

Assessing Information Systems and Computer Information Systems Programs from a Balanced Scorecard Perspective

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ABSTRACT

Assessment of educational programs is one of the important means used in academia for accountability, accreditation, and improvement of program quality. The assessment practices, guidelines, and requirements are very broad and vary widely among academic programs and from one institution to the other. In this paper, from the theoretical lenses of a strategic planning and management methodology, the Balanced Scorecard, we try to integrate various perspectives into a performance assessment framework for an educational assessment of computing and information systems. Particularly, based on the actual accreditation experience, we propose two assessment models: a conceptual model and a process model. This modeling approach addresses the critical conceptual elements required for educational assessment and provides practical guidelines to follow for a complete, smooth and successful assessment process. In addition, we present a set of robust tools and techniques, incorporated into the process steps, team work, and task-driven management process. We were successful in our accreditation efforts, and improved the quality of our computing and information systems programs by using these presented assessment methods. We share our views and thoughts in the form of lessons learned and suggested best practices so as to streamline program assessment and simplify its procedures and steps.

Keywords: Assessment, Program assessment/design, Accreditation

1. INTRODUCTION

People can interpret and apply assessment guidelines, practices and requirements in many ways. Typically, in academia, educational assessment facilitates program quality improvement and accreditation. In this work, the main motivation is to tackle an assessment process and to present specific assessment models and a set of tools with the framework of process steps, team work, and project based tasks. Moreover, we view this as a way to share and disseminate our work practices, findings, and lessons learned in an assessment task.

For an educational accreditation purpose, a number of criteria and guidelines for assessment are typically mandated by a national or regional accreditation agency such as ABET, AACSB, and SACS, with the main responsibility of maintaining the standards for degree confirmation. An

assessment process is not always simple and direct, because there are many factors to consider and evaluate from different perspectives at different levels. However, the assessment of computing and information systems programs and disciplines for an educational accreditation purpose is a procedural-based evaluation process. The academic assessment is accomplished typically at three levels: institution-level (e.g., university), school-level (e.g., school of business, or school of education), and program-level assessment (e.g., information systems program or accounting program).

Although program-level assessment is the focus of this paper, the modeling described here can also be used for institution-level and school-level assessment. In fact, a university may pursue accreditations at all three levels at the same time by applying the same model to satisfy all assessment needs, resulting in improved effectiveness and

efficiency. There are several reasons for assessment. They are grouped into three major categories: (i) to satisfy external accreditation requirements at various levels: university, school and program; (ii) to satisfy internal requirements of the university, such as periodic program reviews, etc.; and (iii) to utilize the results internally to improve the programs or for recruiting and marketing purposes.

The goal of this paper is to present and explain a set of robust and comprehensive assessment guidelines for computing and information systems (CIS) fields using a set of models. We designed and implemented a comprehensive assessment methodology for two computing programs (computer information systems and computer science). We started with the mission statements and streamlined the main objectives of the programs. The method includes a comprehensive and solid set of measurable goals and outcomes. In the final, or 'closing the loop' phase, we took the assessment results and applied the recommendations to improve the quality of the programs. We have been using this presented assessment methodology for several years, and it has helped us not only to acquire an educational accreditation but also to improve the quality of our programs from different perspectives. Moreover, this assessment method has simplified the accreditation process of two computing and information systems programs by ABET under the computer information systems (CIS) and computer science (CS) curriculum guidelines.

The more specific objective of this study is threefold: to propose models addressing conceptual foundations and processes required for program assessment, to discuss our experiences that we gained through ABET accreditation in line with the proposed models, and to provide insights to practitioners who are interested in assessing their programs.

The rest of the paper is structured as follows: Section 2 reviews literature on program assessment and a relevant theory background of our proposed assessment models. Drawing upon the theoretical foundation, Section 3 proposes a conceptual model along with a process model to provide specific ideas about how to assess a program. It describes the actual assessment phases that we went through following the process model. Section 4 discusses the contributions of our efforts, along with limitations and suggestions for future directions. The final section concludes the study.

2. LITERATURE REVIEW and THEORY BACKGROUND

2.1 Relevant Work

Faculty who recognize the advantages of an accredited program are familiar with curriculum models and accreditation requirements. Landry, et al. (2009; 2006) discuss the Information Systems (IS) 2002 model curriculum and how 150 learning units map into six IS core areas. The model curriculum is a result of a collaborative effort that describes the characteristics of the IS profession. It was updated recently (IS 2010) to maintain currency with rapidly advancing IS technology and globalization (Topi et al., 2010).

DeLorenzo, et al. (2006) frame the ABET accreditation model with respect to the balance between business and stand-alone IS programs and overview the common curricular components of the ABET-CAC in the context of

the top 19 rated MIS programs. Hilton, et al. (2003; 2004) conduct a comparison of the school-level Association to Advance Collegiate Schools of Business (AACSB) and program-level ABET/CAC accreditation standards. They find AACSB and ABET/CAC accreditation standards to be generally compatible.

Based on a survey of IS program leaders in business schools, the understanding of potential benefits of accreditation is quite low. Challa, et al. (2005) find that many of the requirements of ABET, including assessment, are applicable to IS programs in general. Nicolai (2004) addresses the dilemma of how a particular curriculum is positioned into an accreditation model. She concludes that "IS expects database students to achieve a higher level of learning (application) and IT expects database students to achieve the first level of learning (understanding)."

