MANAGEMENT INFORMATION SYSTEMS (MIS) PROGRAM ASSESSMENT: TOWARD ESTABLISHING A FOUNDATION

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ABSTRACT

This paper provides a foundation for program assessment in the discipline of management information systems. This foundation is generated by analyzing the suitability of various assessment methods and techniques and by using the knowledge gained to begin the evolution of an MIS program assessment process. Factors contributing to the successful development and implementation of an assessment process are identified by the authors.

Keywords: Program Assessment, Outcomes Assessment, MIS, Information Systems

I. INTRODUCTION

In the last 15 years educational assessment has become a major trend in U.S. higher education. This trend has been motivated by the actions of many groups, including universities and departments, accrediting agencies, professional academic associations, and government legislative bodies. Universities and departments in particular have been encouraged by the desire

to improve student learning and achievement and by the concern about declining student enrollments.

According to Banta, Lund, Black and Oblander [1996] questions about the program assessment process and what methods to use are being asked by more people and with more intensity than ever before.

However, program assessment resources are relatively scarce within the field of management information systems (MIS). Examples of MIS program assessment publications include a study of graduate programs using survey instruments [Pick and Kim, 2000] and a national study using a comprehensive exit exam to assess an MIS program [Reynolds et al., 2004].

The authors' approach to assessment complements the existing program assessment work by exploring the integrated and iterative process of assessment, curriculum design, and instruction, advocated by Heywood [2000]. Heywood espouses the importance of assessing a program and applying the knowledge learned to curriculum and instruction. This paper describes MIS program assessment, curriculum, and instructional initiatives begun in 2002 and evolving over a four-year period at a mid size university in the Northeast. Its contribution is in its evaluation of the suitability of program assessment methods for an MIS program assessment and in its reflection on the evolution of a program assessment process being developed at this Northeast university, which may be useful to other institutions in their efforts toward continuous program improvement.

The first year of the program assessment process was devoted to researching the program assessment literature. During the second year, the department used a course embedded pilot assessment; i.e., an assessment using a comprehensive course project. After interpreting the results and reflecting on the assessment efforts, the department changed the assessment strategy moving from a one-course embedded assessment to a four-course

embedded assessment, using artifacts from four selected courses. Now in the fourth year of the assessment, the department is working toward a web-based portfolio assessment, whereby a complete set of artifacts and outcome assessment data giving a holistic view of student learning will be available and archived on the web.

In this paper, the authors discuss the meaning of program assessment derived through their review of the literature and through their interpretation of existing theory. The authors then discuss the most popular assessment methods and analyze their suitability for assessing MIS programs. Using the knowledge gained through this analysis, an MIS program assessment process is evolving at this mid size Northeast university. This evolving MIS program assessment process is documented, and the authors provide a short description of the factors that in their opinion contribute to the successful development and implementation of a program assessment process.

II. UNDERSTANDING ASSESSMENT--ASKING QUESTIONS

Although the literature offers many definitions of assessment, most authors characterize it as an important activity to improve the learning and development of students [Erwin, 1991]. The American Association for Higher Education (AAHE) proposes one of the most comprehensive definitions of assessment:

"Assessment is an ongoing process aimed at understanding and improving student learning. It involves making our expectations explicit and public; setting appropriate criteria and high standards for learning quality; systematically gathering, analyzing, and interpreting evidence to determine how well performance matches those expectations and standards; and using the resulting information to document, explain, and improve performance. When it is embedded effectively within larger institutional systems, assessment can help us focus our collective attention, examine our assumptions, and create a shared

academic culture dedicated to assuring and improving the quality of higher education." [Angelo, 1995]

If one examines the issue of assessment from a macro perspective, the conclusion could be reached that a better understanding of the assessment process has resulted due to the continuous effort to improve higher education over the last two decades. Some authors such as Heywood [2000] claim that we need a multiple-strategy approach to assessment implying a systems approach to the design, implementation, and evaluation of the curriculum, learning, and assessment process. This view broadens the understanding of assessment from the narrow scope of assessing individual students and courses to the more complicated process of assessing departments or programs – and finally – to the very complex and difficult task of assessing whole institutions. The authors used this systemic view advocated by Heywood [2000] in addressing assessment at the departmental level.

