On The Development of Assessments of Student Learning in an Introductory Information Management Course

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Abstract

This paper discusses various assessment approaches and their relevance for the Business Information Systems (BIS) course on Information Management, a sophomore course part of the general education or Liberal Arts Core (LAC) program at a public liberal arts university. It proposes revised learning outcomes for the course that are better aligned with the learning outcomes of the LAC program and an instrument for assessment of student learning as a final exam with a rubric for evaluation of student performance. The proposed measures are coherent with the learning outcomes of LAC and the IS programs.

Keywords: Assessment of student learning, Information Systems, Information Management.

1. INTRODUCTION

Information Management is a course offered by the Information Systems (IS) program of a public liberal arts university in the Northeast USA for almost fifteen years. It is part of the general education or Liberal Arts Core (LAC) Program. It has grown substantially since its inception due to student demand, with currently over 20 sections offered each year. It is perceived to be an important factor for the success of the LAC program as well as for the IS program, which is among the top two programs at the university ranked on student retention. The program started officially in 2002 and has at present around 100 majors in IS and over 150 minors in three areas: Business Information Systems Management, Social Informatics and Healthcare Informatics.

Assessment has been discussed in a number of papers presented at ISECON conferences over

the years. It has often been in the context of development of standard testing of student learning spearheaded by the Center for Assessment of Student Learning (see Landry et al., 2006, Reynolds et al., 2004) or accounts of assessment work at program level (see White and McCarthy, 2007; Aasheim et al, 2007). Abraham (2012) presents a ten year retrospective on the lessons learned from assessment practices of an IS program and at course level. Humpherys et al (2014) focus on improving personal and life skills as a strategy in a first year IS course. To the best of our knowledge, besides Diagle et al (2007) there is very little work about assessment in an introductory IS course. While most of the published papers provide value in stimulating further practical and theoretical work on assessment in IS programs, there is a need for more papers capturing real assessment experiences in individual IS courses and hence the motivation for this paper.

The goal of this paper is to show the process of developing assessments of student learning in the Information Management course. These assessment measures needed to be practical and implementable across all sections, and better aligned with the LAC program goals and the requirements for professional accreditation agencies of business programs. The lack of published case studies documenting assessment work in Information Systems courses provides however justification for this work. The paper presents a case study explaining the assessment instruments and the process that we followed in a recent assessment development project that had four goals:

1. Revise the learning outcomes in the course on Information Management to align them with the developments in the field of Information Systems.
2. Further the alignment of learning outcomes from the course with those of the university-wide LAC program and the Business Information Systems program.
3. Determine appropriate, direct measures for the assessment of student learning that meet the requirements of professional accreditation agencies.
4. Develop compatible ways to measure student knowledge at the start and at the end of the course.

The rest of the paper is organized as follows. We begin by reviewing the theoretical foundations of general as well as course level assessment of student learning outcomes. We then propose methods to measure learning outcomes for the course in Information Management followed by an implementation plan for these assessment methods.

2. METHODS FOR MEASURING LEARNING OUTCOMES AND THEIR RELEVANCE FOR THE INFORMATION MANAGEMENT COURSE

Assessment as a term refers to the processes used to determine an individual's mastery of complex activities, generally through observed performance (Ewell, 2002:9). According to Kuh et al. (2014:4), "colleges and universities must cultivate an institutional culture that values gathering and using student learning outcomes data as integral to fostering student success and increasing institutional effectiveness as contrasted to demonstrating compliance".

According to Kuh et al (2014) and Banta and associates (2002), assessment is a growing field in education. Published work on assessment in IS education is generally modest in and is concentrated mostly in two special issues on assessment for the Journal of Informatics Education Research in 2006 and the Journal of Information Systems Education in 2008 and a small number of papers at annual conferences like ISECON (references). Insights about the overall process of establishing program assessment in an IS program may be found in Petkova and Jarmoszko (2004), Stemler and Chamblin (2006), Aasheim et al. (2006) and White and McCarthy (2007). Assessment activities in the IS discipline have been boosted by the work of the Center for Computing Education Research (See McKell et al., 2006).