Sun (2003) and Kortsarts et al. (2009) discuss the technical and personal skills necessary for effective IT professionals. Necessary skills include: helpdesk skills, programming and optimizing code, systems administration, security, systems integration, database, web mastering, knowledge of disaster recovery procedures, and business planning. Such a person also possesses personal skills: creativity to know whether a thing is possible, ways to work around problems, organization skills, interpersonal skills, the ability to explain complexities in simple terms, to link components together, to see where future growth can happen, to work effectively on a team, and to possess the spirit and practice of cooperation. The authors conclude that the assessment of such skill mastery is, thus, critical to a success of IT professional.

2.2 Theoretical Background - Balanced Scorecard

The Balanced Scorecard (BSC) is a strategic planning and management methodology aimed at the inclusion and integration of various perspectives into one framework for a business (Balanced Scorecard Institute, 2011). Traditionally, financial performance is considered a lagging indicator telling the story of how well a business did in the past, but not a predictor for future success. To 'balance' the traditional financial perspective, BSC adds the learning and growth perspective, the customer perspective, and the business perspective to provide leading indicators on how well the company will "create future value through investment in customers, suppliers, employees, processes, technology, and innovation" (Balanced Scorecard Institute, 2011; Kaplan & Norton, 1996).

Although BSC was originally proposed as an improved performance measurement system, it is more commonly used as a strategic management system that implements business strategy at all levels of the organization by facilitating the following four recursive phases: i) strategic focus – the foundation of performance measures, ii) assessment – auditing existing measures, developing, and applying new measures, iii) change planning and implementation – developing plans for specific improvement initiatives, and iv) continuous improvement – continuing to track key measures and providing feedback to support continuous improvement programs.

Since its introduction, at least 60% of Fortune 1000 organizations used a BSC system (Niven, 2008). As BSC becomes more popular, there are also quantitative studies on

its positive performance effectiveness. For example, de Geuser, Mooraj and Oyon (2009) collected and analyzed survey data from 76 business units to affirm its positive impacts on organizational performance. Specifically, they indicated that the positive impacts are primarily based on better and continuous strategizing and greater alignment of organizational processes, competencies, structures and services (de Geuser, et al., 2009).

This success aided the spread of BSC to non-business institutions, such as government and nonprofit agencies (Niven, 2008). In non-business organizations, the primary goal is not necessarily financial performance. However, the central idea of balancing lagging and external performance outcome indicators with leading internal indicators is adaptable to other types of organizations (Balanced Scorecard Institute, 2011; Niven, 2008). This adaptation process includes defining performance indicators and perspectives that fit the nature and objectives of the targeted organizations.

BSC is also used by academic institutions, for strategizing within a university divisions (McDevitt, Giapponi, & Solomon, 2008) and administering online educational programs (Shelton, 2010). However, to the best of our knowledge, there is no discussion of BSC in the context of learning outcome assessment, especially with accreditation as the context. A main goal of our paper is thus an attempt to fill this gap.

2.3 Conceptual and Process Models of Assessment

When we started to develop and implement the assessment plans for our computing and information systems programs, we did not initially consider the BSC framework. In hindsight, many insights from BSC framework would have favorably enhanced our assessment process. The crucial foundation of the assessment models that we propose are similar to the recursive phases of the BSC framework. Although the concept of balancing perspectives was not considered explicitly in the context of BSC from the beginning, it was always a key element in our assessment process.

Fostering the recursive phases of BSC and the core components of assessment from the ABET Assessment for Quality Assurance Model (ABET, 2010), we propose a conceptual model of assessment (see the conceptual model in Figure 1), which demonstrates the general idea of what assessment is. The conceptual model consists of four parts: i) institutional/school/program level's strategic guidance components, ii) evaluation components including performance criteria and assessment, iii) interpretation of the assessment results, and iv) continuous improvement for quality assurance through feedback. The strategic guidance components interconnect with the management direction of institutional/school/program, which include mission, objectives, and outcomes. A mission is a broad and long-term vision of an institution/school/program. There are objectives, outcomes, and strategies that achieve the mission, but the mission is the eminent and most important aim. Objectives, on the other hand, are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve. Outcomes are specifications that describe what students are expected to

know and are able to do by the time of graduation (Vlasceanu, Grunberg, & Parlea, 2007).

At the program level, we anticipate that students are able to achieve the educational objectives after graduation, if they achieve these outcomes. Appendix 1 shows the program-level mission statement, educational objectives and outcomes of our CIS program as an example. The evaluation components include performance measurement criteria of the strategic guidance components, assessment of performance, and interpretation of the results of assessment. While the guidance components are about "where to go," the evaluation components are related to analysis mechanisms to answer "where do we stand."

Performance indicators are specific and measurable metrics identifying the performance(s) required to meet outcomes (Prados, Peterson, & Lattuca, 2005). Our goal is to have students who are able to demonstrate these high level measurable statements that represent the knowledge, skills, attitudes or behavior by the time of graduation. *Assessment* consists of the processes that identify, collect, use and prepare data that directly or indirectly evaluates performance (i.e., achievement). *Interpretation* is the process that translates the meaning of the assessment results and provides recommendations. The feedback process is critical to creating and maintaining a systematic quality assurance system. When successfully implemented, all elements of the quality assurance process interact with one another (ABET, 2010). This model maps easily to the assessment requirements of accreditation bodies such as ABET (2010), ACCSB (2010), and SACS (2010), as well as the internal needs and framework for program improvement.

