2005

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ABSTRACT

Using the six information systems core areas for accreditation and the IS 2002 model curriculum as a framework, this paper proposes and uses metrics for reporting the breadth and depth of coverage across content areas, using data from a sample of 18 four-year IS degree programs. The results indicate that *analysis and design* and *role of IS in organizations* are covered in the greatest breadth, according to aggregate mappings of local courses to IS 2002 learning units and IS core accreditation areas. *Networks and telecommunications* and *hardware and software* are covered in the least breadth and depth. The remaining two areas—*data management* and *modern programming language*—are covered in the most breadth and depth as a percentage of core area size and total coverage, respectively. The results provide IS institutions with a basis for comparing their IS curricula both in terms of accreditation standards and the IS model curriculum.

Keywords

IS2002, model curriculum, curriculum development, IS accreditation

INTRODUCTION

While curriculum accreditation guidelines for degree programs in information systems are now in place, very little information exists on how institutions actually perform along curriculum accreditation criteria. The ABET Computing Accreditation Commission (CAC) defines six core areas for information systems curriculum content (ABET, 2004), but it is up to IS institutions to self-report semester hour coverage in CAC core areas for IS, and no specific coverage requirements exist. Curriculum self-studies are typically kept confidential, preventing the dissemination of a potential source of accreditation guidance.

Recently, the IS 2002 information systems model curriculum (Gorgone, Davis, Valacich, Topi, Feinstein, and Longenecker, 2002), a much more detailed document defining curriculum standards for IS degree programs, has been mapped to the ABET CAC core areas for IS curriculum accreditation (Landry, Pardue, Reynolds, and Longenecker, 2004). The linkage of the model curriculum and its 150 learning units to the six IS core areas provides a published framework for modeling IS degree program in preparation for accreditation efforts.

IS curriculum modeling efforts, which have lead to mapping of local (institutional) courses to the IS 2002 learning units at an increasing number of institutions, can usefully serve to document how individual institutions conform to accreditation guidelines. One such source of curriculum mapping data is at the Center for Computing Education Research (CCER). More than 50 institutions have participated in a project that encourages the mapping of local courses to the learning units of IS 2002, and assessing their students against the learning units through a 3-hour, online exit assessment exam. The purpose of this paper is to utilize aggregate mapping data from the CCER database of curriculum maps to answer the question: *To what extent do IS programs cover the IS core areas for accreditation?*

Answering this question is useful to institutions with IS programs seeking accreditation. Knowing the extent of coverage in the core areas for accreditation provides a benchmark against which a school seeking IS accreditation can compare its IS program. Our study should shed some light on questions such as “how much breadth and depth *should* our curriculum have in an area, such as analysis and design (or some other core area)?”

CORE AREAS FOR ACCREDITATION AND IS 2002

ABET defines and requires IS degree programs to assess their curricula on six core areas for IS accreditation. These are widely recognized topic areas of IS content. For accreditation, schools are required to report their semester hour coverage in each area.

Prior work (Landry, Pardue, Reynolds, and Longenecker, 2004) proposed a link between the IS 2002 model curriculum and the IS accreditation core areas by mapping the learning units to the IS core areas. A learning unit defines an educational goal and related set of educational objectives, along with a prescribed depth of coverage. The IS 2002 modified-Bloom metric is used as a basis for quantifying depth. The 0-4 scale defines coverage of an IS 2002 learning unit by a local curriculum as being at a level of 0-none, 1-recognize, 2-differentiate, 3-use, and 4-apply. To simplify analysis, levels 3 and 4 were considered in-depth, while 1 and 2 were defined as shallow. This breaking point assumes that the difference between the educational concept of differentiation and use is very great.

All 150 learning units of IS 2002 were mapped into one and only one of the six IS core areas for accreditation. The usefulness of the mapping is to provide a detailed means of assessing one's curriculum while simultaneously analyzing it in terms of the ABET areas. Each of the six areas is listed below, with a count of the number of IS 2002 learning units (abbreviated "LU") mapped into each core area:

- hardware and software, 13 LUs
- a modern programming language, 13 LUs
- data management, 18 LUs
- networking and telecommunications, 10 LUs
- analysis and design, 45 LUs
- role of IS in organizations, 51 LUs

From the data, it is clear that two areas contain a majority (96 of 150 or 64%) of the learning units in IS 2002: analysis and design and the role of IS in organizations. If the IS programs in the sample are indicative of the model curriculum, it would be expected that these two areas would be covered in the most breadth.