An overview of academic program assessment methods is presented in Palomba and Banta (1999). They categorize program assessment approaches as direct and indirect methods.

Methods for *direct* assessment of student learning include:
- Exams, with multiple choice questions, essays and problem solving using local or national instrument.
- Performance measures (demonstrating student competence in one or more skills), including oral presentations, projects, demonstrations, case studies, simulations and portfolios.
- Juried activities with outside panels rating student work.

- Internships, national licensure or professional exams and certifications.

Indirect assessment methods utilize:
• Questionnaires designed to provide proxy information about student learning.
• Interviews.
• Focus groups.

The selection of assessment of student learning methods across an academic program is a complex process and involves multiple criteria reflecting the goals of the assessment exercise and constraints such as class size, mode of course delivery and assessment resources. Possible selection criteria are the ability of these methods to address the necessary assessment questions and the ability to provide useful information that indicate whether students are learning and developing in the desired ways. Other relevant selection criteria are: reliability, validity, timeliness, cost, motivation of the students to participate and ease of understanding and interpretation (Banta and Associates, 2002; Stassen et al, 2001).

Petkova et al. (2006) discuss the implementation of the assessment process in an IS program including these activities: curriculum mapping and syllabus analysis, course-embedded assessment, portfolio assessment and performance appraisal. It is evident that these steps relate to methods which can be classified as direct assessment, which are usually considered more objective and preferred in comparison to the indirect methods.
At the IS program level, several assessment approaches are applicable including:

1. A student survey of IS knowledge and expectations or a direct entry level test at the start of the students' studies in the first specialized courses of the program.
2. A senior survey of student experiences at the end of the capstone course.
3. Standardized exams.
4. Longitudinal assessment of student learning in the core IS courses.
5. Student web portfolios.

The development of instruments on the first two program assessment approaches above may be based on published work like in Kim and Pick (2000). Standardized exams are discussed in Reynolds et al (2004) and Landry et al. (2006), while their use to support program assessment is demonstrated in White and McCarthy (2007).

Longitudinal assessment studies in IS are rare with few exceptions like the one conducted by Williams and Price (2000). Portfolios are widely used as an assessment method in education, however, there are very few reports on their usage in computing and IS programs like Higgs and Sabin (2005).

The importance of having rubrics for project assessment that are derived from the overall IS program goals and have a standardized structure in various courses is illustrated in Petkov and Petkova (2006). A combination of portfolios and rubrics for assessment of information literacy has been reported in Diller &Phelps (2008). The use of projects for program assessment in Information Systems is discussed further in Petkov, Petkova, D'Onofrio and Jarmoszko (2008). The development of a conceptual model for the effective assessment of individual student learning in team-based subjects is discussed in Eliot et al (2012).

Kinzey (2010:1) concludes that four themes are "most pronounced in discussions on issues in assessment of student learning by US higher education leaders:

1. Assessment has taken root on campus.
2. Accreditation is the major catalyst for student learning outcomes assessment.
3. Faculty involvement is central to meaningful assessment.
4. Best practices in assessment weave assessment into organizing structures."

Since this paper deals with course level assessment, we will discuss that next. Course level assessment in an IS program is often left to the preferences of the individual professor and typically includes pre-test and post-test quizzes, tests on the content of the covered material, homework assignments, exams and team projects. These approaches are all relevant for the Information Management course and the details of their specific content as well as how they can be used will be discussed next.

3. COURSE LEVEL METHODS OF ASSESSMENT APPROPRIATE FOR THE INFORMATION MANAGEMENT COURSE

According to Brualdi (2002:65) it is essential to define clearly the purpose of assessment of student learning. Questions that can be used to define the purpose of assessment according to the same author are:

1. What am I trying to assess?
2. What should the students know?
3. What is the level?
4. What type of knowledge?

The above questions are related also to the role of the course in a particular program, according to Bloom's taxonomy of student learning outcomes (see Bloom, 1956; Gorgone et al, 2002, Topi et al., 2010). Hence, it is essential that any IS program needs to define first the skill sets resulting as learning outcomes linked to the goals of the program (see Petkova et al., 2006, Aasheim et al., 2007 and White and McCarthy, 2007).