Although there is a general conceptual-level of understanding of assessment, there is limited literature that discusses how to do it. Based on our actual accreditation experience and research on assessment, we also propose a process model of assessment (see the process model in Figure 1) in line with the conceptual model. The process model consists of six stages that show how to prepare an educational assessment in details.

- Stage 1: Develop institution/school/program level mission statement, objectives and outcomes
- Stage 2: Develop and map program objectives, outcomes, and performance indicators
- Stage 3: Build a long-term assessment plan
- Stage 4: Apply direct and indirect assessment
- Stage 5: Interpret the results of assessments and provide recommendations
- Stage 6: Feedback - revise the assessment process based on the recommendations

3. ASSESSMENT MODEL IMPLEMENTATION

The proposed conceptual model outlines a process model for assessment as shown in Figure 1. We followed the process model for both (1) program improvement, and (2) preparing for ABET accreditation. A committee of five dedicated faculty carried out the implementation of the assessment process tasks. This committee met regularly to plan for and spearhead the assessment cycle. In the following, we will shed more light into the implementation by dividing it into the six stages that we propose in the process model of assessment.

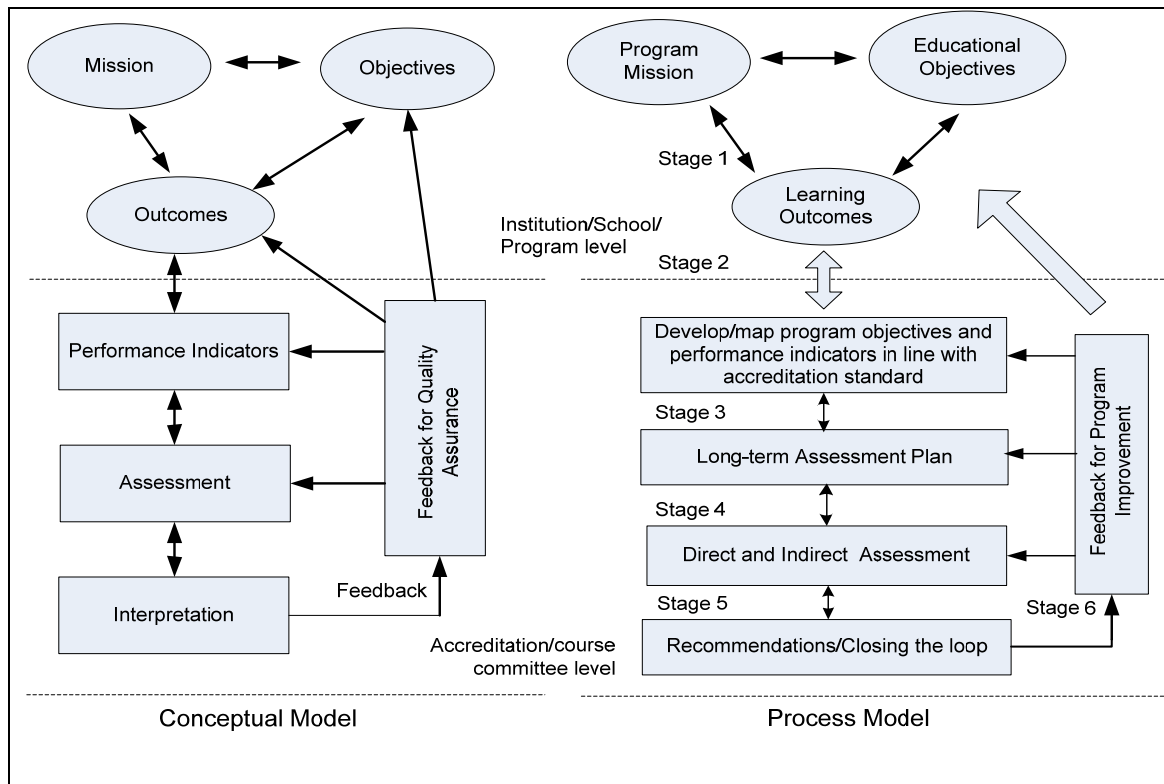


Figure 1. Conceptual and Process Models of Assessment

Stage 1: Develop Program-Level Mission Statement

Developing a mission statement for the program is one of the most essential steps in the assessment model implementation. All program faculty members should contribute to developing this mission. The program mission statement should: (1) be consistent with the university mission statement (2) reflect the programs vision and ambition, and (3) be embraced by all stakeholders of the program. Since the program objectives and outcomes explained in stage 2 will implement and reflect this mission statement, it should encompass the long term vision and objectives of the program.

Since in Stage 2, most of the steps are written with a statement on what it should be followed by what we did to accomplish it, maybe we should write something here on what we did to figure out the mission statement too. I would think that we should continue this pattern for all the stages, and therefore, I will edit it this way. Please delete if it is unnecessary.

Stage 2: Develop Program Objectives, Outcomes, and Performance Indicators

Once the program mission is in place, the faculty members begin the process of identifying overarching objectives and measurable outcomes expected of the students in that program. Because we were interested in obtaining accreditation by ABET, Inc. (ABET, 2010), we followed the guidelines suggested by ABET to ensure that our programs were in accord with other ABET-accredited programs. Based

on existing program objectives, we refined and developed six objectives for our CIS program; we then further divided each objective into two to five learning outcomes. For example, one objective is for students “to be competent in core foundations of information systems, computing and mathematics.” An example of an outcome to measure that objective is “students will be able to effectively solve computing problems using an appropriate programming language, data structures and algorithms.”