DEFINING BREADTH AND DEPTH METRICS FOR CORE AREAS OF IS

The approach taken to describe how IS programs cover the IS core areas for accreditation utilizes metrics to describe the breadth and depth of learning unit coverage, aggregated by the IS core area content groups. That is, we define each IS core area in terms of the learning units that make up the area, and then quantify breadth and depth of coverage in each area.

In order to describe the breadth and depth of coverage of IS core area content across our sample of IS degree programs, we created three simple metrics, shown in Table 1. Two of the metrics defines breadth, while the other two are depth metrics.

The first two metrics assess a program's breadth. The first of these metrics defined is called *core area coverage*. It is simply a count of the number of local course objectives defined for an IS core area, aggregated across the sample. It indicates breadth, that is, how much educational material covers each area, regardless of how shallow or deep the coverage goes.

The second metric accounts for the unequal sizes of each of the core area groups and is called *average coverage*. It is calculated as the number of local course objectives per LU defined in the core area. It adjusts the first breadth metric by the sizes of the core areas, using the numbers listed for each core area given above.

The other two metrics are assessments of depth. The third metric listed in Table 1 is *core area in-depth coverage*. The metric ignores shallow coverage, focusing instead on in-depth coverage. Core area in-depth coverage is computed by counting all of the level 3 and 4 level local objectives for each core area across the sample. The level 1 and 2 local objectives are not counted. The remaining metric is called *core area in-depth coverage proportion*. It measures the extent to which coverage of a core area is in-depth and is calculated by dividing the third metric by the first metric. That is, core area in-depth coverage proportion is the number of in-depth local objectives for a core area divided by the total number of local objectives for a core area. A depth proportion of .75 would mean than a program covers 75% of its local objectives at level 3 or 4 (in-depth). A high value, closer to 1.0, indicates that a program tends to cover the area in-depth when it covers that area. A low number indicates that the area, when covered, tends to be covered at a low (level 1 or 2) level of depth.

Metric	Definition	What measure indicates
core area coverage	number of local objectives covered	how many local course objectives are being taught in an absolute sense; indicates the amount of educational material covered within a core area
average coverage	number of local objectives divided by the number of learning units mapped to the core area	The amount of educational material covered within a core area, adjusted for the size of the core area.
core area in-depth coverage	number of in-depth (level 3 and 4) local objectives covered	how many in-depth course objectives are being covered in an absolute sense, for a core area
core area in-depth coverage proportion	proportion of local objectives covered in-depth for a core area, calculated as core area in-depth coverage divided by core area coverage	the extent to which coverage of a core area is in-depth

Table 1. Depth and Breadth Metrics For IS Core Areas

THE SAMPLE

The study uses a secondary data set to describe the breadth and depth of IS core area coverage in IS degree programs. More than 54 institutions completed an online mapping exercise as part of participating in the Center for Computing Education Research's (CCER) IS 2002 Exit Assessment Exam (Center for Computing Education Research 2004). Of this sampling frame of 54 schools, we chose a subset of institutions that most completely identified and mapped their local courses. A total of 18 schools defined at least nine local courses and mapped more than 70 local course objectives. The data from these 18 programs, 12 of which were located in colleges of business, were used as the data set for this study. The data from the remaining schools were too scant to be used. Either too few courses or too few local course objectives were defined to be considered a representative map.

The mapping exercise implemented a technique for mapping one's local curriculum to the learning units of IS 2002 (Daigle, Longenecker, Landry, and Pardue, 2004). A faculty member or group of faculty members at each institution defined the degree program's set of required IS courses. For each local course, the faculty member(s) identified IS 2002 learning units covered by the course, writing a local objective for each learning unit identified and assigning a depth level in each case.

Using the learning unit to IS core area mappings defined in Landry et al., we computed the breadth and depth metrics defined above, using data provided by the 18 institutions.

RESULTS

The results of the analysis have been summarized in Table 2. Each IS core area is listed, along with the computed breadth and depth metrics.

