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Connecting the docs: information systems model curricula and accreditation criteria

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Abstract

The most recent publication of a model curriculum for information systems programs; IS2020 Competency Model for Undergraduate Programs in Information Systems updated the recommended content for information system programs. Meanwhile, accreditation criteria for such programs need to remain current and relevant. With ABET accreditation, students, administrators, and employers receive confidence that a program meets the standards that produce graduates prepared to enter a global workforce. These standards need to remain current within the guidelines of accepted model curricula. Aligning these two documents is an iterative process. In this paper, the co-chair of the IS2020 Competency Model, and chair of the ABET computing area delegation for accreditation of computing programs present the connection between the competencies recommended in the model curriculum document and the required criteria for accreditation. An example of the continuous process of improving model curricula and contemporary accreditation criteria is demonstrated with a survey of information systems program heads and accreditation program evaluators and the resulting recommended changes to criteria.

Keywords: model curriculum, information systems accreditation, curriculum accreditation

Introduction

The Association of Computing Machinery (ACM), the Association of Information Systems (AIS), along with the Information Systems and Computing Academic Professionals Education Special Interest Group (EDSIG) recently published IS2020: Competency Model for Undergraduate Programs in Information Systems. The IS2020 report (Leidig et al., 2021) is the latest iteration of model curriculum work for the Information Systems (IS) discipline that dates to the early 1970s. The production of this model curriculum concluded a once-in-a-decade process. Meanwhile, computing education continues to evolve along with rapidly changing technology. Therefore, maintaining appropriate model curricula, as well as accreditation criteria for such programs that remain current and relevant requires experts to continuously assess and provide feedback.

With ABET accreditation of a program, students, administrators, and employers receive confidence that a program meets the standards that produce graduates prepared to enter a global workforce. Note: ABET is no longer an acronym, rather the name of the organization that accredits post-secondary education programs in computing, engineering, engineering technology and applied and natural sciences. In this paper, the co-chair of the IS2020 Competency Model and chair of the ABET computing area delegation for accreditation of computing programs presents the connection between the competencies recommended in the model curriculum and the criteria required for accreditation. The continuous process of improving model curricula to remain current with industry needs, while maintaining contemporary accreditation criteria is an ongoing challenge. This process is demonstrated with the results of a survey of information systems program heads

and accreditation program evaluators. The value of the contributions of program evaluators and heads of information systems programs in this continuous feedback process is discussed.

Model Curricula and IS2020

A defining characteristic of IS education is that IS programs co-exist in a wide variety of faculties and institutions. Information Systems programs are often structured differently with different views of what to emphasize or include in an IS degree. A larger challenge from the perspective of offering guidelines is that the number of courses available or allowed for a major differs considerably. Undergraduate IS programs in many business schools offer a limited number of courses, while programs housed in other units such as computing schools, normally do not have restrictions that come with the broader coverage required from other contexts are therefore able to offer more courses in information systems.

The IS2020 taskforce addressed this diversity of programs when deciding whether to define a list of core and elective courses. The initial question was whether it was even possible to identify a set of courses that would be appropriate for the variety of programs that adequately matches the mission of each institution. The taskforce chose to move away from defining a model curriculum consisting of courses, and instead defined a competency model. The model defines what graduates should attain upon completion of a program instead of what specific courses are offered. These models are more flexible and can be adapted to fit individual institutions.

For this effort, the taskforce defined a competency as the graduate's ability to apply knowledge, skills, and dispositions to effectively complete tasks. (Figure 1) The knowledge component includes the core concepts of the discipline of study. Elaborations on knowledge units have been the mainstay of most curricular models. Moving to a broader competency model is intended to provide a more flexible model that is adaptable to the fast-changing technologies and skills desired in graduates from information systems programs. The competency model allows institutions to map competencies to courses independent of a one-to-one relationship. (Leidig & Salmela, 2022)

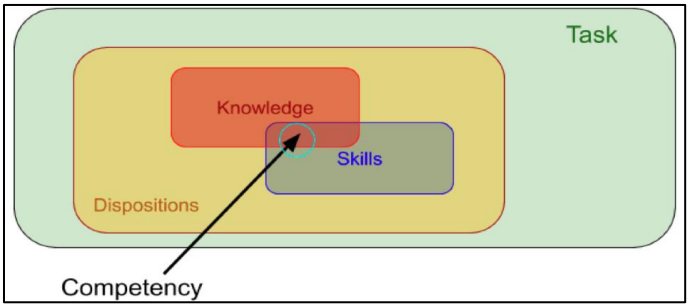

Figure 1: Components of Competencies

IS2020 identifies a common core of required competency areas, while also identifying possibilities to profile a program adding electives. (Figure 2) At the highest level, we identify six competency realms. By grouping competency areas into broader realms, it intends to promote program-level discussions on core competencies and specializations electives. In particular, the four competency realms (Data, Technology, Development, and Organizational Domain) aim at providing depth by allowing sequencing, thus also providing a possibility for a profile for the program to have a specialization.

