

# SKILL LEVEL ASSESSMENT AND MULTI-SECTION STANDARDIZATION FOR AN INTRODUCTORY MICROCOMPUTER APPLICATIONS COURSE

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## ABSTRACT

*Since students now enter college with a great deal of experience with computers, we explored how much computer technology knowledge, typical of the content of an introductory microcomputer applications course, may have been acquired prior to matriculation. Four pre-tests were administered on-line to 14 sections of the introductory course (approximately 500 students) within the first two weeks of class to determine the students' computer knowledge. Also, four post-tests were given to these same students throughout the course. Data was collected over two semesters. A passing score would be 70% or higher on each of the pre-tests, as well as for the post-tests. Results indicate that students are not entering the introductory computer course "computer literate;" however, they are exiting the course with pass rates of 70% or higher. Differences between pre-test and post-test means were significant.*

**Keywords:** computer technology knowledge, computer literacy, college student computer knowledge, microcomputer applications course standardization

## INTRODUCTION

Most, if not all, institutions of higher education value computer literacy in their students. Although the definition of computer literacy is varied, it includes both an understanding of basic computer concepts and an ability to use the computer to achieve personal and academic goals. Institutions of higher education view this knowledge as a necessary component for many of their higher-level courses.

Many colleges of business administration require students to take a microcomputer applications course as part of their pre-business core curriculum. It is believed that business school graduates should be knowledgeable in basic microcomputer concepts and be capable of using microcomputer software as a tool to meet business and industry needs. This course is often a pre-requisite for many if not all of the higher-level business courses in which the student will subsequently enroll. Plutsky and Wilson found in their study of undergraduate business students that the completion of the business pre-requisite computer literacy course requirement positively contributed to the students' overall performance in a higher-level business communications course (6).

Today, many college students matriculate who have been exposed to several years of computer use, either in home or school settings. Therefore, it is often assumed that today's entering college students are already computer literate; and thus, do not need a course to cover basic computer concepts nor microcomputer applications. Yet, a recent study of undergraduate students' perceptions of their computer literacy skills showed that students perceived themselves to be better prepared in word processing than they did in spreadsheet and database applications and that they had not received extensive coverage of ethical, social, legal, and global issues (2). Also, in a recent longitudinal study, Robinson and Thoms found that "students are not entering their first college of business computer course any more computer literate in computer technology knowledge than they were several years ago"(7). These authors argued that although students have been exposed to computers, this exposure has not resulted in the mastery of computer technology necessary for the successful undergraduate business student. The question remains: are entering college students "computer literate:" are they knowledgeable in basic computer concepts and can they use the microcomputer as a tool to meet business and personal needs?

## **BACKGROUND OF THE STUDY**

The initial purpose of this study was to assess the skill levels of students entering the introductory microcomputer applications course. This course is required of all undergraduate students at an AACSB-accredited College of Business. Since we had no data on the basic computer skills of these students, we developed a set of pre-tests to establish a base line of skill levels for these students.

Based upon our observations of these students, we believed there might be a large variation in the students' skill levels; but, again, we had no data to support this assumption. Due to this presumably large variation, we recognized the difficulty of getting the majority of students to achieve specific outcomes by the completion of the course. Therefore, a second purpose of this study was to assess the skill levels of the students exiting the course. This purpose was two-fold – (1) to measure the variation in computer skills at course entry and course exit, and (2) to provide us with data of student skill levels for the second Computer Information Systems course required by the College of Business. We also believed that the variation in the students' skill levels would be less when the students exited the introductory course.

A third purpose of this study was to use this data as a means to evaluate the standardization of the course content across multiple sections of the course. Since 14 sections of the course are offered each semester, it is important to ensure a level of consistency across all sections. By analyzing pre- and post-test data, we are better able to assess consistency across multiple sections as well as recognize and address any inconsistencies that may exist.

The objectives of this study were as follows:

1. Assess computer skills of students entering the introductory microcomputer applications course.
2. Assess computer skills of the same students at the conclusion of the introductory microcomputer applications course (or when the material has been covered).
3. Assess the variation within the pre-test scores and within the post-test scores.
4. Assess the consistency across multiple sections of the course.

## **HYPOTHESES**

Our hypotheses were:

1. Students entering an introductory microcomputer applications course will be able to pass each of four pre-tests where passing would be achieving a score of 70% or more.
2. Students exiting an introductory microcomputer applications course will be able to pass each of four post-tests where passing would be achieving a score of 70% or more.
3. Post-test scores will be significantly higher than pre-test scores.

## **METHODOLOGY**

To meet the objectives of this study, skills assessments were developed and administered to a few sections of the introductory microcomputer applications course (CIS 100) over the course of several semesters (Summer 2001 – Fall 2002). Initially, paper and pencil pre-tests consisting of multiple-choice questions in Windows, Word, and Internet skills were used to evaluate the students' introductory computer skills as they matriculated into the course. Similar post-tests were used to test the students' knowledge at the conclusion of the course.

