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ABSTRACT

In this report, we describe assessment efforts in the MIS curriculum at a major Midwestern U.S. university. We discuss both direct and indirect assessment measures that may either be used as complements or on a stand-alone basis. Because direct assessment efforts are usually more time consuming and work-intensive, it would be helpful for ongoing program assessment if indirect assessment could be used as an effective alternative, at least on occasion. The validity of student self-assessments has been debated in the assessment literature. This study compares results for common learning outcomes assessed with direct measures and student self –assessments. We find that for certain types of learning outcomes student self-assessments are valid proxies for direct assessment.

Keywords

Accreditation, direct assessment, indirect assessment, learning outcomes, MIS curriculum

INTRODUCTION

For MIS programs in the United States, assessment has become a way of life. Each program must assess its own effectiveness to satisfy the regional agency that accredits the university or college in which it is located. Programs housed in a business school must also assess if the school wants accreditation by the Association of American Colleges and Schools of Business (AACSB). In addition, programs aspiring to gain or maintain recognition by the Accrediting Board for Engineering and Technology (ABET) need to assess for that agency as well

The goal of assessment for all of these agencies has changed dramatically in the past two decades. Whereas they once focused on evaluating the components of a program—its courses, faculty, and resources—they now want evidence that the program is effective at providing its students with the knowledge and abilities it claims to impart [Higher Learning Commission, 2007; AACSB, 2008; ABET; 2009]. Accrediting agencies have also transformed assessment from an occasional activity to a continuous one. In the past, a program needed to reflect on its effectiveness only when each accreditation review approached, an event that might occur as infrequently as every ten years. Now, a program must create a culture of assessment in which assessment is an ongoing activity [Cooper and Heinze, 2007; Gardiner, 1994]. Further, the program must not only present assessment results to the accrediting agencies but also show that it has initiated improvements in response to what the results disclose.

Through these changes, accrediting agencies aim to engage U.S. higher education in continuous improvement, a worthy goal in fields like MIS where content changes so rapidly and the outcomes can have such profound effects on organizations and nations. Taken together, these changes also increase substantially the amount of intensive work that must be invested in assessment. Academic programs in all fields are looking for valid, reliable methods that produce maximum improvement with minimal effort. In this research report, we describe efforts at a midwestern university to explore the feasibility of including student self-assessment among the more time-consuming assessment methods for MIS programs.

ASSESSMENT METHODS FOR IS

Palomba and Banta [1999] define assessment as the "systematic collection, review, and use of information about educational programs undertaken for the purpose of improving student learning and development." It is inextricably linked to the intended learning outcomes of a course or program [Marriott and Lau, 2008] and may be gathered using a wide variety of both quantitative and qualitative methods depending on the outcomes being measured [ABET 2009]. Harper and Harder [2009] maintain that in IS these outcomes fall into four categories: technical, analytical, communication and managerial.

IS programs can employ both direct and indirect assessment methods. In either case, the focus is on what students have learned, what they know and can do. Direct measures involve a systematic and objective examination of actual student products to determine the extent to which the students are able to do what the program's student-learning outcomes state they should be able to do. The outcomes must be broken down into specific characteristics or traits that can be measured [Pringle and Michel, 2007]. For direct assessment, IS programs can use tests, term papers, and presentations. They might also examine databases students have designed and reports in which they advise imaginary or real decision-makers about the best course of action to take, based on their analysis of enterprise data.

In contrast, indirect measures ascertain people's *perceptions* of the students' abilities relative to stated program or course learning outcomes. IS programs may gather these perceptions from students, employers, or others deemed capable of judging. Perceptions may be gathered via surveys, focus groups, exit interviews, and other means.

Although both direct and indirect measures may be used in assessment, AACSB, ABET and other accrediting agencies state that indirect measures alone are not sufficient. Direct measures must be included. On the other hand, multiple methods and multi-source approaches—including indirect assessment—reduce bias and increase the validity of data. Many colleges and universities have found that in order to measure the skills and competencies they value, they need to use multiple methods and triangulate the assessment data that they produce [Lopez, 2002].