On the first question, "What am I trying to assess?"

We developed a mapping showing the links between: 1) the broad LAC program goals, 2) the general learning outcomes for the LAC Tier II Applied Information Technology group of courses, 3) the goals of the IS program and 4) the revised learning outcomes in the Information Management course. The Information Management course is the only course at the university combining equally the development of personal productivity skills and knowledge of information systems for Business related discipline students and for other students that are also not majoring in Information Systems or Computer Science.

The simplified set of learning outcomes for Information Management is presented next:
Upon completion of BUS205 Information Management, a student should apply critical thinking skills and be able to:

- Understand the role of digital information technology in organizations, identify relevant information sources for problem solving and be able to analyze and present their findings.
- Understand important information systems used in organizations;
- Apply hands-on IT personal productivity skills in information management.
- Explain the technical and ethical limits of information systems in a global environment.

The small number of revised learning outcomes and the avoidance of overlap between them makes them easier to understand. It may be argued that these outcomes are more specific and thus they explain more concisely to the students what they can expect to master at the end of this course.

On the second question in Brualdi (2002): What should the student know?

For this purpose a mapping is developed of the learning outcomes in BU205 to the content of the custom textbook for the course (not shown for space reasons).

Regarding the *third and fourth* questions in Brualdi (2002) listed above, we will point out that typically the students are expected to master the material relevant to all six types of cognitive skills according to Bloom's taxonomy: Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation of issues related to Information Management taking into account however that this is a sophomore course [see for more details Bloom (1956) and the IS 2010 curriculum guidelines].

Thus we have addressed the first two objectives of our assessment project: 1. Revise the learning outcomes in the course on Information Management to align them with the developments in the field of Information Systems and the changing nature of teaching methods that are relevant for this course. 2. Refine the alignment of learning outcomes of this course to those of the university-wide LAC program and the Business Information Systems program.

Next, we will discuss how we addressed the third objective of our work: Determine appropriate, direct measures for the assessment of student learning that meet the requirements of professional accreditation agencies and that promote a better understanding of what students learn and to improve teaching approaches. As a starting point, we may note that to achieve objective measurement of student learning outcomes the focus of assessment work should be the application only of direct methods of assessment. However, we will apply also one indirect method, namely a student survey for a pre-test and post-test instrument to achieve the fourth objective of our assessment project: Develop compatible ways to measure student knowledge at the start and at the end of the course.

4. PROPOSED METHODS TO MEASURE LEARNING OUTCOMES IN THE COURSE

The proposed methods to measure learning outcomes in the course are following the third and fourth objective of the assessment project:

- Pre-test and post-test student survey reflecting the learning outcomes in BUS205
- A semester long project and presentation.
- Midterm exam.
- Quizzes.
- Student lab work assessed via a learning environment like SAM by Cengage Learning.
- Four individual home assignments.
- Class participation.
- Final exam given by each instructor individually.
- Final standard test across all sections (evaluated with a rubric).

Most of the above assessments will be designed and managed individually by each instructor who is responsible for achieving the learning outcomes by the students in her/his section.

We proposed two common assessment elements for all sections in BUS205 Information Management that will assist in the coherent measurement of learning outcomes for assessment purposes across all sections.

The first one is the Pre-test and post-test student survey reflecting the learning outcomes in BUS205, which has no weight for the final student grade.

The second common assessment instrument is a Final standard test across all sections with practical questions evaluated with a rubric (Appendix 1). It should be noted that it is not a substitute for the final exam given to the students by each section's instructor.

5. IMPLEMENTATION OF THE ASSESSMENT MEASURES OF STUDENT LEARNING OUTCOMES IN INFORMATION MANAGEMENT

The activities related to this assessment project can be grouped in three stages.

a. The first stage was by the end of the June 2015 session section for the course:

Prior to the course were developed:

- The pre-test and post-test student survey reflecting the learning outcomes in BUS205.

- The final standard test across all sections with practical questions evaluated with a rubric.

During the June 2015 course the two instruments in the summer class were tested.
b. By the end of the summer holiday:

The suggested assessment instruments were refined.

c. Additional activities by the end of the 2015-2016 academic year:

At the August instructor meeting on this subject were reported the results of the project.