Over time, however, the desire to assess the students' skills more easily and quickly became apparent, especially given the number of course sections and different instructors per semester (14 sections; 5 instructors). The authors chose to incorporate McGraw-Hill's PageOut® (3) and SimNet® (4) products, which allowed us to administer pre- and post-tests on-line using a web interface with the results returning immediately to the course web site for the instructor's and the students' review.

The SimNet® package is based on the Microsoft® MOUS (Microsoft® Office User Specialist) certification program, the only Microsoft® approved program for certifying proficiency in the Microsoft® Office desktop applications and Microsoft® Project (1, 5). The SimNet® package emulates the MOUS examination environment, whereby SimNet® places the student into a simulated application program, such as Microsoft® Excel, and asks the student to complete a task within that environment.

Each pre-test/post-test consisted of 35 questions that were chosen from approximately 100 questions that cover each Microsoft® application. The questions were chosen from the CORE (most basic) level skill-set for MOUS certification, and they were selected because they

reviewed skills that closely aligned with the course learning objectives. After beta-testing the SimNet® program in a few course sections (Spring 2002), we were able to test the program in all 14 sections of (CIS 100) beginning Fall 2002.

To be consistent with Robinson and Thoms' study, our students needed to achieve at or above 70% for each pre- or post-test. Also, we chose 70% as a pass rate as well as a timed, experiential exam to better emulate an actual MOUS User Exam, which requires somewhat higher standards for certification (5).

Beginning Spring Semester 2003, four pre-tests and post-tests were given on-line to 14 sections of CIS 100 (approximately 500 students per semester). Each pre-and post-test consisted of 35 questions that evaluated the students on basic computer skills. The pre-test and post-test questions were the same; however, the questions were presented to the student in random order. The four pre-and post- tests used were:

1. **Computer Concepts** – this pre-test evaluated the student's knowledge of introductory computer concepts – such as recognizing input and output devices and system board components, differentiating between examples of systems and applications software, and understanding the systems development process.
2. **Microcomputer Operating Systems** – this pre-test evaluated the student's knowledge of the basic features of the Microsoft® Windows 2000 operating system, such as how to use Windows® Explorer, open programs using the Start Menu, work with open windows on the taskbar, and customize the desktop.
3. **Word Processing** – this pre-test evaluated the student's knowledge of basic word processing skills within the Microsoft® Word 2002 environment. Questions chosen for this pre-test were exclusively from MOUS Core Level for Microsoft® Word 2002.
4. **Spreadsheet** – this pre-test evaluated the student's knowledge of basic spreadsheet skills within the Microsoft® Excel 2002 environment. Questions chosen for this pre-test were exclusively chosen from Microsoft® Core Content for Excel.

Students were asked to complete the pre-tests as part of their first lab assignment. Students were informed that their actual grades on the pre-tests did not count toward their final grades in the course. However, by completing the pre-tests, regardless of their scores, the students earned credit for completing Lab 1.

Throughout the semester, students were assigned a variety of SimNet® lessons, which allowed the students to practice the skills in a non-threatening simulated environment. Students were also assigned additional labs and lecture materials from the textbooks and the instructors. As the students finished each area of study within the course (Windows, Word, Excel, and Computer Concepts), they were post-tested using the same content as was assessed on the pre-tests. Students were allowed two attempts for each question on the post-tests. Students' scores on the post-tests did count toward their final course grade.

## RESULTS

Results are shown in Table 1 and Table 2. Pre-test and post-test results were analyzed as matched pairs using standard t-tests. For each course section (14 in total), four t-tests were conducted, one each for Computer Concepts, Windows, Word, and Excel. Considering the spring and the fall terms, 112 content area pairings were analyzed using t-tests.

In Table 1, percentage correct scores are displayed for the pre-tests, post-tests, and learning gain for each content area by term. Learning gain is a measure of student performance: the difference between the post-test mean and the pre-test mean.

**Hypothesis 1.** Although students were expected to achieve a 70% or greater pass rate on each of the four pre-tests, our analysis demonstrated the contrary. Students did not achieve a 70% or greater pass rate on any of the four pre-tests during either semester. Across the four content areas, students' scores averaged 54.9% correct for the pre-tests.

**Hypothesis 2.** As expected, post-test scores demonstrated that students achieved a passing score (>70%) in three of the four content areas. However, post-test scores for Excel were not statistically greater than 70% correct. It is important to note that even though the Excel pass rate was the lowest of all four areas, the Excel scores showed the largest learning gain (see below).