For both direct and indirect assessment, course-embedded methods are generally preferable. Course-embedded direct assessment relies on a review of regular coursework, such as projects and exams, rather than external exams or evaluations of non-course performances [Borin, Metcalf and Tietje, 2008]. Course-embedded indirect assessment gathers the student perception of learning that takes place in the course, for instance through a survey that asks students to rate their ability to perform or achieve different outcomes of the course [Nuher and Knipp, 2003]. Course-embedded measures are widely used in business schools [Pringle and Michel, 2007] because of their relative ease of use [LaFleur et al, 2009]. They require little or no additional work for faculty and students, they can be linked directly to learning goals actually covered in the curriculum, and they can identify shortcomings prior to student graduation [Gardiner, Corbitt and Adams, 2010].

BENEFITS OF EMBEDDED STUDENT SELF-ASSESSMENT FOR IS PROGRAMS

For IS departments, a major barrier to creating and maintaining formal assessment programs is faculty resistance, which arises in part because of the time required. As Merhout et al. [2008] argue, student self-assessment not only takes less time than direct assessment, but also provides a powerful tool for faculty because of the different perspective it offers.

Self-assessment is an indirect assessment method that can also be an effective method to help develop certain competencies (i.e., tools) needed as a professional and as a life-long learner [Sluijsmans, Dochy and Moerkeke 1999]. Larres et al. [2003] also argue for self-assessment as an important factor in career development because it stimulates reflection about one's competence, something professionals must continuously think about if they are to stay current in their chosen careers. Self-assessment is a mainstay of education in the medical professions because it is presumed to be directly linked to the quality of patient care [AMA Council on Medical Education, 2009; Davis et al, 2006; Westberg and Jason, 1994]. The American Board of Medical Specialties includes self-assessment among the four elements in its Maintenance of Certification program.

ACCURACY OF STUDENT SELF-ASSESSMENT OF THEIR LEARNING

Reviews of self-assessment research conclude self-assessment is both helpful and useful, but comparisons of self-assessment and instructor assessments yield mixed results [Chen, 2008]. Rogers [2006] states, "as evidence of student learning, indirect methods are not as strong as direct measures because assumptions must be made about what exactly the self-report means." Students exhibit overconfidence and tend to rate their abilities higher than they actually are [Price and Randall, 2008]. In the

field of computer literacy, Larres et al. [2003], and Ballantine et al. [2007] report significant differences in the students' perceived and actual computer literacy with the vast majority over-estimating their computer knowledge.

Research also indicates that self-assessment is more accurate in some circumstances than others. For example, students with greater computer skills and ability were more accurate in their self assessment. Self-assessment measures depend on their specificity and correspondence to actual performance tasks [Zimmerman, 1995]. Clear criteria, feedback and practice improve the accuracy and quality of student self-assessments [AlFallay, 2004]. Also, students may be able to assess some kinds of knowledge, skills, and abilities than others. Falchikov and Boud [1989] report greater agreement between student and faculty assessments in science subjects than in social science subjects. Similarly, Brewster et al. [2008] found that residents' self-assessment of their surgical abilities agreed with the assessments of trained faculty in medical school, but their self-assessments of their skills in dealing with patients before and after surgery did not.

ACCURACY OF DIRECT ASSESSMENT OF STUDENT LEARNING

Just as some kinds of student self-assessment may be more accurate than others, various forms of direct assessment may vary in their accuracy, as can be illustrated by comparing the kinds of examinations that are most often used in IS programs.

Essay exams are used because they test a deep, conceptual understanding of the material. Students have to take the business context into account, integrate material and communicate cogent arguments for their point of view. In an IS context, concepts such as the strategic use of information systems, or the analysis and design of different information systems might be better suited for testing with essay questions. A drawback of using essay questions for assessment is that the grading of essay questions can be subjective and time-consuming. In addition, to be truly useful for assessment, more than one faculty member needs to grade the essay question. A calibration step is essential to ensure inter-rater reliability among the team of examiners grading the exams.