The next step is to break the learning outcome into specific measures called performance indicators. The main idea is to have a measurable indicator that is a discrete action for which student understanding is quantitatively determined. For example, one of the performance indicators for the preceding outcome that we came up with was that a student is able to “design, implement and select appropriate data structures.” We then used one or more of the courses in the curriculum to measure this performance indicator. Once the program objectives and the learning outcomes are defined for the entire program, it is necessary to designate courses in which the different outcomes are measured. The course committees separately determine the course goals for each course. We used a spreadsheet that listed each program objective, each of the related learning outcomes, and one or more courses to which the outcome pertained (see Appendix 2). The type of assessment that we wanted to do for that outcome was also listed in the spreadsheet. Our process included revisiting these assignments (i.e., which courses, which outcomes, and type of assessment for a given semester) as necessary.

Stage 3: Build a Long-term Assessment Plan

It is imperative that the assessment plan is simple and manageable to all parties involved. To make the assessment process manageable, we opted for a 3-year cycle in which each objective and each outcome is assessed at least once. Thus, we proposed to conduct assessment of a subset of outcomes every semester. The assessment plan timeline with 3-year cycles is shown in Appendix 3. In this way, most courses were assessed once every 2 years, or every 3 years at most. This is a very achievable plan with minimum impact on workload, which is a common concern among faculty (Hogan, Harrison, & Schulze, 2002).

Stage 4: Apply Direct and Indirect Assessments

We defined several assessment methods, including both indirect and direct methods (see Appendix 4).¹ The indirect methods are usually easier to implement and less time-consuming. One of our most helpful indirect methods is the exit survey. At the end of each semester, students in every course are surveyed in a questionnaire that asks how well the learning outcomes for that course were met. The tallied results are provided to the course committees for review and recommendations. While the student responses are more likely opinion than fact, it is important to know whether or not the students recognized the learning outcomes as major components of the course. Using this method, we regularly identified issues that needed resolution.

The direct methods of assessment, on the other hand, are much more time-consuming to the instructor; however their results are more factual. An example of direct assessment is the assignment analysis, in which the course committee evaluates an assignment or a problem that determines the students' understanding of one learning outcome, or a specific performance indicator.

The committee identified eleven assessment methods, out of which nine are direct methods of assessment. It is critical that the assessment process does not overload the faculty; that is, the process should not outweigh the benefits. It was also important to us that the assessment duties are spread among all faculty as much as possible with main assessment tasks rotating among all faculty.

Stage 5: Interpret the Results of Assessment

At the end of each semester, assessment results are collected and tallied. The results and summaries are given to the faculty and the course committees for their review and recommendations. Results come from student surveys, assignment analysis, logbook analysis, exit interviews, etc. At this stage, we receive information about the quality of classes, and the quality and ability of our students. Overall, the results help to point out areas that are strong and areas that need improvement.

Stage 6: Feedback and Revision

The last stage is the feedback step that 'closes the loop' and provides recommendations to revise and improve the course. The resultant recommendations and results from the

assessment eventually make for a better program. As demonstrated in the continuous improvement stage of BSC, we realize that feedback for quality assurance of the program is important in this stage. Thus, some course material, assessment methods, assessment plan, and even learning outcomes need revision. For example, the feedback and revision could require that more material is added to a class, or more time spent on a specific topic. Some assessment methods are found ineffective for measuring the performance, thus assessment methods are replaced. Some courses require no changes. In other courses, changes are made based on the recommendations that are generated as a result of the assessment. Categories of recommendations we have implemented include changes in program and course outcomes, changes in performance indicators and assessment tools, increases in course support and changes in instructors. Table 1 presents some examples and reasons for revisions as result of this stage.

Closing the loop ²	
Reasons	Examples of revisions/changes
Students did not feel that material was covered well in the course.	Adding one more teaching hour to the target topic to give more coverage of the subject. For example, add one hour to explain more on the topic of threads and multithreading in Java.
Faculty recognizes that material or topic is no longer necessary.	Revise learning outcomes to exclude that topic. For example, remove bubble sort.
The assessment tool of a given topic is not effective.	Revise assessment plan so that exam evaluation is used instead of assignment evaluation for this topic.

Table 1. Examples of Revisions

4. DISCUSSION AND LESSONS LEARNED

In this section, based on the models that we presented and lessons that we learned during the course of this work, we discuss our contributions in the area of education program assessment and summarize three suggested best practices as our views and thoughts of the assessment.

The most important contribution of this work is to provide both conceptual and process models at the same time. Based on the important concepts and components that we learned through the ABET accreditation process, we conceptualize "what to do" in the conceptual model and "how to do" in the process model. We hope that our efforts provide not only a conceptual understanding of program assessment but also procedural guideline to those who are interested in assessing their programs.

¹ Please note that the assessment methods are very vast. Individual universities may custom designed their programs to focus on a specific set of assessment methods.

² In the final stage of our assessment methodology, we implement and apply improvements to the program and courses as recommended by the assessment process. The improvements include applying changes and revisions to the courses based on the assessment recommendation and feedback.

Another important contribution from a BSC perspective is the introduction of supplementary perspectives to balance the main goal in strategy planning. The main goal of a company is high financial performance. The financial perspective is both centrally and externally measurable by metrics such as profits and revenues. However, it is also a lagging indicator measuring the fruit of company effectiveness in the past, but not the current and future readiness of the company. Thus, BSC introduced balancing perspectives to serve as leading and internal indicators so the company can measure and improve them.