Planned work during the fall semester:

All instructors will use the two instruments developed in this summer project but will not consider this semester the results from the final standard test as part of the official final student grade. The results are not gathered and analyzed formally for each section but each instructor is expected to perform these activities for self-training purposes and as a source of information for her/his report at the December 2015 course instructor meeting on possible suggestions for improvement in the assessment instruments.

During winter break:

Faculty will finalize the two instruments proposed to be used by all instructors in the spring term.

During the spring semester:

Instructors collect relevant data from applying the two proposed instruments, analyze it, keep the student tests for record purposes and report the analysis at the instructor meeting in August the following year.

6. CONCLUSION

The new assessment measures in the Information Management will be implemented in a coherent way in all sections of the course during the 2015-2016 academic year. This work in progress paper documented as a case study the process that was used for development of the assessment instruments. A limitation of this paper is that more work is needed on the validation of the proposed instruments. Future related activities will be on validating the instruments and on analysis of gathered data and its interpretation.

The results of this project will create preconditions for improvement of student learning in the introductory IS course and for the subsequent improvement in teaching this course and its content in the future by closing the assessment loop. The experience from this project can potentially be used in the development of other assessment measures for higher level IS program courses.

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Appendix 1.

BUS205 Information Management

Final Standard Test for Assurance of Student Learning

(This information is only for instructors and not for students,
the explanations for the students on the nature of the test are at the end of this document while the
questions for the actual test appearing below can be easily formatted separately)

BUS 205 Learning Outcomes

Upon completion of BUS205, a student should apply critical thinking skills and be able to:

1. Understand the role of digital information technology in organizations, identify relevant information sources for problem solving and be able to analyze and present their findings.
2. Understand important information systems used in organizations.
3. Apply hands-on IT personal productivity skills in information management.
4. Explain the technical and ethical limits of information systems in a global environment.

Questions to use for measuring the degree of achieving the BUS205 learning outcomes

Learning outcome 1: Understand the role of digital information technology in organizations, identify relevant information sources for problem solving and be able to present their findings. (Students are expected to be able to locate relevant information on the web and in library databases, and apply critical thinking in the evaluation of their findings).

Question to use:

1.   Unilever, a large international food and personal care manufacturer has implemented an interesting internet portal showing its brands, strategies for sustainability, information on investor possibilities and careers and its multi-national subsidiaries. You may find out more on those issues by exploring briefly the Uniliver portal on your own as a starting point. Please consider appropriate means for search like library databases or internet search engines to find out how two other companies, Wal-Mart and Apple, use the Internet.

1.1. Provide a brief analysis on up to 8-10 lines on how Wal-Mart and Apple use similar Internet technology. (5 points)

1.2. Please provide the steps and sources you used to collect the information on the above task in question 1.1. (5 points)

Learning outcome 2: Understand important information systems used in organizations. (Students are expected to know the typical characteristics of various types of information systems like complexity of the application, who is using it, amount of input and amount of output for the specific type of system).

Question to use:

2.   Provide a brief explanation of how the electronics retailer, Best Buy, can use the listed several types of information systems in its operations (you can use brief examples as part of your answers)

2.1. Transaction processing systems (5 points)

2.2. Management information systems (5 points)

2.3. Decision support systems. (5 points)

Learning outcome 3: Apply hands-on IT personal productivity skills in information management.

(In Excel the students should demonstrate understanding of types of cell references and how they are used, ability to perform arithmetic operations and apply formulae in a spreadsheet as well as to visualize data with relevant charts).

(In Access the students should demonstrate understanding of the structure of tables, types of data fields and their format, relationships between tables and how those affect their structure through appropriate key fields).