Table 1. Percentage Correct Scores and Learning Gain

2003 Results: Percentage Comparisons	Computer Concepts		Windows		Word		Excel	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Post-test Mean	87.4%	76.3%	82.0%	76.9%	81.8%	78.0%	71.8%	70.7%
Pre-test Mean	62.7%	62.0%	61.9%	60.0%	58.3%	59.7%	38.0%	36.9%
Learning Gain	24.7%	14.4%	20.1%	16.9%	23.5%	18.3%	33.8%	33.8%
% of Course Sections with Statistical Learning Gains (alpha=0.05)	92.9%	92.9%	85.7%	100.0%	100.0%	100.0%	100.0%	100.0%

**Hypothesis 3.** Post-test scores were significantly higher than pre-test scores for 96.4% of the analyzed pairings. The t-tests were significant (alpha=0.05) for all but four of the 112 (96.4%) content areas across multiple sections. The learning gain averaged 23.2%, with a low of 14.4% (Computer Concepts, spring) and a high of 33.8% (Excel, spring and fall).

Further analysis of responses, as shown in Table 2, provided additional explanation of the learning gain. In addition to improving the mean responses for content areas, the pre-post test model demonstrated reduced response variation in the post-tests. Post-test standard deviations ranged from 3.3 to 4.8, while the pre-test standard deviations fell in range of 4.6 to 5.9. The simultaneous improvement of mean responses and reduction in variations were indicated by the coefficients of variation. For the pre-tests, the coefficients of variation ranged from 0.22 to 0.45. For the post-tests, the corresponding coefficients of variations fell between 0.11 and 0.19.

Table 2. Pre-test/Post-test Response Summary

2003 Results: Raw Scores	Computer Concepts		Windows		Word		Excel	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Post-test Mean	30.59	26.72	28.69	26.92	28.62	27.29	25.12	24.75
Pre-test Mean	21.95	21.69	21.65	21.00	20.41	20.88	13.29	12.93
Post-test Standard Deviation	3.26	4.32	3.48	3.77	3.89	4.00	4.52	4.82
Pre-test Standard Deviation	5.20	4.99	4.66	4.55	5.03	5.40	5.10	5.86
Post-test Coefficient of Variation	0.11	0.16	0.12	0.14	0.14	0.15	0.18	0.19
Pre-test Coefficient of Variation	0.24	0.23	0.22	0.22	0.25	0.26	0.38	0.45
Total students (n)	391	344	419	384	417	379	404	366

Note: Each content area test contained 35 multiple choice questions. Post-test questions were identical to pre-test questions.

## DISCUSSION

The overall purpose of this study was to assess the basic computer skills of students enrolled in an introductory microcomputer applications course. There had been an assumption within our College of Business that students no longer needed to be taught the basic computer skills - that most students matriculated into the College already capable of using the computer to meet their personal and academic needs. Until this study was undertaken, we had no data available to support or refute this assumption.

One goal of the study was to measure computer knowledge and skills **before** students were exposed to any of the course content. Therefore, we pre-tested the students within the first two weeks of the course. Pre-test results demonstrated that students have not mastered the content of the introductory microcomputer applications course prior to taking the course. It is important to note that Excel pre-test scores were considerably lower both semesters than the other three pre-tests either semester. Clearly, students are not entering the course with sufficient spreadsheet skills.

A second goal of the study was to measure the computer knowledge and skills **after** students were exposed to the course content. Since post-test scores were significantly higher than pre-test scores for 96.4% of the analyzed pairings, clearly students demonstrated content mastery, although to varying degrees across the four pre-tests and across course sections. Students demonstrated the largest learning gain from the Excel pre-test to the post-test; however, their post-test scores were not statistically greater than 70%. These results suggest that students are exiting the course with more spreadsheet skills than when they entered, but they are still not “computer literate” in this important business-related area.

The third goal of the study was to use the pre/post-testing model as an avenue toward course standardization. Clearly, the similarities across the pre and post data support the presence of a “standardized” course, with 96.4% of course sections showing learning gains. Also, the decrease in variation in post-test scores compared to pre-test scores suggests that course content is being mastered more consistently across multiple sections.

The pre-post test model using standardized course content provides several advantages:

- ◆ Learning gains are easy to demonstrate to those who question the need for, structure of, and content of the course. High school students are not as prepared to use application software as many stakeholders believe they are.
- ◆ Students have the advantage of assessing their skill levels early on in the course to allow them time to master the course content.
- ◆ Standardized content and in-class teaching practices produces a more consistent student learning experience.
- ◆ Students may be more prepared to pass Microsoft's User Certification Exams. Since they purchased the SimNet® software as part of the course, they will always have access to its learning and assessment components.
- ◆ Reducing variation of student responses, as indicated by the pre-test and post-test statistics, is an important measure of the course's contribution to student learning.
- ◆ Differences in instructors' teaching methods have less impact. Identifying instructors who are not placing adequate attention on the course materials and class exercises will be clear from the post-test responses. Before the standardized instruction model was in place, instructor effectiveness was limited to student evaluations at the end of the course and to the instructors' opinions of student performance in the upper division computer information systems courses. Skill level assessment and intervention is now possible based on more reliable indicators of student learning.

## **CONCLUSION**

Entering college students are not as "computer literate" as many constituencies would believe. Simnet® and PageOut® are effective tools to facilitate course management and computer skills assessment. This study is a vital step in the development of a more comprehensive assessment of learning outcomes.

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