IS curricula during the past ten years. IS 2010.3—Enterprise Architecture and IS 2010.7—IS Strategy, Management, and Acquisition were covered at a significantly lower percentage (17 percent and 29 percent, respectively), perhaps because they are newer in concept and were not present in the IS 2002 Model Curriculum. Results observed for IS 2010.4—IS Project Management, another topic lacking coverage by a majority of IS programs, are surprising since this topic is present in the IS 2002 Model Curriculum [Gorgone et al., 2002], IS 97 Model Curriculum [Davis et al., 1997], and IS 95 Model Curriculum [Couger et al., 1995]. The capstone course requirement in the final year of the program was also offered in a modest 44 percent of the IS programs across the country. This suggests two possibilities. Either some programs are offering an integrated class specifically designated as a capstone course or they are using another course such as IS 2010.6: Sys. Analysis/Design as both a required core area and the capstone.

Overall, the disparity in IS 2010 course coverage indicates that many programs have not yet implemented some IS 2010 core components, particularly the new core courses/topics that were not represented in prior curriculum models. We readily acknowledge that this could be attributable to relative novelty of these elements and the

protracted time period often required to evolve academic curricula. The Enterprise Architecture topic, for instance, still suffers from the lack of strong textbooks that would facilitate its integration into the curriculum. However, we also posit that our results could possibly signal reluctance on the part of many IS programs to expand or modify their curricula to include new topics even though they have become mainstream in industry. Such reluctance may portend a disconnect between what contemporary IS programs teach and what graduates need to succeed in industry. For example, omitting Enterprise Architecture (IS2010.3) from the core curriculum, notwithstanding lack of a standardized text, is likely to produce IS graduates who lack a grasp of the complex technical and human issues that surround the implementation ever-more ubiquitous enterprise systems [Strong et al., 2006]. Similarly, in an economy where IS has become an unprecedented enabler of business strategy [McLaren,Head, Yuan, and Chan, 2011], a program that fails to adequately address concepts relating to IS Strategy, Management, and Acquisition (IS2010.7) does a disservice to emerging IS graduates who must grapple with complex build vs. buy and other strategic decisions. Perhaps most noteworthy in our view is the apparent paucity of programs offering project management and capstone courses, two areas that enable students to synthesize distinct IS concepts and manage the requirements and constraints of a complex IS project. Although the absence of these specific courses does not necessarily mean that students are not being exposed to these concepts, there is little doubt that graduates who lack these holistic skills are likely to face significant challenges as they move from a compartmentalized academic program to a much more ambiguous and interdependent work environment.

2) *Perceived adherence to IS 2010 guidelines among program administrators is higher than calculated adherence.*

One interesting result of our analysis is that perceived adherence to IS 2010 among IS program administrators is significantly higher (Mean = 80.00 percent) than the calculated adherence score (Mean = 50.00 percent). A possible explanation for this outcome is that our calculated score did not adequately capture the full extent to which programs had integrated IS 2010 elements into their curricula. However, the fact that clarification was solicited from participants on any part of the model curriculum not found on the program's course catalog/website renders this explanation unlikely. Alternatively, the disparity in perceived vs. calculated ratings might indicate a cognitive bias wherein many IS programs believe they are more compliant to IS 2010 than they actually are. This latter explanation is somewhat bolstered by our observation during interviews that virtually all program administrators were aware of IS 2010, but many seemed to possess only superficial familiarity with its specific recommendations, with some admitting they hadn't recently reviewed the guidelines. In yet other cases, interview respondents expressed ambivalence about the IS 2010 model. For example, one respondent stated that his program conformed "much more with the 2002 guidelines; with the 2010 IS guidelines, it seems like that committee was envisioning students getting degrees in consulting or moving towards positions as CIOs," a direction this program did not seem interested in pursuing.

Whether IS programs are complacent in their perceived adoption level of IS 2010 or unabashedly indifferent, our results suggest the presence of adoption barriers that must be overcome before IS 2010 is fully integrated into the majority of IS curricula. Encouragingly, most program administrators interviewed did exhibit confidence in their awareness of the IS 2010 model and their program's effort to integrate it into the curriculum; hence, their reported adherence scores may reflect the intended direction of the program more than its current state. Regardless, our results suggest that efforts to further educate program administrators on the particulars of the IS 2010 model and ways to measure compliance would likely be beneficial. For example, curriculum workshops at academic conferences could provide an opportunity for program administrators to receive assistance with program assessment and share best practices for implementing IS 2010 guidelines. Such a forum could both reveal undetected deficiencies in existing program curricula and offer insight for those seeking to update their programs.