Multiple-choice exams have inherent benefits in assessment, as they can be graded easily, quickly, consistently and with very little load on faculty time. A common use of multiple-choice questions in information systems courses is to test whether the student understands a definition or technical terms used in the course. For example, introductory MIS books provide test bank questions on the definition of relational databases and the query languages they use. In addition, some introductory MIS books also provide test bank questions that purport to measure the strategic use of IS. However, the extent to which multiple-choice questions can evaluate higher order concepts and learning skills is debated in the literature. From a review of relevant literature, Street [1990] concludes that objective testing methods are not likely to evaluate higher order learning. A study by Kuechler and Simkin [2004] in the accounting and information systems domain found only moderate relationships between the constructed responses and the multiple-choice portion of the exam. However, Martinez [1999] also states that just because there is a correlation involved, it does not mean the same kind of thinking and reasoning is involved. Ruiz and Primo [2001] found that students reasoned differently on highly structured and loosely structured assignments. In highly structured problems, students strategized as to which alternative is best, while they reasoned through the problem for loosely structured assignments.

Regardless of these mixed results, the literature from educational psychology and assessment domain suggests that it is possible for multiple-choice questions to be developed that measures some of the same cognitive abilities as essay questions [Martinez, 1999; Kuechler and Simkin, 2010]. Wainier and Thissen [1993] argue that anything measurable with essay questions can be measured by constructing objective questions.

OUR RESEARCH QUESTIONS

Given the time effort that could be saved by using student self-assessment in IS program assessment and given the uncertainty about the accuracy of student self-assessment, we decided to address two research questions.

1. Do IS students' self-assessments of their abilities correlate with their performance on direct assessment of their accomplishments?
2. Are there positive correlations related to some types of learning outcomes but not others?

METHOD

To address these questions, we worked with an introductory, sophomore-level course in management information systems. A required offering for all students majoring in the school of business, it enrolls approximately 550 students per term and has 19 learning outcomes specified for the course and included in the syllabus for all sections. The course is taught in sections of approximately 40 students but has a common final exam taken by all students.

Selection of Outcomes

To address our research questions, we chose to focus on five learning outcomes. To identify the most important outcomes, four IS faculty members independently ranked the outcomes in order of importance. However, because of research suggesting that self-assessments of some kinds of knowledge agree with direct assessment more than self-assessments of other kinds of knowledge [Brewster et al., 2008; Falchikov and Boud, 1989], we also wanted the five outcomes to include a variety of kinds of learning. Consequently, we chose the three most highly ranked managerial/conceptual outcomes and the two most highly ranked technical outcomes. All of the course's learning outcomes, including the five we selected, were phrased to complete a sentence that begins, "When they complete this course, students should be able to . . ."

1. Explain how information systems influence organizational competitiveness.
2. Describe how organizations develop, acquire and implement information systems and the role that users play in this process.
3. Explain how information systems enable organizational processes and process change.
4. Choose when spreadsheet and database technologies are applicable to solve various business problems.
5. Access information in a relational database using Structured Query Language.

Direct Assessment

For direct assessment, we employed selected multiple-choice questions on the common final exam. For each of the five outcomes, we used a set of 4 to 6 questions. Traditionally, the questions on the final exam are created collaboratively by the faculty teaching the course. For the last two outcomes, this group created the questions we used. For each of the other three outcomes, three faculty independently drafted several questions. From this pool, the group selected and refined four questions.

Self-Assessment

To elicit students' assessment of their own abilities, we created a student survey based on the learning outcomes specified for the course and included in the syllabus for all sections. For example, one desired outcome was that students should be able to "Explain the role of information technology including: How information systems influence organizational competitiveness." This outcome was translated into a survey question that asked students to agree or disagree with the statement "I can explain how an information system could give a company competitive advantage." Each learning outcome for the course was similarly translated to a self-report survey question. All questions used a five-point scale that varied from strongly disagree to strongly agree with three being neutral.