According to Stassen, Doherty, and Poe [2001], an effective program assessment helps faculty to answer three questions:

- What are we trying to do?
- How well are we doing it?
- How can we improve?

To adequately address the first question, program assessment goals and objectives need to be developed. The American Association for Higher Education [Astin et al., 2004] provides insight into student learning and the formulation of goals and objectives.

III. DEFINING THE GOALS AND OBJECTIVES

The association states that “The assessment of student learning begins with educational values … Where questions about educational mission and values are skipped over, assessment threatens to be an exercise in measuring what’s easy, rather than a process of improving what we really care about” [Astin

et al., 2004]. The MIS department embraced this principle. During a series of meetings, the mission of the department was discussed, scrutinized and reformulated. Next, program goals and objectives were formulated.

Program Goals

While the terms *goals* and *objectives* are often used interchangeably, describing the intended results of educational activities and providing direction for assessment [Palomba and Banta, 1999], there is a difference between the two terms, reflecting the level of precision [Erwin (1991]. Goals are used to express intended outcomes in general terms while objectives are used to express intended outcomes in precise terms.

One of the most important sources used in the definition of the MIS program goals was the IS2002 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems, recommended by the Association for Computing Machinery, the Association for Information Systems and the Association of Information Technology Professionals [Gorgone et al., 2002]. According to the IS2002 Model Curriculum, there are four major characteristics of the IS profession that should be integrated in Management Information Systems programs, namely:

1. IS professionals must have a broad business and real world perspective.
2. IS professionals must have strong analytical and critical thinking skills.
3. IS professionals must have interpersonal communication and team skills and have strong ethical principles.
4. IS professionals must design and implement information technology solutions that enhance organizational performance.

Stassen et al. [2001] propose several initial activities in the development of program goals:

- Describe the ideal student in the program at various phases throughout the program.

- Collect and review instructional materials.
- Collect and review documents that describe the department and its programs.
- Review and react to goals and objectives from another unit that is similar but external.
- Administer a goals inventory or conduct an interview study involving a variety of groups (or “stakeholders”).

The IS2002 guidelines, the departmental and school missions and all of the above listed activities facilitated the department's generation of program learning goals. The MIS department identified four main program goals. A small number of critical learning goals is one of the characteristics of a good assessment plan, according to the assessment guidelines used by Concordia College [2004]. These four goals are:

1. Understand the leadership role of MIS in achieving business competitive advantage through informed decision-making.
2. Analyze and synthesize business information needs to facilitate evaluation of strategic alternatives.
3. Effectively communicate strategic alternatives to facilitate decision-making.
4. Apply MIS knowledge and skills learned to facilitate the acquisition, development, deployment and management of information systems.

After the main program goals were formulated, the next step in the assessment process was to develop program objectives. Program objectives transform the general program goals into specific student performance and behaviors that demonstrate student learning and skill development [Palomba and Banta, 1999].

Program Objectives and Bloom’s Taxonomy

One can approach the development of program objectives in a variety of ways. The authors researched the work of prominent authors [Bloom, 1956; Palomba and Banta, 1999; Stassen et al., 2001] to clarify their thinking on program objective development.

