

## UNDERSTANDING STUDENT PERFORMANCE IN AN INTRODUCTORY INFORMATION SYSTEMS COURSE: AN ASSESSMENT FOR ABET

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### ABSTRACT

*Assessment of course outcomes is an important aspect of ensuring that educational institutions deliver quality and relevant education to students. Accreditation adds value to a collegiate program and ensures that it has met standards necessary to produce graduates who would have better opportunities in employment, mobility and providing positive impact on society (abet.org). Approximately 85,000 students graduate from ABET-accredited programs each year (abet.org). This paper explores the process of assessing course outcome for an introductory information systems course. The methodology is discussed, recommendations are provided, and a conclusion is presented.*

**Keywords:** Course outcomes, assessment, ABET, information systems, accreditation

### INTRODUCTION

Institutions of higher education are under pressure in recent years to graduate students with better communication, thinking, and teamwork skills [2]. Industry surveys indicate that college graduates should have soft skills such as written communications, analytical/critical thinking, oral communications, computing technology, teamwork, etc. [3]. Accreditation bodies require colleges to assess student learning directly through the use of exams, projects, and written papers. While faculty generally agree that these skills are important, it is often difficult to find time in courses to explicitly teach and assess these skills.

In the past decade, accrediting bodies have changed assessment from a stand-alone one time activity to a continuous one [1]. In this new culture of assessment, an institution has to demonstrate a culture of continuous assessment as an ongoing process [6]. It is important now that programs not only present assessment results to the agencies but also show how it has initiated improvements based on the results they obtained from such activities. 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. 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 [8]. This makes sense in an ever-changing field such as information systems.

The course in discussion here, INFS 1020, is a university-wide core course and is usually taken by students in freshmen year. It includes topics such as hardware and software, operating systems, systems development, database, networking and information security. However important these concepts might be to an upcoming graduate, the relevance of learning these topics is not so obvious to the students. This has been the case with introductory MIS courses at other schools as well. Aytes (2004) notes that for a core MIS course students do not readily recognize the value that information plays in integrating business functions. They feel that they need additional help in learning to use technology, rather than an overview of conceptual concepts. The content of this course has always been a point of discussion in the department and the school.

A description of the course is as follows:

INFS1020 - Introduction to Decision Support Systems provides the student with an understanding of computers, essential computer hardware and software, and the impact of information technology on organizations and society. The complexity of designing effective information systems is discussed, and the student learns to compare, analyze, and evaluate information from various systems. The course involves both an overview of technological concepts and student practice in solving typical information-related problems. The importance of logical reasoning and solving specific technical problems is addressed by developing structured logic combined with software. Course also includes Excel and Access software.

Our BS in Computer Information Systems degree and our BS Information Science degree are both accredited by ABET-CAC. Earning a degree is a significant achievement and an important investment in a student's future. Since so much of their future success depends on their educational foundation, the quality of the education they receive makes a big difference. ABET-accredited programs such as we have at Robert Morris assure prospective students a quality education and an enhanced employment opportunity. (<http://www.abet.org/accreditation-matters-students>). Because of this accreditation, we are very concerned about assessment of all INFS courses especially in INFS1020 because it is in the RMU Core and its regular assessment is very important to meet Middle States Association of Colleges and Schools Regional Accreditation criteria.

The rest of the paper is organized as following. The next section of the paper talks about assessment in general. There are different types of assessments and this section provides a detailed overview of these available assessment approaches. Following a discussion on assessment, the methodology applied for assessing this particular course is described along with the data collection for assessment. The section following the methodology description presents the results of data analysis from the academic year 2010-2011. The discussion and recommendation section presents the insights from this assessment exercise. The recommendations are based on our experiences with this core introductory-level IS course. Finally the conclusion section presents a summary of the paper.

## ASSESSMENT OF COURSES

Assessment is often equated and confused with evaluation, but the two concepts are different. Assessment is used to determine what a student knows or can do, while evaluation is used to determine the worth or value of a course or program [12].

There are many other definitions of assessment, too. The definition we used is the following:

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 [4].

### Purpose of Assessment

The purpose of assessment is to support data-driven decision-making and measure knowledge, skills, or abilities against defined competencies or learning outcomes. Assessments associated with the learning process are often classified as diagnostic, formative, needs, reactive, or summative.