Data Collection

We collected two sets of data, in spring 2009 and fall 2009, in order to assure that whatever results we found would hold up for different groups of students.

The self-assessment survey was administered in the individual sections during the last two weeks of each semester. Participation was optional but made available to all students. The surveys were distributed and collected in class by a neutral third party while the instructor was outside of the classroom. Students could return the survey form without filling it out, if they wished. On the form, students could provide their university ids for the purpose of participating in the research comparing self-assessment with direct assessment. The ids enabled us to link a student's survey with his or her final exam. Data was recorded and verified manually into an excel spreadsheet.

Data for the direct assessment was collected via the common final, for which students responded to the multiple-choice questions on scantron sheets. Electronic files of student responses identified by user ids were obtained and merged with the

self-assessment responses of students who provided their ids. Usable self-assessment responses that could be merged with direct data were received from 280 students in Spring 2009 and 460 in Fall 2009.

Data Analysis

To test the level of agreement across the two types of assessment measures, the single item self-assessment measure for each learning objective was correlated with a factor score for the direct measures for each learning outcome. Factor scores were calculated by summing the number of correct responses for each objective.

RESULTS

Table 1 lists descriptive statistics for the data from both semesters of data collection.

	Spring				Fall			
Learning Objective (Number of Direct Questions)	Self-Assess-ment Mean	SA Std. Dev	Direct Assess-ment Mean	DA Std. Dev	Self-Assess-ment Mean	SA Std. Dev	Direct Assess-ment Mean	DA Std. Dev
1. Explain how information systems influence organizational competitiveness. (4)	4.35	0.58	2.34	0.97	4.30	0.56	2.32	0.97
2. Describe how organizations develop, acquire and implement information systems and the role that users play in this process. (4)	3.96	0.69	2.42	0.92	4.03	0.67	2.61	0.93
3. Explain how information systems enable organizational processes and process change. (4)	4.16	0.69	3.23	0.87	4.18	0.63	2.79	0.97
4. Choose when spreadsheet and database technologies are applicable to solve various business problems. (5)	3.85	0.84	4.19	0.92	4.11	0.71	4.25	0.93
5. Access information in a relational database using Structured Query Language. (6)	4.00	0.69	4.55	1.28	4.02	0.99	4.79	1.28

Table 1. Descriptive statistics for self-assessment and direct assessment in Spring and Fall Semesters 2009

Table 2 (next page) provides the correlation of the direct to self-assessment measures for both semesters. The direct and self-assessment measures for the most technical of the learning outcomes were the only ones that significantly correlated both semesters. Two of the more conceptual outcomes significantly correlated in the Spring data only.

DISCUSSION

The results suggest that the five learning outcomes we selected represented a range of mental abilities rather than two distinct categories, the conceptual/managerial and the technical. They also suggest that as the objectives become less technical and more conceptual, there is a diminishing likelihood that self-assessment and direct assessment will correlate. This pattern is consistent with Brewster et al. (2008), who interpret surgical skill as a technical skill when speculating on the reasons that medical residents' self-assessment of their surgical skill correlates with trained medical teachers but their clinical patient relations skills do not. Falchikov and Boud's [1989] finding that self-assessment of their abilities in science are more accurate

Learning Objective	Spring 2009 Pearson Coefficients and Significance	Fall 2009 Pearson Coefficients and Significance
1. Explain how information systems influence organizational competitiveness.	0.061 p>0.309	-0.061 p>0.193
2. Describe how organizations develop, acquire and implement information systems and the role that users play in this process.	0.040 p>0.501	0.018 p>0.695
3. Explain how information systems enable organizational processes and process change.	0.151 p>0.012*	0.053 p>0.257
4. Choose when spreadsheet and database technologies are applicable to solve various business problems.	0.135 P>0.023 *	0.022 p>0.638
5. Access information in a relational database using Structured Query Language	0.197 p>0.001**	0.238 p>0.001**

Table 2. Pearson Correlation Coefficients for Self-Assessment and Direct Assessment for Spring and Fall Semesters 2009

than in social science might reflect the tendency of science education to focus on correct answers while the social sciences require more conceptual understanding and application.