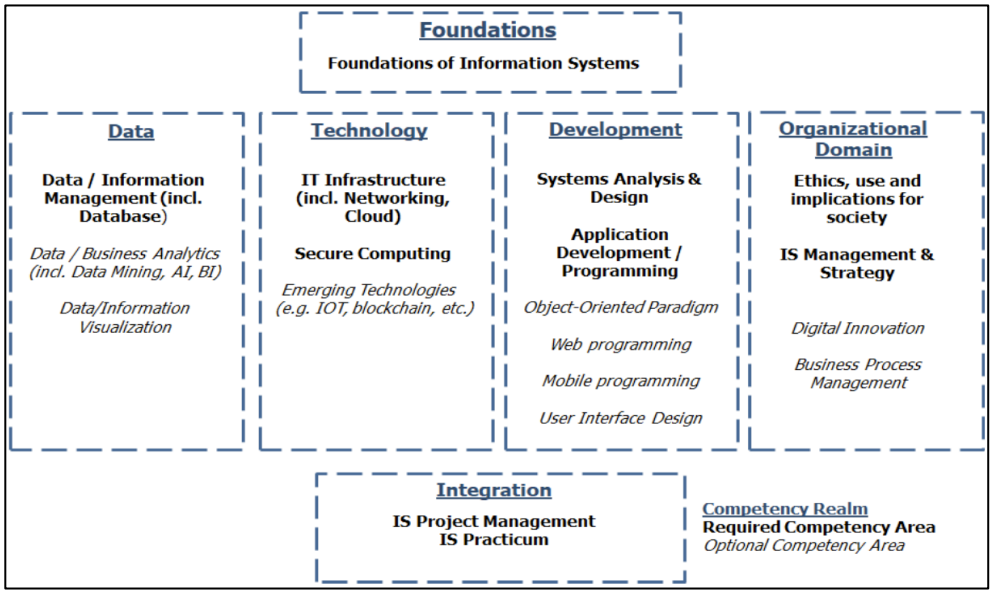

Figure 2: IS2020 Competencies

For each realm, however, at least one competency area is identified as required, thus ensuring the breadth of coverage that characterizes the IS degree. The ability to integrate knowledge across four realms is further strengthened in the Foundations and Integration realms, thus preparing a more holistic understanding of the discipline. Improving the ability of students to first identify required competencies is accomplished in Foundations, and the ability to combine and deploy acquired knowledge and skills as needed completed via Integration.

While the competency model does not map directly to the IS2010 model (Topi et.al, 2010), two key changes are considered significant: the addition of a programming requirement and the inclusion of a capstone project tying together the four competency realms. It should be noted that the programming requirement was a controversial exclusion in the IS2010 model compared to prior information systems model curricula.

Adoption of competency thinking raises questions outside the scope of curriculum guideline work, such as methods for measuring students' competencies. Also, the number of competencies can become very high, leading to a large number of details. Proposing a traditional curriculum model with a fixed set of core and elective courses might have been easier to adopt. The tension between flexibility to adapt guidelines to different contexts and ease of adoption and application was one element in the call for a more continuous and community-based effort in updating the guidelines.

Efforts to create a living document approach to keep the model curricula and competencies current are ongoing. Parallel efforts are also ongoing to maintain current and relevant criteria for accreditation of IS programs within the ABET community. A formal ABET criterial process contributes to the continuous improvement of the implementation of these curricula models.

Accreditation of IS Programs

Program accreditation might not be appropriate for every computing program, but accreditation does provide value to its stakeholders and to institutions. It helps maintain standards through an honest self-reflection of the program under a formal structure of an unbiased structure. Accreditation helps provide and

maintain accountability to constituents. In a period where many questions exist regarding the value of higher education, accreditation helps provide needed program validation thorough a formal review process.

Accreditation does not indicate that a degree from one accredited institution is identical to a degree from another accredited institution. Accreditation criteria enables programs to identify their own niche and to deliver the program within the required criteria. Program-level accreditation is intended to ensure that degree programs meet established standards for curriculum, appropriate faculty expertise, student admission and graduation requirements, adequate facilities, and financial resources. Matching accreditation curriculum criteria to established model curriculum guidelines is an ongoing process, just like the ongoing process required of institutions in assessing their institution's programs.

The Association for Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers Computer Society (IEEE-CS) worked together to create the Computing Sciences Accreditation Board (now called CSAB) in 1984. In 2021, the American Statistical Association (ASA) joined CSAB coinciding with the addition of data science accreditation. CSAB is currently the lead ABET society for computer science, cybersecurity, information systems, information technology, software engineering, and data science. As the lead society CSAB has responsibility for the accreditation criteria and the selection, training, and assignment of program evaluators. CSAB serves as the sole society of the Computing Accreditation Commission (CAC) of ABET.