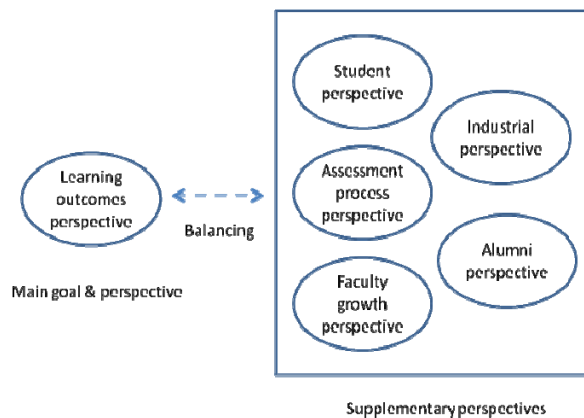


Figure 2. A conceptual framework of BCS as applied to learning outcome assessment

Figure 2 shows the conceptual framework of BCS as adapted to learning outcome assessment. In this context, the learning outcome assessment perspective replaces the financial perspective as the main goal. As discussed earlier in the paper, we define this main perspective by the set of mission statements, learning objectives, goals and performance indicators, and measure the performance indicators by the set of assessment tools.

For the supplementary perspectives, the customer perspective now becomes the student perspective. These considerations are directly related to learning outcomes, including what the students want and expect to learn. Or the considerations are associated with the issues of quality and effectiveness of learning, directly required for assessment by the accreditation bodies. Some examples of these considerations include the level and quality of advising, the sequencing of courses for effective completion of degrees, the integrated uses of learning management systems (LMS) and the student proficiency of using them, etc. It is possible to incorporate some of these considerations directly into learning goals and performance indicators, such as proficiency on LMS. Other considerations are measured under other departmental goals. This holistic consideration of complementary and balancing perspectives leads to better definition and fulfillment of the overall departmental goals. In this context, student learning outcomes is just one of these overall departmental goals, albeit a very important one.

The business process perspective is substituted by the assessment process perspective which is a key component of the assessment plan discussed in the paper. Without an efficient and effective process to ensure using the assessment results to improve the program, future fulfillment of student

learning outcomes is at risk. This is indeed a leading indicator.

The learning and growth perspective is superseded by the faculty growth perspective to emphasize that learning and growth refer to the employees, i.e., faculty, and to remove the ambiguity of the word “learning” being associated with students. This perspective is especially important for information systems and computing programs as the technology changes very quickly. In fact, many of our remedial recommendations based on assessment results are related to the addition and refinement of course material in which faculty development is needed. This perspective includes issues such as securing funding for faculty development, cultivating faculty culture for adopting technology and improving teaching skills, providing resources to share teaching experience and course material, emphasizing teaching effectiveness in faculty annual evaluation, etc. We adopted some measures in this perspective for program improvement. However, the best action plans are usually different for different universities. Raising this as an explicit perspective can bring focus on these issues to sustain long-term success of learning outcome assessment.

We add two new perspectives: the industrial perspective and the alumni perspective. Our departments have a close relationship with industrial partners and an active industry advisory board. They have mentored more than 100 real-world capstone projects in the past seven years. Their priorities of desirable student knowledge and skills are not always the same as those of the faculty and the accreditation guidelines. In our experience, their continuous involvement in our program activities, including learning outcome assessment such as senior project evaluation workshops and exit interviews, help keep our program abreast of industrial development.

Finally, our alumni are in the unique position in helping us to refine our program learning outcomes and how the outcomes are mapped to our courses, simply because the alumni have gone through the degree programs themselves. In the past, we have not solicited input from our alumni explicitly during the assessment process. Several alumni serve in our industry advisory board and thus contribute to our assessment as industrial partners, while bringing in the alumni perspective. A more systematic method to solicit alumni participation is one of our future directions.

Besides our proposed BCS model adapted for learning assessment, we elaborate three suggested best practices we learned from our accreditation efforts below.

Suggested Best Practice #1: Formation of a program accreditation and assessment committee

In the past, our ABET accreditation effort was spearheaded by one or two individual faculty members, usually the program chairs. This occasionally resulted in uneven faculty participation and missed tasks. Despite best efforts and successful accreditations, the experience was less than fulfilling. There was not sufficient discussion among faculty members to recommend and implement comprehensive changes to improve the programs. Efforts were focused only on issues of perceived weaknesses related to accreditation. Furthermore, the concentration of work created stress for the lead persons.

However, it is also not realistic to manage accreditation preparation through the entire faculty body. We tried to discuss nuanced accreditation issues in the past which usually ended inefficiently as faculty with different levels of understanding tended to over-discuss unimportant issues and details. The uneven level of contributions during and after the meetings also discouraged faculty participation.

In the latest ABET accreditation cycle, we formed a committee of five devoted faculty members to lead the effort for both accreditation and assessment. This was a suitable size for gathering ideas and effectively executing the preparation plan. As the committee successfully resolved tasks effectively, a culture of teamwork began. The resulting collaboration continued beyond accreditation and assessment, resulting in resolving other program matters and publications of papers. Merging accreditation and broader assessment efforts also reinforced each other, resulting in program improvement beyond accreditation

Suggested Best Practice #2: Adoption of a management process for accreditation and assessment

Accreditation and assessment involve many concurrent tasks to prepare a large collection of documents. These tasks are identified, refined and specified. Solutions to these tasks are designed and implemented (Mayes & Bennett, 2005). Leaders and supporters of tasks and deadlines are established and monitored. Many documents are written and refined many times before their finalization. Furthermore, documents are updated and accessed by many different groups of users: faculty members, supporting staff, adjunct faculty, course committees, etc. Thus, in a sense, accreditation and assessment is regarded as a project with many similarities with software development projects: risk management, version control, feature completeness, etc.