In our study, the most technical learning outcome concerned students' ability to access information in a relational database using structured query language (Outcome 5). The direct questions associated with this objective required critical thinking. Students had to understand the managerial question being asked, the data model provided, as well as SQL syntax in order to recognize the correct query from the alternatives provided. Nevertheless, the direct questions ultimately tested their ability with SQL. Students accurately perceived their ability for this outcome. In both semesters, the self-assessment and direct assessments for this highly technical learning objective were strongly correlated ($p<0.001$).

The two most conceptual outcomes involved explaining how information systems influence organizational competitiveness (Outcome 1) and describing how organizations develop, acquire and implement information systems and the role that users play in this process (Outcome 2). Neither the textbook treatment nor class presentations related to these outcomes included the specific, detailed, invariant procedures of the kind that are involved in Outcome 5, for which students use a specific language to access particular pieces of information in a certain kind of database. Results for these two conceptual outcomes (1 and 2) show no correlation in either semester between the students' self-assessment and the direct assessment of their knowledge.

In this interpretation, the other two outcomes (3 and 4) would be in the middle between completely conceptual and completely technical. Outcome 4, choosing when spreadsheet and database technologies are applicable to solve various business problems, fits this characterization. When this topic was discussed in class, students had hands-on experience with both technologies, and examples involved the specific spreadsheet and database programs and procedures the students had used. The self-assessment and direct assessment results for Outcome 4 correlated significantly one semester ($p<0.05$) but not the other.

Results for Outcome 3 also showed correlation in one semester but not the other. However, it is less clear why Outcome 3 could be seen as partly conceptual and partly technical. Neither the presentation in the textbook nor discussions in class referred to specific technologies nor detailed step-by-step procedures involved with using information systems to enable organizational processes and process change. Perhaps students interpreted the learning outcome in different ways when responding to the self-assessment questionnaire, with some believing they were being asked about their conceptual understanding while others assumed they were being asked whether their technology work with spreadsheet and database programs allowed them to explain how information systems enable organizational processes and process change.

In sum, the most striking result is the correlation between self-assessment and direct assessment results for the most technical outcome. The absence of correlation for two of the outcomes and the difference for two other outcomes in the two semesters may have many causes. These include ambiguity in the students' minds about the meaning of the outcome statements; difficulty of creating valid multiple-choice questions for assessing conceptual outcomes that renders direct assessment

inadequate; and students' general tendency to overestimate their abilities [Price and Randall, 2007], at least when they don't receive direct feedback on their performance.

NEXT STEPS

We plan next to address one of the questions raised by our study: are multiple-choice questions weak direct measures of student performance with regard to conceptual learning outcomes? In Fall 2009, several sections of the course used essay exams to test students' achievements with respect to several of our five learning outcomes. We plan to perform another direct assessment using their written responses to determine whether students' self-assessment correlates with direct assessment based on their writing. The data for this assessment already exists and can be tied to the self-assessments gathered during Fall 2009. We are currently developing rubrics for the assessment exercise and plan to have this analysis completed for discussion at the conference.

CONCLUSION

This study suggests that for outcomes associated with a student's technical abilities, of which there are plenty in the IS discipline, self-assessment may serve as a valid proxy for direct assessment. As outcomes become more conceptual, the validity of self-assessment comes into question. There is more work to do in this area, but because of the ease of use of indirect when compared to direct assessment, this study lends hope to reducing the perceived burden of assessment for faculty.

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