ABET is recognized as the accrediting body for programs in computing, engineering, engineering technology, and applied and natural science. It is the gold standard for accreditation. Within ABET, the CAC is responsible for accrediting all computing related disciplines. Choosing program accreditation has been viewed as optional at higher education institutions, however many institutions require program accreditation when available. Despite the lack of mandatory accreditation expectations, an increasing number of institutions seek accreditation for their computing programs each year, suggesting a recognized value of accreditation. ABET is recognized by the Council on Higher Education Accreditation (Oudshoorn et al., 2018). While Computer Science programs make up the majority of accredited computing disciplines, the number of accredited computing programs in other disciplines are increasing (Figure 3).

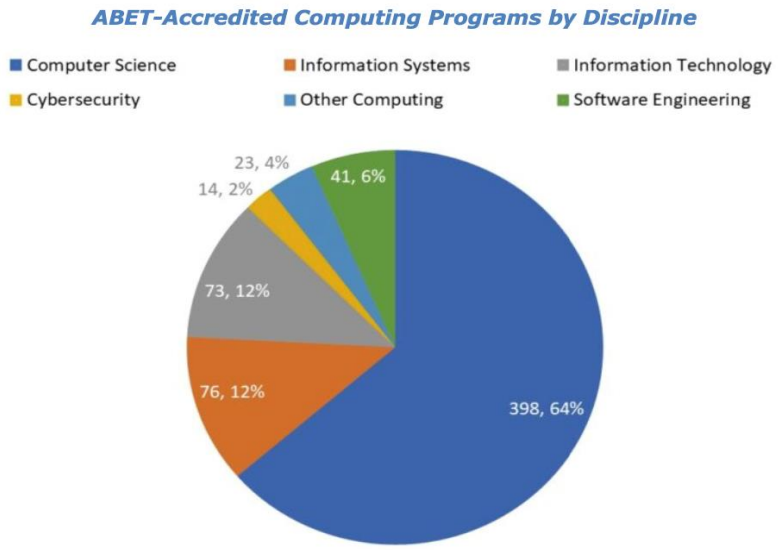

Figure 3: ABET-Accredited Computing Programs

With the rapid increase in the number of computing programs, there is a similar rise in the desire for accreditation of those programs. As an organization dedicated to quality assurance in STEM education, ABET accreditation criteria has evolved to provide confidence that these programs meet the quality standards that produce graduates prepared to enter the workforce.

The CAC of ABET is responsible for accreditation of all disciplines involved in the development and use of technology related to computers. All members of the computing community have the opportunity to influence computing accreditation criteria by providing feedback on proposed program criteria changes while open for public review and comment. In addition, those responsible for developing criteria often seek a wide set of input from experts in related disciplines. The four commissions of ABET (computing, engineering, engineering technology, and applied natural sciences) follow a harmonized set of accreditation requirements. The computing accreditation criteria have eight criterion categories that all six computing disciplines share.

ABET CAC General Criteria (ABET, 2022) required of all computing disciplines fit into eight criteria:

1) Students
2) Program Educational Objectives
3) Student Outcomes
4) Continuous Improvement
5) Curriculum
6) Faculty
7) Facilities
8) Institutional Support.

In addition, each discipline can have program-specific criteria. Currently, there are additional program criteria for computer science, information systems, information technology, cybersecurity, and data science. For example, institutions seeking accreditation of an information systems program must also meet specific program criteria in the areas of student outcomes, curriculum, and faculty, delineated below.

ABET IS Criterion 3 – Student Outcomes

All computing programs must have documented and publicly stated student outcomes that include general criteria 1 through 5 and information systems also have an additional sixth criteria. These criteria state that graduates of the program will have an ability to:

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
3. Communicate effectively in a variety of professional contexts.
4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
6. [Information Systems] Support the delivery, use, and management of information systems within an information systems environment.

ABET IS Criterion 5 – Curriculum

For all computing programs, curriculum requirements specify topics, not prescribe specific courses. All programs must include mathematics appropriate to the discipline and at least 30 semester credit hours of

up-to-date coverage of fundamental and advanced computing topics that provide both breadth and depth. The computing topics must include:

1. Techniques, skills, and tools necessary for computing practice.
2. Principles and practices for secure computing.
3. Local and global impacts of computing solutions on individuals, organizations, and society.