As a result, an early task our accreditation committee undertook was to adopt a reasonable project management process. On one hand, we needed a process to ensure the systematic identification and completion of needed tasks. On the other hand, we needed a process that is flexible enough to let innovative ideas flow freely. As information systems and computer science faculty members, we borrowed ideas from Rational Unified Process (RUP) (Kruchten, 2003) and Scrum Development (Schwaber, 2004). RUP is a leading iterative software development framework and Scrum is “an iterative, incremental framework for project management and agile software development” (Schwaber, 2004; Wikipedia, 2010). Ideas we borrowed from them are iterations of task management until completion, frequent and systematic status updates, change control, continuous quality verification, and heightened communications through frequent meetings.

The process we eventually adopted was to hold weekly meetings. A dedicated work area folder, which also served as an archive and version control, held the documents developed during the week. A progress file, simply in Microsoft Word format, documented every task, its leader and steps remaining for the task. The urgency and progress status of each task was color coded. Each task was re-visited each week to check its progress with possible re-examinations of their goals, design and implementations. This ensured that tasks were completed effectively within

deadlines and that no task was missed. The longitudinal sequence of progress files also provided a good history of progress. As an example, Appendix 5 shows a snapshot of some assessment tasks in a progress file during the preparation process of our previous ABET accreditation cycle. There were 25 such progress files, one per meeting.

We were cautious to identify tasks that were best resolved during the meeting and they were worked upon immediately. For example, the assessment committee refined the wordings of updated program objectives during the meetings. This provided quick consensus so that the objectives are presented to the full faculty body for approval rapidly. On the other hand, there were many tasks accomplished by individuals after the meeting. We would have used project management software which provides aids using a more formal project management process. However, since the key members met frequently in person, we found that our informal approach incurred the least overhead while keeping communication of ideas open.

Suggested Best Practice #3: Use of technology when appropriate

We used technology to aid the assessment process only when the benefit justified the overhead. We used an Intranet to provide easy access to the myriad of documents we created. There were sections to host documents that were relatively stable and areas for documents that were more volatile, requiring rapid changes. We developed a Web database application to hold the exit surveys of all undergraduate courses. The application also allows members of the course committees to enter their recommendations, which are then collected, discussed and approved. Appendix 6 provides selected screenshots of the Web application to illustrate its main functionality. We did not use any particular collaborative tool for developing documents. Instead, the committee worked together to finalize versions created by individual members during our meetings. Using a real-time collaborative tool, such as those similar to the now defunct GoogleWave (2010), is an experiment we will pursue in the future.

5. CONCLUSION AND FUTURE DIRECTIONS

In higher educational institutions, the assessment process is a crucial task that can benefit many stakeholders. Assessment is a very broad process with no fixed procedure or methodology mandated. In the information technology disciplines, however, there are certain rules and actions that are necessary to accomplish for a reasonable assessment. In this paper, based on BCS, we presented a conceptual model and a process model with some tools for assessment for information technology programs.

The future direction in this work is twofold: (1) Unifying the terminology and language of the assessment. The definitions of the terms for assessment may lead to different notions in different contexts. Standardized assessment language and terminology will lead to simplifying operations that build upon assessment, like accreditation. (2) Relating model curricula and accreditation requirements for specific disciplines with assessment models. This aids in using a holistic model to satisfy varying assessment goals. With the entire faculty participating in the assessment process, it was

a very positive eye-opener for our program, and assessment was definitely a positive addition to our programs.

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APPENDIX 1: Program Level Mission Statement, Objectives and Outcomes (Example)

The mission of the CIS program is to prepare students for technical, administrative and management careers in the analysis, design, implementation, maintenance, support, operation and management of computer information systems.

CIS Objectives and Outcomes

CIS Objective #1: Computer Information Systems graduates will be competent in the fundamentals of information systems, computing, and mathematics.

Outcome 1.1: Students can present the key concepts and principles of computer and information systems.

Outcome 1.2: Students will be able to effectively solve computing problems using an appropriate programming language, data structures and algorithms.

Outcome 1.3: Students can use mathematical concepts in the analysis and design of information systems.

CIS Objective #2: Computer Information Systems graduates will understand the role of IS and be able to work effectively within information systems environments.

Outcome 2.1: Student will be able to identify significant opportunities and problems in information systems.

Outcome 2.2: Students will be able to understand the role of information systems in helping individuals and groups make decisions efficiently and effectively.

Outcome 2.3: Students will be able to evaluate the role of information systems in solving significant business problems.

CIS Objective #3: Computer Information Systems graduates will be able to apply techniques in broad information systems areas, including database, networking, systems administration, and Web application development.

Outcome 3.1: Student will be able to apply database theory and practices to information systems development.

Outcome 3.2: Student will be able to develop Networking and Internet applications.

Outcome 3.3: Student will be able to administer information systems infrastructures.

Outcome 3.4: Student can develop applications in advanced information systems areas (area is based on the required and elective CIS courses selected by the student)

APPENDIX 2: Mapping of Objectives, Outcomes and Performance Indicators (Example)

CIS Objective #1: Computer Information Systems graduates will be competent in the fundamentals of information systems, computing, and mathematics.