Diagnostic assessments are primarily used to identify needs and to determine prior knowledge of individual participants. Diagnostic assessments usually occur prior to a learning experience. These are often known as "placement tests" or "placement exams."

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Formative assessment has the primary objective of providing prescriptive feedback to a student to inform next steps in the instructional process. Educators tend to use quizzes in this fashion.

Needs assessment is used to determine the knowledge, skills, abilities and attitudes of a group to assist with gap analysis and courseware development. Gap analysis determines the variance between what a student knows and what they are required to know. This too is a diagnostic tool, but it is used in the context of performance improvement in a workplace.

Reaction assessment takes place after a course or learning experience to gather the students' opinions. Reaction assessments are often known as "smile sheets," "level 1 surveys" or "course evaluations."

Summative assessment is where the primary purpose is to give a quantitative grading and make a judgment about the participant's achievement. Summative assessments typically take place at the end of a course of instruction where the goal is to provide overall information on the amount and quality of student learning. These are often known as "mid-term exams" or "final exams." [5]

## Types of Assessments

There are a number of types of assessments, each of which is appropriate for different assessment purposes or goals. When deciding the type of assessment to use, first consider the purpose of the assessment. Is it for diagnostic or placement purposes? Is it to provide feedback throughout the learning process? Is it to determine at the end of a course of study if a student has mastered skills defined in a set of standards? Is it to determine the gap between what students know and what they need to know? Is it to determine student opinions? Depending on the purpose of the assessment, different types of assessments may be utilized [5].

**Table 1:** Types of assessment

Type of Assessment	Definition	Purpose	Examples
Performance	A stimulus or prompt designed to elicit a performance from a student to demonstrate knowledge, skills, and abilities related to a specific problem-solving activity in a specific context.	Needs Diagnostic Formative Summative	1. Use appropriate tools in an automotive skills class to fix a mechanical problem with an engine. 2. Class assignment. 3. Tutorial. 4. Interviews. 5. Peer reviews.
Portfolio	Systematic collections of work products that are typically collected over time. May contain assessment scores, work artifacts, student journals or notes.	Formative Summative	1. Course portfolio. 2. College portfolio. 3. Student portfolio. 4. Journals.
Production	A stimulus or prompt designed to have a student produce a work artifact to demonstrate knowledge, skills, and abilities related to a specific problem-solving activity in a specific context.	Needs Diagnostic Formative Summative	1. Produce an Excel spreadsheet in an accounting class to demonstrate mastery of accounting practices. 2. Class assignment. 3. Tutorial. 4. Essay test. 5. Speaking test.
Survey	A set of questions designed to elicit student opinions about the learning environment	Reaction Needs	1. Course or instructor evaluation. 2. Survey of student services. 3. Survey of student satisfaction. 4. Focus groups.

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Quiz	A set of questions used to measure a student's knowledge or skills for the purpose of providing feedback to inform the student and the teacher of the current level of knowledge or skill.	Formative	1. Informal, in-course set of questions to determine if students are tracking with the content or if misconceptions are developing. Useful for determining next events in learning process. 2. Class assignment. 3. Tutorial. 4. Case study.
Test	A method for determining student learning at defined intervals before, within or after a course of study to determine if students are ready for the next stage of instruction.	Needs Diagnostic Summative	1. Placement test or pretest before a course starts. 2. Mid-term. 3. Final test in a course. 4. Case study.
Exam	A method for determining whether student learning meets criteria established by an external source.	Summative	1. Certification exam where a cut-score must be achieved before the student may be certified or licensed in a field. Job placement exam, where a cut-score must be obtained before a job will be offered.

## METHODOLOGY

We mapped the course objectives of this course with the performance indicators established by the department to assess the performance of students for this required 1000 level introductory IS course. Majority of the students in this course are freshmen (more than 90%) and this is a required course. In any typical semester, between 200 and 250 students take this course. For this assessment, we collected 150 responses. Several sections of this course are offered and many of these are taught by part-time faculty.

The table below lists the performance indicators established to assess the student performance in this course.