While Palomba and Banta [1999] identified different aspects of student learning (cognitive, affective, and behavioral/skill), Stassen et al [2001] identified levels of learning (mastery and developmental). The seminal work of Bloom [1956] identified six levels of learning: (knowledge, understanding, comprehension, analysis, synthesis, and evaluation). The authors found that these six learning levels were in concert with the five levels of knowledge in the IS2002 Model Curriculum (awareness, literacy and deep knowledge, concept/use skill, detailed understanding/application ability and advanced). Also, the work of the IS2002 Model Curriculum Committee provided a template for writing behavioral and cognitive objectives and facilitated the development of activities associated with attaining a given level of knowledge. Thus, the decision was made to use Bloom's work and the IS2002 Model Curriculum Committee in developing and operationalizing the MIS program objectives for the undergraduate program. Sample MIS questions which may be used in assessing each of Bloom's learning levels are provided in the following table

Table 1. Application Of Bloom's Taxonomy To The MIS Discipline

Level of Learning	**Type of Learning**	**Sample MIS question**
Knowledge	Memorization	List the steps in project initiation.
Comprehension	Information transfer using own words	Describe the steps in project imitation.
Application	Abstraction and application to a particular situation	How can data flow diagrams be used as analysis tools?
Analysis	Comparison and contrasting of relationships	Compare data flow diagrams to Oracle's process model diagrams.
Synthesis	Blending of parts and elements to create a coherent whole	What are the roles of data flow diagrams, decision tables, state transition diagrams, and entity-relationship diagrams in building a complete model of a system?
Evaluation	Decision making and judgment	Recommend an appropriate enterprise resource planning design strategy for Project X and justify why this strategy was selected over other known strategies.

Analysis of Program Objective Measures

The authors provide further analysis of program objective measures in the three categories of cognitive learning, behavior/skill learning, and attitude and value learning below [University of Montana, 2004].

The authors believe that cognitive learning is best measured via application, analysis, synthesis, and evaluation levels of learning. Some of the most common measurement methods for this are course tests, writing assignments and summative knowledge projects during the senior year.

The second type of learning outcome is related to behavior/skills. Behavior/ skills outcome measures assess not what the students know but what they can do. The skills and behaviors for effective practice in the MIS profession (programming, systems analysis and design, networking and in general decision making skills; ability to work in teams, manage time, present, defend an argument) must be measured here. Team projects have proved to be the best activities to measure these skills and behaviors.

The third type of learning outcome is related to attitudes and value outcomes. The assessments here must determine personal and social values; namely, responsibility, commitment, engagement, ability to compromise, etc. Two useful tools for measuring attitudes and value outcomes in MIS are peer assessment and lesson learned reports as part of the team project activities. According to Palomba and Banta [1999] survey instruments can be also quite helpful in obtaining information about affective outcomes.

After the goals and objectives were articulated and before designing additional assessment components, it was important to analyze how the existing curriculum matched the goals and learning objectives identified by the department. This process is described in the section titled Curriculum Mapping. Curriculum Mapping is one of the many assessment techniques that can be used

in program assessment. Some assessment techniques are listed below and their suitability for MIS program assessment is discussed.

IV. ASSESSMENT METHODS OVERVIEW

A wide variety of assessment methods, also called techniques, instruments, measures, or indicators of learning, are described in the literature [Banta et al., 1996; Palomba and Banta, 1999; Banta and Associates, 2002; Prus and Johnson, 1994; Rogers, 2002; Stassen et al., 2002; University of Wisconsin, 1998]. According to Palomba and Banta [1999], assessment methods should include both direct and indirect approaches. Those methods suitable for assessing MIS programs are discussed.

Direct Indicators of Learning

Direct measures of learning require students to demonstrate their knowledge and skills as they respond to the instrument itself. Some of the more prominent direct measures are described below:

- Commercial, norm referenced, standardized examinations (commercial examinations developed by some authoritative institution) are often used in higher education to assess the learning outcomes for a particular region. According to Perrin, Dillon, Kinnik, and Miller-Jones [2002], standardized tests have known psychometric properties but they are usually not very diagnostic as they probably do not contain questions that address the specific learning objectives outlined by a specific program. However a recent national test for Information Systems graduates aims to avoid such a problem by focusing rather on the standards provided by the IS2002 curricular recommendations. The Center for Computing Education Research (CCER) developed a successful beta test in 2004 and tested more than 950 students at 34 participating schools. Individual programs are able to assess their graduating seniors, track the progress of students through the program, and evaluate their courses against the IS 2002 Model Curriculum (see Reynolds et al., [2004]).