In addition, information systems programs have a fourth criteria consisting of three elements:

4. Information systems program criteria.

    a. At least 30 semester credit hours that include coverage of fundamentals and applied practice in application development; data and information management; information technology infrastructure; systems analysis, design and acquisition; project management; and the role of information systems in organizations.

    b. Information Systems Environment: At least 15 additional semester credit hours (or equivalent) of a cohesive set of topics that provide an understanding of an information systems environment.

    c. Quantitative analysis or methods that must include statistics.

ABET IS Criterion 6 Faculty

Each faculty member teaching in the program must have expertise and educational background consistent with the contributions to the program expected from the faculty member. The competence of faculty members must be demonstrated by such factors as education, professional credentials and certifications, professional experience, ongoing professional development, contributions to the discipline, teaching effectiveness, and communication skills. Collectively, the faculty must have the breadth and depth to cover all curricular areas of the program.

The faculty serving in the program must be of sufficient number to maintain continuity, stability, oversight, student interaction, and advising. The faculty must have sufficient responsibility and authority to improve the program through definition and revision of program educational objectives and student outcomes as well as through the implementation of a program of study that fosters the attainment of student outcomes.

In addition to the general criteria, information systems criteria include additional faculty requirements, some full-time faculty members, including those responsible for the information systems curriculum development, must hold a terminal degree with a program of study in information systems.

The Continuous Improvement Process of Criteria

As discussed earlier, all members of the computing community have the opportunity to influence computing accreditation criteria by providing feedback on the proposed program criteria while it is still open for public review and comment. The joint CSAB/CAC Criteria Committee regularly seeks input on necessary changes to existing criteria. With the release of IS2020 there were several recommended changes in competencies as different from the previous requirements in IS2010 (Topi et.al., 2010). The question arises as to whether ABET IS Criteria are in line with the evolving model curriculum and required core competencies.

As is often done to maintain currency between changing model curriculum and the requirements for accreditation, feedback in the continuous improvement process is desired. The CSAB/CAC criteria committee sent a survey to all (72) ABET IS Program Evaluators (PEV) and all chairs of ABET accredited IS programs. Respondents were asked specific questions regarding the changes recommended in IS2020 compared to IS2010. We received a 41% response rate, with responses indicating:

- Relevance (High/somewhat) – Adding and requiring a high-level programming language (68%) and major project (72%) was very positively received and supported.

- Elements in the current ABET Criteria 5 items were still found to be relevant by more than 64% of respondents, as being relevant and in line with the recommendations of IS2020.

- IS 2020 recommends requiring competencies of IS management and an IS practicum which is not currently required in ABET Criterion 5. However, these requirements received mixed responses as whether to add these elements to Criterion 5.

- IS2020 added several optional competencies, but there was no consensus on adding any of them to the requirements.

Additional feedback elicited responses such "*Thanks for bringing this topic/discussion to the ABET IS community. It's nice to see that our opinions are important to ABET*" The results of this survey and additional online feedback are then used by the CSAB/CAC Criteria Committee to keep IS program criteria relevant to the ABET constituencies. Based on the survey and online feedback, the CSAB/CAC Criteria Committee has now proposed changes in the ABET Information Systems program curriculum criteria.

Proposed changes to Criteria 5 - Curriculum

These curriculum requirements are in addition to the General Criteria curriculum requirements and specify topics, but do not prescribe specific courses. Proposed changes are noted in ***italics***. These requirements are:

(a) Information systems: At least 30 semester credit hours (or equivalent) that include:

1. Coverage of fundamentals and applied practice in application development; ***programming;*** data and information management; information technology infrastructure; systems analysis, design and acquisition; project management; and the role of information systems in organizations.

2. A major project that requires integration and application of knowledge and skills acquired in earlier course work.

(b) Information systems environment: At least 15 additional semester credit hours (or equivalent) of a cohesive set of topics that provide an understanding of an information systems environment.

(c) Appropriate mathematical and statistical models and techniques to solve a broad range of problems in Information Systems.

While not responding directly to the recommended changes in IS2020, the CSAB/CAC criteria committee used its own internal continuous improvement process to determine whether any changes were necessary to existing criteria based on the new model curriculum. These proposed changes are now published for public comment and feedback. This process is very similar to the that used by institutions seeking feedback to determine if any changes based on feedback from their constituents for their program objectives and

student outcomes. Just as the requirements of employers and other constituents evolve, thereby driving change to the requirements of an institution's program, so do recommended model curricula and constituent feedback drive change in accreditation criteria.

Conclusion

This paper attempts to explain recommended changes in the latest information systems model curricula and competencies, along with the purpose and basis of the process and value of program accreditation in validating and implementing current and relevant curricula. An example of the process used to keep both model curricula and accreditation criteria consistent was presented. The process for the continuous improvement of accreditation criteria was demonstrated. The process used should provide academic administrators, industry partners, prospective students, and the public confidence in relevancy and currency in the accreditation standards use to assess academic programs.

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