**Table 2:** Performance Indicators for INFS 1020

1	Establish a firm foundation in information systems on which students can build successful careers in an area of expertise of their choice.
2	Identify the key components of information technology equipment.
3	Understand the difference between computer hardware and software.
4.	Identify the types and purposes of computer software who primary use is in a business environment
5.	Identify the applicability of the life cycle approach to developing information systems and understand the activities and expected results of each phase of this process.
6.	Apply microcomputer software and database software to the solution of problems typically encountered at the various levels of society and organizations.
7	Understand the encompassing impact of information technology to different aspects of personal, social and cultural life

Several learning objectives were established for the students and all the objectives were mapped with our performance indicators for this course for assessment purposes (table 3 below).

**Table 3:** Mapping of course LEARNING objectives with performance indicator used for assessment

<b>Course Learning Objectives</b>	<b>Performance Indicators used for assessment (Table 1)</b>
Understand the principles of Information Systems.	1,2
Establish a firm foundation in Information Systems on which students can build successful careers in an area of expertise of their choice.	1,2
Understand how the major categories of information systems support the information requirements of all organizations.	6
Understand the role and applicability of personal information systems, work group systems and enterprise wide systems in providing the required information.	6
Understand and apply the concepts of blending technology with the needs of people and the requirements of an organization and the related concept of putting needs before the technology.	2
Understand the capabilities of available information systems technology and select appropriate technology for the addressing of the defined information requirements.	3
Understand current trends in the evolution of information systems technology and identify the implications of these trends on the organization's information systems.	4
Identify the applicability of the life cycle approach to developing information systems and understand the activities and expected results of each phase of this process.	5
Identify the role of and understand the activities performed in prototypes and other alternatives to the life cycle approach to systems development	5
Identify the applicability of personal information systems and end-user computing, understand the problems related to these approaches to providing information and the techniques used to evaluate applicability, select technology and control the implementation and utilization.	4
Identify ethical, moral and legal issues relating to the storage and dissemination of information and the use of information systems.	7
Apply microcomputer software and database software to the solution of problems typically encountered at the various levels of society and organizations.	6

For the purposes of this research, a survey instrument comprising 50 items was created by the researchers. The items in this survey were mapped to the performance indicators such that we get some understanding of how well are the students performing of several dimensions defined up front. The data from this test was analyzed to assess the performance based on predefined performance indicators. This test was used as final exam by one researcher and as extra credit test for the other researcher. Students took the survey on scantrons and the data was analyzed using Test gen analyzer and exported on SPSS.

Results:

To analyze the performance level of the students in this course, the following rubric was used:

**Table 4:** Performance assessment rubric

Level of Performance	Categories of Result
Performance level < 60 %:	Unacceptable
Performance level > 60% and <70%:	Satisfactory
Performance level > 70% and <80%:	Good
Performance level >80% and <90%:	Excellent
Performance level > 90% :	Outstanding

The table below suggests the performance of students based on each performance indicators established for this course.

**Table 5:** Breakdown of performance indicators (item wise) with the student performance data

Course Objectives/ Performance Indicator	Items	Number of respondents			Comments
		Items	Correct response	%	
Performance Indicator 1: Establish a firm foundation in information systems on which students can build successful careers in an area of expertise of their choice.	8	Item 1	43	93	Overall performance averages around 92% - Outstanding
		Item 7	45	98	
		Item 12	38	83	
		Item 20	36	78	
		Item 21	43	93	
		Item 23	42	91	
		Item 28	46	100	
		Item 34	44	96	
Performance Indicator 2: Identify the key components of information technology equipment.	12	Item 2	45	98	Overall performance averages around 81% - Excellent
		Item 3	46	100	
		Item 6	40	87	
		Item 11	12	26	
		Item 14	35	76	
		Item 15	27	59	
		Item 17	28	61	
		Item 19	43	93	
		Item 27	45	98	
		Item 30	46	100	
Performance Indicator 3: Understand the difference between computer hardware and	2	Item 4	46	100	Overall performance averages around 100% -