- Locally developed examinations, designed by faculty and staff can be used to address specific departmental goals. However the psychometric properties of these tests must be established to ensure that the tests are accurately measuring what they are supposed to measure. Pre-test and post-test can be an effective way to collect information on students when they enter and leave a particular program and provide data over a period of time. However the time used to develop and administer such tests, and the data collection and storage can pose problems [as pointed out by Stassen et al. [2001].
- External examiners can assure high program standards. External field experts--particularly those from a similar program at another institution can be used to conduct, evaluate or supplement the assessment of students. More details on this topic can be found in Heywood [2000].
- Oral examinations are suitable for assessment of knowledge levels. Time constraints and logistics are usually a hindrance to the use of oral examinations on a wide scale. This method, however, presents an opportunity for the examiner to obtain a better estimation about student knowledge than any other written examination. To the best knowledge of the authors there are no recorded cases in the literature on the use of oral examinations in program assessment.
- Behavioral observations can be used to measure the frequency, duration and context of a subject's actions, usually in a natural setting with non-interactive methods. Although this method is particularly suitable for assessment of programs in Education, Medicine and the like, it can be used also in MIS for assessment of group work. However group dynamics is not always easy to observe since most of it takes place outside the class setting.
- A simulation method of assessment is a competency-based measure where a person's abilities are measured in a situation that approximates a real world setting. Simulation is primarily used when it is impractical to observe a person performing a task in a real world situation. Traditionally this method has been used in many business and Information Systems courses. The use of simulation through standardized business cases provides the possibility for relatively easy, formalized assessment of the learning outcomes.

- Performance appraisal is the systematic measurement of acquired skills demonstrated overtly, generally through direct observation in a real world situation (e.g., while a student is working on a project for a client). Most of the activities in an MIS course involve problem solving, decision-making, and teamwork. This makes performance appraisal one of the most suitable assessment methods.
- Portfolios are collections of work samples, usually compiled over time and rated using rubrics. According to Serafini [2000] portfolios are a vehicle for promoting student and teacher reflection, self-evaluation and goal setting. The nature of the MIS discipline involves tangible artifacts by students and this makes portfolios a very important assessment method.
- Course-embedded assessment refers to a method of assessing student learning within the classroom environment, using course goals, objectives and content to gauge the extent of the learning that is taking place. This technique is using existing information that instructors routinely collect or obtain through assessment instruments used specifically for the purpose of measuring student learning [Palomba and Banta, 1999]. It is an effective and easy to use method since the data comes from activities conducted in existing courses.

Indirect Indicators of Learning

Indirect measures ask students to reflect on their learning, rather than demonstrate what they have learned [Palomba and Banta, 1999]. Written surveys, focus groups and exit interviews are typical representatives of indirect measures:

- Written surveys and questionnaires are very popular methods for assessment. The surveyed individuals are asked to share their perceptions about the issue being assessed via a formally prepared research instrument. Georgia Southern University [Williams and Price, 2000] and the University of Redlands [Pick and Kim, 2000] used surveys to assess graduate and undergraduate programs respectively in MIS. Although surveys and questionnaires provide opportunities for comprehensive assessment, there are some disadvantages associated

with them. Logistically it is difficult to obtain the contact details of former students. A low response rate is another disadvantage.

- A focus group is a guided discussion of a group of people who share certain characteristics related to the research or evaluation question, conducted by a trained moderator. This method can be used in combination with written survey and questionnaire methods, as described by Pick and Kim [2000]. Careful consideration should be given to the selection of group members, not neglecting alumni, advisory boards and other external stakeholders that can contribute greatly to the assessment results.
- Exit and other interviews in which individuals are asked to share their perceptions about the target of being assessed in a face to face partially structured research instrument are often used as assessment methods. Segers and Dochy [2001] describe semi-structured interviews for assessment of programs in the Maastricht School of Economics and Business Administration in the Netherlands. In the case of large student populations this assessment method can be time consuming and difficult to administer.