3) *Several non-IS 2010 core topics are still included as required components in many IS programs, with programming/application development required in 81 percent of programs surveyed.*

Beyond disparities in coverage of the IS 2010 core topics, our analysis revealed several non-IS 2010 core courses that are still included as core elements in many IS programs. The most prominent of these is a programming/application development course, which was expressly removed as a core topic in IS 2010 but is still required by over 80 percent of the IS programs surveyed. Again, this observation could signal either unawareness of the IS 2010 recommendation or a conscious decision not to comply. Though not definitive, our data seems to suggest the latter as the more likely explanation. Many interviewees expressed concern about a required programming class missing from the model. For example, one person stated: "we just redesigned the curriculum and are pretty much using [IS 2010] as the guidepost. The big exception that we did notice is that 2010 doesn't require programming; it puts it in the elective pool. Both faculty and advisory board kept it as a required class." Several others expressed the same concern. The implication of this finding is that most IS programs still seem to value programming as an essential IS skill and, therefore, may be reluctant or unwilling to sacrifice this course in favor of additional high-level, managerially-focused content. Although IS 2010 no longer includes it as a core topic, the task



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force did acknowledge that “a strong case can be made for inclusion of programming, computational thinking, data structures, and related material in an IS program” [Topi et al., 2010, p. 384]. Consequently, we believe classes such as Web development, electronic commerce, business intelligence, and business analytics will continue to surface as required courses, while others on the list such as microcomputer applications might be more likely to decline in the future.

4) *Although few IS programs have formally implemented IS 2010 career tracks, perceptions of career tracks are generally favorable, and those who do offer career tracks include unique options beyond the exemplar tracks depicted in the IS 2010 curriculum.*

Another noteworthy finding was that only 8 percent of IS programs offer explicit career track options in their curricula, suggesting that very few IS programs have formally implemented the IS 2010 career track guideline recommendations. Although interview feedback on career tracks was generally positive, some respondents expressed concern that focusing on career tracks leads to “overspecialization” that was more appropriate for a trade school than a university. This suggests a philosophical tension between the often competing objectives of providing a broad-based education focused on concepts and critical thinking or more specialized training to meet specific industry demands. Our results imply that IS programs that favor a broad-based approach may be less inclined to implement the career track elements recommended by IS 2010. This is an important issue that the IS discipline should carefully consider in ongoing curriculum decisions.

Programs that did offer career tracks offered between two and five, with a total of nineteen unique career tracks identified. Together, these results suggest that while formalized career tracks may not yet be widespread, it is evident that the breadth of career tracks offered extends beyond the proposed sample tracks depicted in the IS 2010 curriculum guidelines. This supports the notion that IS programs who do implement career tracks are not necessarily confined to the prototypical model, but are customizing their curriculum in a way that serves their unique circumstances and needs (i.e., local industry demands, attracting greater amount of students, catering courseware and teaching objectives to faculty skill set, etc.).

5) *Resource constraints and program enrollments/class sizes are commonly described barriers to developing career tracks.*

Interview respondents frequently indicated that their departments had discussed developing or implementing career tracks, and even provided specific rationale for departmental decisions related to career tracks. However, actually implementing career tracks appears to be a challenge for smaller programs due to resource constraints, program enrollments, and worries about small class sizes. IS 2010 [Topi et al., 2010] acknowledges the need for adequate program resources to support the curriculum model, including faculty, computing infrastructure, laboratory, and classroom resources. However, the well-known recent decline in IS enrollments has forced many programs to downsize and focus more exclusively on the “bread-and-butter” of their curriculum. Consequently, the dearth of formal career tracks may have less to do with principled objection than with a simple lack of adequate resources to implement them. This means that it might be unreasonable to expect significant growth in career track options until increasing enrollments justify the acquisition of more resources.

One potential solution to the problem of resource scarcity could be to connect with other academic units or industry partners to provide the necessary course coverage to support a career track. For example, one interview respondent described assistance from an outside organization to create a career track in enterprise systems; however, few other respondents seemed to have explored this avenue. With its borders overlapping diverse fields such as computer science, instructional technology, engineering, marketing, entrepreneurship, sociology, and psychology, IS is uniquely positioned to leverage other academic disciplines in order to provide a diverse set of career options to students. With limited resources, especially for smaller departments, it may be worthwhile to explore the development of career tracks with other departments or industry sponsors.