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software.		Item 5	46	100	Outstanding
Performance Indicator 4: Identify the types and purposes of computer software who primary use is in a business environment	6	Item 13	17	37	Overall performance averages around 69% - Satisfactory
		Item 16	43	93	
		Item 18	27	59	
		Item 22	45	98	
		Item 29	20	43	
Performance Indicator 5: Identify the applicability of the life cycle approach to developing information systems and understand the activities and expected results of each phase of this process.	7	Item 35	37	80	Overall performance averages around 54% - Unacceptable
		Item 37	26	57	
		Item 38	27	59	
		Item 39	43	93	
		Item 40	27	59	
		Item 41	4	9	
Performance Indicator 6: Apply microcomputer software and database software to the solution of problems typically encountered at the various levels of society and organizations.	10	Item 42	25	54	Overall performance averages around 69% - Satisfactory
		Item 43	20	43	
		Item 31	40	87	
		Item 32	45	98	
		Item 33	38	83	
		Item 45	29	63	
		Item 46	20	43	
		Item 47	24	52	
Performance Indicator 7: Understand the encompassing impact of information technology to different aspects of personal, social and cultural life	5	Item 48	37	80	Overall performance averages around 94% - Outstanding
		Item 49	25	54	
		Item 50	27	59	
		Item 8	36	78	
		Item 9	43	93	
		Item 10	46	100	
		Item 24	45	98	
		Item 25	45	98	

## DISCUSSIONS AND RECOMMENDATIONS

This course is targeted at freshmen level students and is required by all the students in the University. An acceptable performance level for this course has been estimated at 70%. The course assessment results suggest there are several areas in this course where students are doing very well. Data for performance indicators 1, 2, 3 and 7 suggest an impressive performance for these dimensions. Data for performance indicators 4 and 6 suggest a good grasp of the concepts under this dimensions and a fair room for improvement. Data for indicator 5 suggests a below average performance on concepts under this dimension. Reasons for poor performance in this area call for further scrutiny. We need to prepare our students in a better way in the above dimension. The overall performance for the course can easily be said to be well beyond our acceptable performance level of 70%.

Along with assessment, this course employed several techniques to engage students in theoretical as well as practical aspects of the content. Thirty percent of the total grade was used towards hands-on exercises and assignments in Excel and Access tools for decision making. Fifty percent of the grade was employed in assessing the depth of theoretical concepts in this course along with the ability to apply the concepts in real life situations. Ten percent of

the grade was for a final group project along with mandatory presentation to the class. This exercise has been beneficial to the students in providing an opportunity to work as a team and also engage an audience in a discussion. Remaining of the grade (10%) was awarded for class participation.

Recommendations include the following:

1. We may need to revisit the areas covered in the course. Do students need to know life cycles approach to developing systems (performance was unacceptable)?
2. The concepts considered “satisfactory” should be revisited as to whether we should spend more time on the content or do we not cover that particular subject(s).
3. Ideally, we could have multiple introductory level information systems classes that meet the interests of a variety of students with different learning abilities. This would not only reduce the number of students in the introduction to computer science classes, but this solution might capture the interests students have for computers and computer science.
4. Maybe, a more realistic approach to our situation is to separate the information systems department into theoretical and applied, and therefore, students have a better idea of the type of I/S class they are entering and the material covered. There is a reason why such a variety of people take the introduction to information systems course, and the reason is because the students are intrigued by the subject itself and/or they feel the subject can aid them in their discipline of study. However, instead of seeing a non-I/S student's curiosity for computers being kindled, one tends to see quite the opposite. Very rarely do most of the students who take a traditional introductory-level course take another computing course in the future. (Parham, 2003, page 125)
5. We might also want to “tackle” the problem by trying to decide what “should” be taught in an introductory course rather than trying to “fit” the course to a table of contents in a textbook.
6. The final aim of any assessment process is improving the academic programs being offered by educational institutions. Even though we place great effort in collecting data and creating assessment reports for courses such as INFS 1020 the bigger questions still remains: Are we improving our programs and curriculum based on the results that we get? In other words there is a need to establish a “feedback loop” into our curriculum development process such that the benefits of performing assessments are realized sooner than later. It is imperative that eventually all the assessment efforts result into program improvement and value addition to institutions.

## CONCLUSION

This study presents the assessment results from an introductory IS course at Robert Morris University. The methodology of conducting this assessment along with the results is presented. There are certain areas identified in the curriculum that need more focus on the part of faculty as well as students. Recommendations are provided to identify areas of improvement in the content of the course. Further studies are required to study the impact of recommended changes and use the leanings in the way which is beneficial to the students.

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