Employer surveying, use of archival methods, and curriculum and syllabus analysis are indirect methods that can provide additional assessment information:

- Employer surveying informs educators about the employer's satisfaction with the abilities and skills of recent graduates. An advantage of this approach is the ability to obtain external data that cannot be provided on campus. Tracing the employment of the recent graduates can be a potential problem.
- Archival records may be used as a secondary source of data to complement the previous methods. Biographical, academic or other filed data can be available from the college or other agencies and institutions.
- Curriculum and Syllabus Analysis is a very popular assessment technique that should be used to identify what assessment-related

information/processes are already in place. More discussion on this technique will be provided in the section titled Curriculum Mapping.

The variety of assessment methods briefly discussed above provides a rich set of tools for the assessment of MIS programs. In the authors' opinion, no single method is best or applicable. Rather, combining different approaches to assessment can generate a complete picture of what students understand and have internalized. Their strategy was to use a combination of assessment methods consisting of course-embedded, four-course assessment, performance appraisal, and curriculum mapping and syllabus analysis.

Course-embedded assessment has the advantages of implementation ease, cost and time, and student acceptance. Performance appraisal is the natural choice of assessment methods used when assessing problem solving, communication and teamwork skills. Curriculum mapping and syllabus analysis are two assessment methods that should have a place in every assessment process for reasons outlined in the next section.

V. CURRICULUM MAPPING

Several authors [Allen, 2004; Palomba and Banta,1999; Heywood, 2000] claim that the most effective program assessment plan is closely linked to the curriculum and uses available information and resources to the greatest degree possible. Part of the assessment process is to identify what assessment-related information and processes are available already in the department by the use of curriculum mapping. Curriculum mapping also identifies how the existing curriculum addresses the program goals [Palomba and Banta, 1999]. It is a simple technique using a matrix representing the program objectives vertically and the courses horizontally.

During a brainstorming session the MIS faculty applied curriculum mapping and jointly decided which of the objectives were addressed in the different MIS courses. The extent to which the objectives were addressed was

also determined (Central focus, Considerable, Some, None). Stassen et al. [2001] suggest somewhat more detailed qualifications (Introduced, Emphasized, Utilized, and Assessed Comprehensively) that can also be used for the same purpose.

Four courses covering most comprehensively all educational goals listed above and the corresponding objectives were identified as a result of the curriculum mapping process. These courses are: Business Decision Analysis using Knowledge Bases, Enterprise Strategies and Transformation, Networking and Telecommunications, and Systems Implementation and Project Management.

Curriculum mapping proved to be a very useful technique offering an opportunity for dialog among the faculty members. It not only identified the links between the curriculum and the learning objectives, but also provided information about the sequencing of the courses and possible shortcomings in this area that had to be addressed immediately. In general it contributed to the spirit of cooperation and teamwork in the department.

Throughout the subsequent syllabus analyses, conducted by faculty teams teaching the four identified courses, the most important artifacts and activities for measuring the learning outcomes were identified.

VI. SCORING RUBRICS, DATA COLLECTION AND INTERPRETATION OF RESULTS

These artifacts from the four selected courses included but were not be limited to:

- several reports on individual projects in knowledge management
- a group report on an interactive simulation exercise in strategic decision making
- a group project report on decision support systems
- a group project report in network design

- a group project report and a fully implemented information system

Scoring Rubrics

For each one of these artifacts a working group of two faculty members was created. Each working group was responsible for creating their own scoring rubric, reflecting different objectives used in assessing the artifacts. A uniformed three-level scale: fails to meet the objective, meets the objective, or exceeds expectations for the objective was used for all rubrics. Analytic rubrics were used for most of the artifacts because they provide better feedback to the students [Mertler, 2001]. In addition to assessing the artifacts, analytic rubrics were developed also for the presentations, and peer evaluation forms were used to reflect the group dynamics and the students' ability for teamwork.