IS Core Area	Core Area Coverage	Average Coverage	Core Area In-Depth Coverage	Core Area In-Depth Coverage Proportion
Analysis and Design	1228	27	705	0.57
Role of IS in Organizations	1191	23	364	0.31
Data Management	519	29	302	0.58
Modern Programming Language	440	34	244	0.55
Hardware and Software	292	22	96	0.33
Networking and Telecommunications	228	23	68	0.30

Table 2. Breadth and Depth Results by IS Core Area

The results indicate that analysis and design and role of IS in organizations are covered in the greatest breadth. The core area coverage metric for breadth was computed as 1,228 and 1,191, respectively, for these two core areas. On average IS degree programs defined 68 local course objectives covering the learning units making up analysis and design and 66 local course objectives for role of IS in organizations. These two areas were covered with twice as many objectives as any other of the four core areas. The core areas data management and modern programming language were next, with midrange values for core area coverage. Covered in the least amount of depth were the two remaining areas: hardware and software and networking and telecommunications.

When adjusted for size of the core area, however, analysis and design and role of IS in organizations were not covered in any breadth than any other area. Using the average coverage metric, which divides the number of local objectives covering an area by the size (number of learning units) of the area, modern programming language, with an average coverage value of 34, comes out on top. All of the remaining core areas have between coverages between 22 and 29. This is an indication that, when adjusted for size, the core areas are relatively equal in the way they are covered. Perhaps a better way to view the result is that the core areas are covered in about the amount of depth that the IS 2002 model curriculum calls for, at least in the sample of IS programs studied.

Analysis and design was covered in the greatest depth of any core area. The core area in-depth coverage metric, equal to the number of level 3 and 4 local objectives covering an area, was computed as 705 for analysis and design, more than twice as high as any other area. Role of IS in organizations, data management, and modern programming language were next, with core area in-depth coverages ranging from 244 to 364. The lowest breadth core areas were also covered in the least depth. Hardware and software and networking and telecommunications had depth scores of 96 and 68, respectively.

The other depth metric, core area in-depth coverage proportion, indicates that three IS core areas stand out above the others in terms of their tendency to be covered in depth when they do get covered. The three areas are analysis and design, data management, and modern programming language. Their scores ranged from .55 to .58, indicating they get covered in-depth about half the time they are covered at all. The remaining three core areas had depth proportion scores ranging from a much lower .30 to .33.

DISCUSSION

The results indicate that analysis and design is an area of IS that is covered in the greatest breadth and depth overall. The role of IS in organizations is interesting in that it is covered in breadth but not in depth. Two areas lag behind the others in three of the four metrics.

The low breadth and depth of coverage in networking and telecommunications prompted us to review the data in more detail. Each school's course listing for the IS major was analyzed to see if all courses were covered. We found that 10 of the 18 programs had fully mapped all of the networking and telecommunication courses. Seven programs had not mapped one or more courses in this area. Four of the seven had three ore more missing courses, usually offered as part of an elective track.

Perhaps an explanation for the findings is that undergraduate IS degree programs prepare undergraduate IS students for entry-level career choices as IS analysts, application developers, and database analysts by covering material in depth in terms of both overall coverage and as a proportion of coverage. Degree programs apparently treat hardware and software and networking and telecommunications as areas that require minimal in-depth coverage for the primary occupational fields for the college graduate. Several schools provide elective courses in these areas, however. Four of the 18 schools offer elective tracks in networking and telecommunications with three or more courses in the track. The role of IS in organizations provides the context for the entry-level IS professional and the educational foundation for future advancement to positions such as project manager, IS manager, and CIO, through coverage of a wide range of IS topics. However, programs, in general, do not pursue role of IS in organizations in any depth. Perhaps in-depth treatment of the role of IS in organizations can be expected to be shown in graduate programs geared toward professional advancement.

CONCLUSION

What does this say about undergraduate IS education? It says that we educate students to do programming, analysis and data management first. We provide a broad organizational context for the profession, and treat networking/telecommunications and hardware/software with minimal depth or as an area of elective specialization.

A limitation of our study is that we did not check with each school to confirm that the mapping was complete, or to distinguish between required courses and electives. Post hoc analysis of web-based course listings indicated that about 10 of 18 mappings were complete, but the remaining schools left off some required and/or elective courses.

Overall, our assessment indicates that programs seeking accreditation would be typical of the IS programs in our sample if they:

- cover analysis and design and role of IS in organization topics about twice as frequently as any other area
- focus the coverage of analysis and design, data management, and modern programming language to be in-depth
- emphasize a wide breadth of coverage for role of IS in organizations
- offer at least one course and one or more elective courses in networking and telecommunications with some in-depth coverage

The study synthesized two related educational models and applied the rigorous resulting framework to a sample set of degree program curricula to provide an interesting analysis. The results provide IS institutions with a basis for comparing their IS curricula both in terms of accreditation standards and the IS model curriculum.

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