Questions to use:

3.1. Consider that you are keeping track in a spreadsheet program like Excel monthly of your expenses for these items and that at the end of last month your data in columns A and B looked similar to these values:

A	B	C
11 Food	$350	
12 Rent	$650	
13 Car gas	$250	
14 Entertainment	$200	
15 Miscellaneous	$150	
16 Total	$1600	

3.1.1. You want to show in column C the percentage from the total for each item. Write the formula you will provide in cell C11 so that the formula you wrote in C11 can be copied into the range from C12 through C15 and automatically be reused without having to manually modify each of the formulas in C12 through C15. (10 points)

3.1.2. Describe the steps you will use to copy the formula from cell C11 to the range C12 through C15. (10 points)

3.1.3. What kind of a chart would you use to illustrate your results in column C and why? (10 points)

3.2. You are appointed as a student assistant to the department and your task is to design a simple database showing the relationship between professors and their advisees. (You are told that each student in the department may only have one Professor as their advisor.)

3.2.1. List about 5-6 appropriate fields in the structure of each of the tables Advisee and Professor, showing also their data type and length. (10 points)

3.2.2. What is the relationship between the tables Advisee and Professor? How is it reflected in the structure of the two tables? (10 points)

3.2.3. What fields will be used as primary keys for each of the two tables and what data types they will be? (10 points)

Learning outcome 4:

Explain the technical and ethical limits of information systems in a global environment.

(Students should understand the technical foundations of the Internet and related technologies as enablers of global communications, the basic parameters of computer technology affecting its throughput and usefulness for personal or business use and the basic ethical and privacy issues in using computers, related to appropriateness of the information accessed through computers and stored in them, copyright issues, the need for authentication rules and password protection, protection of personal and other private information etc.).

Questions to use:

4. The following sub-questions relate to some technical and ethical limits of information systems in a global environment.

4.1. Explain how information located at different places in the world can be accessed via computer technology today (in terms of how it can be identified, transferred to your computer and the technology enabling you to access it. (5 points)

4.2. Explain which top five computer parameters one should consider when buying a laptop computer for personal use? (5 points)

4.3. You are working as a salesperson for a pharmaceutical company and they gave you a new powerful tablet computer to use. It is convenient and you like it a lot and have also started using it for personal use as the company allows that under certain restrictions related to its ethical and privacy regulations. Provide at least two-three ethical and privacy considerations that you may have to abide by in order conform to typical/standard company regulations. (5 points)

Evaluation rubric for the student answers in the

Final Standard Test for Assurance of Student Learning

Criteria	Definition of rubrics and scale (1-4)			
	Beginning 1	**Developing 2**	**Accomplished 3**	**Exemplary 4**
1. Understand the role of IT in organizations, identify relevant information sources for problem solving and be able to present their findings				

1.1. Provide a brief analysis on up to 8-10 lines on how Wal-Mart and Apple use similar Internet technology.	Student lists the facts	Lists facts and some evaluation in one paragraph	The evaluation is deeper and structured	Evaluation argument is structured and shows good understanding of IT and organizations
1.2. Please provide the steps and sources you used to collect the information on this task	Uses internet search engines for finding any Postings	Uses also white papers and blogs	Uses search engines and library databases	Uses diverse sources and justifies why they are relevant
2. Provide a brief explanation of how the electronics retailer Best Buy can use several types of information systems in its operations:				
2.1. Transaction processing systems	Answer is repeating the words of the type of system	Provides examples of usage as well	Provides examples and shows links to other systems	As previous but explains also at what level of mgmt. they are used
2.2. Management information systems	Answer is repeating the words of the type of system	Provides examples of usage as well	Provides examples and shows links to other systems	As previous but explains also at what level of mgmt. they are used
2.3. Decision support systems	Answer is repeating the words of the type of system	Provides examples of usage as well	Provides examples and shows links to other systems	As previous but explains also at what level of mgmt. they are used
3. Apply hands-on IT personal productivity skills in information management.				
3.1. Excel				
3.1.1. You want to show in column C the percentage from the total for each item. Write the formula you will provide in cell C11.	Wrong formula format including cells B11 and B16 or just using the numbers	Correct formula format but relative coordinates used for B16	Correct formula format: B11 in relative coordinates , B16-absolute coordinates	Same as previous but showing that the cell C11 is formatted as percentage