Data Collection and Interpretation

The task of the working groups was to evaluate the artifacts and assign performance indicators, which were used to monitor the degree to which the MIS program learning objectives were being met. Having two faculty members assess each artifact and engaging each faculty member in the assessment of at least two artifacts achieves consistent standards in the assessment.

After the final presentations and the submission of the projects at the end of the semester, all professors were involved with the numeric processing of the results and their interpretation. On the basis of the collected information some conclusions about the MIS program emerged:

1. The program prepares students well for flexible and changing organizational and technological environments. Given the challenge, students did more than was expected of them.
2. Program projects create an opportunity for expression of the students' creativity and problem-solving ability. Students appeared not only to enjoy working on projects but also to internalize and apply what they learned to similar decision making exercises. Similarly, concepts

learned in class were used effectively when making strategic decisions.

3. By and large, the students' presentation skills were very good and the presentation content emphasized the main lessons learned in class.
4. Students do not have sufficient skills to handle group conflicts.
5. The practical skills in some areas such as databases and programming were not sufficient.

Several major changes in the MIS curriculum occurred as a result of the assessment process. After the second year of the assessment process, conducted as a course-embedded pilot assessment of the “Systems Analysis and Design” course, the following curriculum changes were implemented.

- A new course “Systems Implementation and Project Management” was created in order to assure that students are exposed to the best practices of Project Management.
- The two courses “Systems Analysis and Design” and “Database Management” were moved from fourth to third level courses in order to assure timely student exposure to important IS development concepts. This change made it possible for students completing these courses successfully to have the necessary background information and maturation period to be prepared for concepts discussed in their senior year courses.

After the second year of the assessment, conducted as a course-embedded portfolio assessment in four core courses, the following curriculum changes were implemented:

- New co-requisites with some business courses were requested in order to assure that students obtain better understanding of the business environment.
- An extensive syllabus analysis was begun within all courses to eliminate duplication and fragmentation of some topics within the curriculum.

- All syllabi were rewritten in order to accommodate the AACSB requested learning objectives.

The results from the MIS program assessment are helping the department and its faculty on a continuous basis to better understand the effectiveness of practiced teaching methods, their syllabi, and curriculum. Consequences of such understanding are continuous improvements that lead to better learning outcomes.

VII. REFLECTIONS ON THE EVOLUTION OF THE MIS PROGRAM ASSESSMENT PROCESS

Generally it can be said that program assessment to date in this MIS department has been a positive and enriching process for the faculty members and for the students. That might seem contrary to the popular opinion that faculty members are reluctant to engage in assessment (e.g. Angelo [1999] and Strada [2001]). Several important factors contributed to the positive assessment experience by the department as outlined in this paper:

- All faculty members were involved in the assessment activities.
- The person in charge was a regular faculty member--not an administrator.
- The assessment process permitted the MIS faculty to share not only examples of problems but also examples of best teaching practices and thereby created a culture of trust.
- The faculty created shared motivation by developing shared learning about the assessment process.
- Improvement versus accountability was used as a motivation for the assessment.
- The faculty built a shared working language by developing a collective understanding of new concepts.
- Course-based versus non-course based model of assessment was used, and it optimized the time and effort spent on assessment.

The MIS program assessment has been a rich learning experience for the MIS faculty. The cyclical nature of the process permits the MIS faculty to reflect on past assessment exercises and to plan for process improvement, which can lead to an improvement in student learning. During the evolution of this assessment process (moving from a one course-embedded assessment to a four-course assessment), the MIS faculty have shared their teaching practices and hopefully have become better teachers. The long-term goal in the MIS program assessment is the creation of web-based student portfolios that will represent students' work and accomplishments. The MIS faculty has reached consensus that the portfolio approach needs to be supplemented with behavioral observations and performance appraisal in order to create an effective assessment program. It is expected that the evolution of the program assessment process to a web-based portfolio will foster continued student and faculty learning.

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