Outcome 1.1: Students can present the key concepts and principles of computer and information systems.

Performance Indicators	Strategies	Assessment Methods	Source of Assessment	Semester	Assessment Coordinator	Evaluation of Results
1.1.1 Identify key concepts and principles of information systems	CINF 3231 CINF 4234	EA or AA, ES	CINF 323	Fall	Instructor A	Course Curriculum Committee
1.1.2 Evaluate the role of information systems in today's competitive business environment	CINF 3231 CINF 4234	EA or AA, ES	CINF 3231	Fall	Instructor B	Course Curriculum Committee
1.1.3 Demonstrate the understanding of the importance of information systems	CINF 3231 CINF 4234	EA, ES	CINF 3231	Fall	Instructor C	Course Curriculum Committee
1.1.4 Understand fundamental relationship between hardware and software	CINF 3231 CSCI 3331	EA or AA, ES	CSCI 3331	Fall	Instructor D	Course Curriculum Committee

Outcome 1.2: Students will be able to effectively solve computing problems using an appropriate programming language, data structures and algorithms.

Performance Indicators	Strategies	Assessment Methods	Source of Assessment	Semester	Assessment Coordinator	Evaluation of Results
1.2.1 Effectively solve computing problems using a high level programming language	CSCI 3134 CSCI 3234 CSCI3133	EA, ES	CSCI 3134	Spring	Instructor A	Course Curriculum Committee
1.2.2 Designs, implements and selects appropriate data structures	CSCI 3234 CSCI 3333	EA or AA, ES	CSCI 3333	Spring	Instructor B	Course Curriculum Committee
1.2.3 Designs and analyzes algorithms	CSCI 3333	EA or AA, ES	CSCI 3333	Spring	Instructor C	Course Curriculum Committee

Outcome 1.3: Students can use mathematical concepts in the analysis and design of information systems.

Performance Criteria	Strategies	Assessment Methods	Source of Assessment	Semester	Assessment Coordinator	Evaluation of Results
Use and explain discrete math to support the design of computer solutions	MATH 3331	EA, ES	MATH 3331	Fall	Instructor D	Course Curriculum Committee
Apply mathematical concepts in the analysis and design of information systems, including statistics, calculus, quantitative methods and discrete mathematics	MATH 3331 Calculus Statistics DSCI 3131	EA or AA, ES	MATH 3331	Fall	Instructor E	Course Curriculum Committee

APPENDIX 3: Three-year Assessment Timeline for Each Objective and Outcome (Example)

CIS Learning Outcomes	2010-2011		2011-2012		2012-2013	
	Fall10	Spring11	Fall11	Spring12	Fall12	Spring13
Objective #1: Computer Information Systems graduates will be competent in the fundamentals of information systems computing, and mathematics.						
1.1: Students can present the key concepts and principles of information systems.					CINF3231 CSCI3331	
1.2: Students will be able to effectively solve computing problems using an appropriate programming language, data structures and algorithms.			CSCI3134 CSCI3333			
1.3: Students can use mathematical concepts in the analysis and design of information systems.					MATH3331	
Objective #2: Computer Information Systems graduates will understand the role of IS and be able to work effectively within information systems environments.						
2.1: Student will be able to identify significant opportunities and problems in information systems.				CINF3231		
2.2: Students will be able to understand the role of information systems in helping individuals and groups make decisions efficiently and effectively.	CINF3231					
2.3: Students will be able to evaluate the role of information systems in solving significant business problems.					CINF3231	
Objective #3: Computer Information Systems graduates will be able to apply techniques in broad information systems areas, including database, networking, systems administration, and Web application development.						
3.1: Student will be able to apply database theory and practices to information systems development.	CSCI4333					
3.2: Student will be able to develop Internet applications.						CINF4230
3.3: Student will be able to administer information systems infrastructures.				CINF4634		