3.1.2.Describe the steps you will use to copy the formula from cell C11 to the range C12 through C15	Student does not answer	Student indicates copy of formula but makes errors	Correct formula entered	Correct, shows more than one way to do it
3.1.3. What kind of a chart would you use to illustrate your results in column C and why?	Student does not answer	Correct answer No justification	Correct answer Justification provided	As previous but showing how the chart will be generated in Excel
3.2. Access and databases				
3.2.1. List about 5-6 appropriate fields in the structure of each of the tables Advisee and Professor, showing also their data type and length.	Student does not answer	Includes grouped fields like address	Suitable fields, FK not included in child table	Suitable fields including FK
3.2.2. What is the relationship between the tables Advisee and Professor? How is it reflected in the structure of the two tables?	Student does not answer	Knows relationship, not showing how to use a FK	Correct relationship and FK	As previous and shows that all PKs and FKs are required and cannot be blank
3.2.3 What fields will be used as primary keys for each of the two tables and what data types they will be?	Student does not answer	Uses last names	Uses IDs but data type is number	As before and shows data type as text
4. Explain the technical and ethical limits of information systems in a global environment.				
4.1. Explain how information located at different places in the world can be accessed via computer technology today (in terms of how it can be identified, transferred to your computer and the technology enabling you to access it.	Student does not answer	Discusses two devices	Discusses more than two devices	Provides considerations for network security as well
4.2. Explain which top five computer parameters one should consider when buying a laptop computer for personal use?	Student does not answer	Only size of RAM and another relevant parameter	Uses RAM, processor clock speeds, No of processor cores	As before and also size of the word, types of outputs and other relevant parameters.
4.3. You are working as a salesperson for a pharmaceutical company and they gave you a new powerful tablet computer to use. It is convenient and you like it a lot and have also started using it for personal use as the company allows that	Student does not answer	Student mentions that no personal information should be stored on the tablet.	As before but add that no copyrighted material will be viewed or stored without proper authorization.	As before and additional considerations related to privacy, security and ethical use of the tablet are provided.

under certain restrictions related to its ethical and privacy regulations. Provide at least two-three ethical and privacy considerations that you may have to abide by in order conform to typical/standard company regulations. (5 points)				

N.B. The above information is for instructors only while the information below is to be provided to the students at the start of the semester as a way to assist them in their preparation.

BUS205 Information Management
Final Standard Test for Assurance of Student Learning
(Instructions for students on the nature of the test)

This test is used to measure student learning in BUS205 Information Management following the course learning outcomes

Upon completion of BUS205, a student should apply critical thinking skills and be able to:
1. Understand the role of digital information technology in organizations, identify relevant information sources for problem solving and be able to analyze and present their findings.
2. Understand important information systems used in organizations;
3. Apply hands-on IT personal productivity skills in information management.
4. Explain the technical and ethical limits of information systems in a global environment.

Nature of the questions used in the test

Learning outcome 1: Understand the role of digital information technology in organizations, identify relevant information sources for problem solving and be able to present their findings.
(Students are expected to be able to locate relevant information on the web and in library databases, and apply critical thinking in the evaluation of their findings. Question to use includes a brief situation describing the use of information systems in organizations. Students should identify sources helping them in understanding the problem and should be able to justify the steps they used to gather information and analyze it.)

Learning outcome 2: Understand important information systems used in organizations.
(Students are expected to know the typical characteristics of various types of information systems like complexity of the application, who is using it, amount of input and amount of output for the specific type of system).

Learning outcome 3: Apply hands-on IT personal productivity skills in information management.
(In Excel the students should demonstrate understanding of types of cell references and how they are used, ability to perform arithmetic operations and apply formulae in a spreadsheet as well as to visualize data with relevant charts).
(In Access the students should demonstrate understanding of the structure of tables, types of data fields and their format, relationships between tables and how those affect their structure through appropriate key fields).

Learning outcome 4: Explain the technical and ethical limits of information systems in a global environment.

(Students should understand the technical foundations of the Internet and related technologies as enablers of global communications, the basic parameters of computer technology affecting its throughput and usefulness for personal or business use and the basic ethical and privacy issues in using computers, related to appropriateness of the information accessed through computers, what information is appropriate to be stored on company owned devices, copyright issues, the need for authentication rules and password protection, protection of personal and other private information etc.).