## Limitations and Future Research

The purpose of this study was to assess the level of adoption of the IS 2010 model curriculum among undergraduate IS programs in the United States. Overall, our results indicate a modest but incipient level of IS 2010 adoption, with new elements, such as career tracks, limited to just a handful of programs so far. We encourage ongoing research to further extend our understanding of the use, or lack thereof, of curriculum models in the curriculum decision and revision process. For instance, the current investigation did not examine adherence based on different regions of the country or school profiles (i.e., private/public, teaching/research). Examining these factors may provide additional insight into why schools are adopting or failing to adopt the curriculum guidelines. In addition, the current investigation was limited to IS programs of AACSB-accredited institutions. Further research examining programs that are not AACSB accredited or located outside business schools may help provide a more comprehensive understanding of IS 2010 curriculum guidelines adherence, career tracks, and required IS curriculum among

programs. Another potential limitation of this study is the relatively short time period (1.5 years) between the publication of the 2010 guidelines and the time of data collection. Although we believe that such an early assessment is worthwhile and useful to the IS community, a follow-up study that revisits IS 2010 adoption levels in a few years will undoubtedly shed further light on long-term curriculum trends. Yet another potential area for future research includes examining the decision-making process for determining whether or not to include career tracks and deciding which career tracks to include. For instance, are career tracks primarily determined based on faculty skills, student interest, or industry demands? Finally, the current study focused solely on the IS 2010 Curriculum Guidelines. Further research should broaden the scope of this inquiry to encompass other curriculum models, such as the MSIS 2006—Curriculum Guidelines for Graduate Information Systems Programs [Gorgone et al., 2006].

In conclusion, this study provides an assessment of curriculum offerings in contemporary IS programs and offers an inaugural assessment of whether and to what extent programs are adopting IS 2010 curriculum guidelines, including new elements such as career tracks. We hope that the trends revealed by our findings will provide IS educators with insight that will help make important curriculum decisions with respect to the IS 2010 curriculum guidelines.

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*Editor's Note*: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the article on the Web, can gain direct access to these linked references. Readers are warned, however, that:

1. These links existed as of the date of publication but are not guaranteed to be working thereafter.
2. The contents of Web pages may change over time. Where version information is provided in the References, different versions may not contain the information or the conclusions referenced.
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## APPENDIX A. DATA COLLECTED FROM INFORMATION SYSTEMS DEPARTMENT WEBSITES AND COURSE CATALOGS

| Table A–1: Data Collected from Information Systems Department Websites and Course Catalogs | |
|---|---|
| Identifier Code | |
| University Name | |
| School Name | |
| School Address | |
| School City Location | |
| School State Location | |
| School Zip Code | |
| Geographic (Censes) Locations: (West, Midwest, Northeast, and South) | |
| Quarters (Q) or Semesters (S) | |
| Public (1) Private (2) | |
| Department/Program Name: | |
| # of IS Courses required? | |
| Required IS Courses | |
| Required Course #C1 | |
| Required Course #C2 | |
| Required Course #C3 | |
| Required Course #C4 | |
| Required Course #C5 | |
| Required Course #C6 | |
| Required Course #C7 | |
| Required Course #C8 | |
| Required Course #C9 | |
| Required Course #C10 | |
| Career Tracks Offered | |
| # of Career Tracks offered? | |
| Career Track #T1 | |
| Career Track #T2 | |
| Career Track #T3 | |
| Career Track #T4 | |
| Career Track #T5 | |
| Career Track #T6 | |
| Career Track #T7 | |
| Career Track #T8 | |
| Career Tracks/Courses | |
| Career Track #T1 Courses | |
| Career Track #T2 Courses | |
| Career Track #T3 Courses | |
| Career Track #T4 Courses | |
| Career Track #T5 Courses | |
| Career Track #T6 Courses | |
| Career Track #T7 Courses | |
| Career Track #T8 Courses | |

### Related Undergraduate Program Administrator Interview Questions

1. Out of 100 percent, how compliant is your IS curriculum with the IS 2010 curriculum guidelines in terms of the seven required topics, identified career tracks, and the capstone course taken during a student's final year?
2. We were unable to locate the following topics within your department's program of study: _____. Can you confirm that these topics are not included in your IS program, or provide the title and how they are included (such as an elective)? For example, we were unable to locate the IS Strategy, Management and Acquisitions topic (IS 2010.7) taught by your department's program of study. Can you confirm if this course topic is included in your IS program, and if so, the title and how it is included (such as an elective), and whether it is a capstone course?
3. We were unable to locate any career tracks within your department's program of study. Can you confirm that currently there are no career tracks, or if there are, what are they and where can that information be found?
4. From your point of view, can you share the advantages and disadvantages of offering IS career track options (and specifically why your department offers the following career tracks _____)?



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