APPENDIX 4: General Assessment Tools Used

1. Examination Analysis [EA]: direct method
 - a. Instructors map examination questions to specific performance indicators.
 - b. Curriculum committee and instructors decide whether these indicators are satisfied or not.
 - c. Curriculum committee and instructors make recommendations
 - d. Curriculum committee reviews the assessment results and recommendations.
2. Assignment Analysis [AA]: direct method (including homework, programming and paper assignments)
 - a. Instructors select assignments that map to specific performance indicators.
 - b. Curriculum committees assess the assignment to decide whether these indicators are satisfied or not.
 - c. Curriculum committees make recommendations.
3. Portfolio Analysis [PA]: direct method
 - a. Every faculty member takes turn to serve in portfolio analysis.
 - b. A selected group of faculty members assesses specific performance indicators by filling out an assessment rubric.
 - c. The collected rubric assessment is used to decide whether these indicators are satisfied or not.
 - d. The group of faculty members makes recommendations.
4. Senior Presentation Evaluations [SPE]: direct method
 - a. Invited industrial advisors and selected faculty members are selected every semester to evaluate senior project presentations.
 - b. The group assesses specific performance indicators by filling out an assessment rubric.
 - c. The collected rubric assessment is used to decide whether these indicators are satisfied or not.
 - d. The faculty group makes recommendations.
5. Behavior Observations [BO]: direct method
 - a. Instructors design, observe, and document defined student behaviors to map to specific performance indicators.
 - b. Instructors decide whether these indicators are satisfied or not.
 - c. Instructors make recommendations
 - d. Curriculum committee reviews the assessment results and recommendations.
6. Oral Examination Analysis [OEA]: direct method
 - a. Instructors design, ask, and document oral examination questions to map to specific performance indicators.
 - b. Instructors decide whether these indicators are satisfied or not.
 - c. Curriculum committee and instructors make recommendations
 - d. Curriculum committee reviews the assessment results and recommendations.
7. Exit Interview [EI]: direct method
 - a. The full faculty body designs the exit interview with an assessment rubric to map to specific performance indicators.
 - b. Invited industrial advisors conduct the exit interview with students and document the results using an assessment rubric.
 - c. The senior project course committee decides whether these indicators are satisfied.
 - d. The senior project course committee makes recommendations
8. Exit Survey [ES]: indirect method
 - a. The course committee designs course exit survey to measure specific performance indicators.
 - b. The exit survey is collected and analyzed near the end of the semester.
 - c. Course objectives are satisfied when 70% of more students agree to their satisfaction.
 - d. The course committee makes recommendations.
9. Student Evaluations of Faculty and Courses [SE]: indirect method
 - a. The School of Science and Computer Engineering administers standard student evaluations near the end of the semester.
 - b. A satisfactory evaluation of the overall quality of the course and the instructor capabilities is used to support the satisfaction of performance indicators related to the course.
 - c. The division chair relates issues of concerns on the performance indicators of the course to the instructor.
10. Logbook Analysis [LA]: direct method
 - a. The students maintain a log of all the work that is done during the semester.
 - b. The course committee evaluates the logbook.
 - c. The course committee assesses specific performance indicators by filling out an assessment rubric.
 - d. The collected rubric assessment is used to decide whether these indicators are satisfied or not.
 - e. The group of faculty members makes recommendations.
11. Peer Evaluation [PE]: direct method
 - a. The course committee and instructor develop a rubric to assess the performance indicator.
 - b. Team members evaluate their fellow team members on their performance according to the rubric.
 - c. Results of the evaluations are collected and analyzed by the course committee to decide whether these indicators are satisfied or not.

- d. The course committee makes recommendations.

Note: For assessing a performance indicator with a course, evaluators can select any one of the listed direct methods.

APPENDIX 5: A Screenshot of a Portion of a Progress File

The task table in the screenshot below shows some assessment related tasks , the leads and members assigned to the tasks, and their color-coded status (such as “IP”, “Urgent: IP”, “Done” or nothing, meaning not started.)

Assessment-Related Tasks:

Tasks	Lead + Members	Status
Approve CIS program objectives	Fac1,	Done
Prepare notebook for each CSCI/CINF course: created but not completed	Fac1, Fac3	Urgent: IP
Construct CIS Outcomes (3 or less per objectives)	Fac2, Fac4	Done
Approve CIS Outcomes	Fac3, Fac4	
Construct Performance Criteria for each CIS outcomes	All	Done
Construct Assessment Methods for each CIS Performance Criteria	Fac1, Fac5	Done
Assessment Timetable/Cycle for CIS	Fac3	Urgent: IP
Approve CIS Outcomes to be assessed this Spring	Fac5	Done
Arrange CIS Outcome Assessment Execution this Spring	Fac2	Urgent: IP
Ask for student evaluation after the semester	Fac4	Urgent: IP
Check completeness and closure of assessment methods	Fac1, Fac3, Fac5	Urgent: IP
Exit survey for CINF 4234	Fac2	IP
Set performance indicators of CINF 4634	Fac3	Done
Set performance indicators of CINF 4230	Fac5	Done
Set Performance indicators of CIS outcomes 4.2, 4.3	Fac2	Done
Clean up and proofread performance indicator document for CIS and CS	Fac4	IP

APPENDIX 6: Selected Screenshots of the Exit Survey Web Application

The Web application allows the users to navigate to any course with an exit survey in a selected semester.

Once a course is selected, there are facilities for entering, updating and displaying exit survey. The display page provides basic statistics and the percentage of students agreeing that a course objective is satisfied. Course committee members can provide comments on each course objective and the overall course. Comments are mandatory for those course objectives below the 7% threshold.

**CINF 3231: Information Systems Theory and Practice
Student Exit Survey: Summary and Review Form**

Semester: Fall 2010 Section: 1 Instructor: [redacted]

Major Respondents	CIS	CS	MIS	CENG	SWEN	SENG	Other	Total
Percentage	82.31%	0.00%	0.00%	0.00%	0.00%	0.00%	7.69%	100%

No.	Objective	Totally Agree	Agree	Neither	Disagree	Totally Disagree	Total	Percent Agree
1	Explain why information are so important today for business and management.	5	7	0	0	0	12	100%
2	Evaluate the role of information systems in todays competitive business environment	5	7	0	0	0	12	100%
3	Explain the role of information systems in helping individuals and groups make decision more efficiently	5	7	0	0	0	12	100%
4	Identify the major management challenges to build and use information systems	5	6	1	0	0	12	92%
5	Analyze the relationship between organizations, information systems, and business processes.	4	6	2	0	0	12	83%
6	Explain how enterprise applications promote business process integration and improve organizational performance	4	6	1	1	0	12	83%
7	Analyze the relationship among ethical, social and political issues that are raised by information systems.	7	5	0	0	0	12	100%
8	Explain why information systems need protection from destruction, error and abuse.	8	4	0	0	0	12	100%



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