Computer Literacy Levels of Students Enrolling in a Post-Secondary Computer Applications/Information Technology Course

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Is a freshman-level microcomputer applications/introduction to technology course obsolete? Are students, especially new freshmen, enrolling in the course already computer literate? To determine the students' computer-literacy level, students enrolled in a Computer Information Systems course entitled Microcomputer Applications I-Introduction to Information Technology during the fall 2004 and the spring 2005 semester completed a computer literacy exam. Results indicated that the students enrolling in the course by and large were not computer literate in general computer technology and spreadsheet applications, but were computer literate in word processing, e-mail, and Internet usage. Other data from the research revealed significant differences in the pretest scores of entering freshmen and other freshmen. The higher the ACT, the better the students scored on the objective pretest exam and the performance-based pretest exam. Only a weak relationship existed, however, between taking a previous computer course and pre-test scores.

> Defining computer literacy is like trying to define "life," "space" or "energy"—pursuits that may be entertaining but don't really bring much to the bottom line or shorten your to-do list....Computer literacy may be hard to define, but computer illiteracy is costly (Coffee, 2006, p. 55).

Computers are here to stay. The explosion of technology and the abundance of accessible computers in every phase of a person's life have made it a necessity for everyone to be computer literate (Higdon, 1995; Reid, 1997; Wolfe, 1992). In order to prepare students with the technological knowledge, skills, and abilities necessary to be productive members of the world of work, educators must be able to determine the computer literacy competencies students already possess. Currently, only approximately nine states have some form of computer literacy requirement for secondary graduation. New Jersey, for example, requires that computer literacy be integrated into the curriculum, and North Carolina requires that computer literacy be demonstrated in order to graduate (University of Minnesota, 2005). The identification of the

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computer literacy status of incoming students will assist educators in the planning of curricula as well as provide documentation to meet accreditation guidelines and standards.

In the literature, we found numerous definitions for the term "computer literacy" (Higdon, 1995; Laubacher, 1982; Matthews, 1997; Reid, 1997; Wolfe, 1992). In bill H.R. 3592, known as the "Education for the 21st Century (E-21) Act," computer-literacy skills are defined as information gathering, critical analysis, and communication with the latest technology (The Orator, 2005). Higdon (1995) stated that the definition of the term computer literacy has changed due to advances in technology. In the 1970s a computer literate person was described as a person who knew what a computer was and how it operated. In the mid-eighties, as technology advanced, especially in the area of hardware and software, educators found the definition of computer literacy evinced several variations as reported by Higdon. Some definitions of the 1980s included a computer literate person as one who has the ability to understand what a computer is and what makes it operate. A computer literate person would be able to communicate with the computer. Or, a computer literate person not only could describe a computer and how it operated but could also comfortably work with computers. Towards the latter part of the 1980s people were defining a computer literate person as one who could operate a computer and utilize computer applications software.

In the 1990s, educators saw yet another change in the concept of computer literacy with the advent of computer networking and the Internet. A computer literate person was familiar with and used e-mail and the World Wide Web and interacted with other people at other locations via the computer (Higdon, 1995). Capron (1992) defined the term computer literacy with three components, which included "awareness, knowledge, and interaction" (p. 7). Long and Long (1999) stated, "In less than a generation, computer competency has emerged in virtually any career from a nice-to-have skill to a job-critical skill" (p. 2). To be considered a person who is computer literate, a person would be a confident user of computer systems and software, be able to utilize the computer and its software to meet one's needs either at home or work, have a grasp of the current and future impact of computers on the world and its people, be able to make reasonable and intelligent decisions about the selection and purchase of computer hardware and software, and, finally, be able to talk intelligently about computers.

As technological changes continue to occur it appears that the term computer literacy has evolved into "information literacy." That is, as technology provides more and more access to information, especially through the Internet, students need skills to be able to find, retrieve, analyze, and use information (Ehrmann, 2004). In fact, the Educational Testing Service began a pilot study of a new information-literacy test in 2006 to help decide if students could handle basic information-processing tasks needed for college work (Young, 2005). We believe that the microcomputer applications and information technology course offered to many university students provides the computer usage foundation required to be a computer literate person, therefore preparing the students to become information literate both in college and in their future occupations.

OBJECTIVES OF THE STUDY

Do students, especially new freshmen who are business majors, have the computer skills required to be considered computer literate? Should the computer applications course be required in the business curriculum?

College of Business students at Northwestern State University must complete Computer Information Systems 1800: Microcomputer Applications I–Introduction to Information Technology (CIS 1800). To determine the computer-literacy level of students in CIS 1800, students took a computer literacy exam in the fall of 2004 and in the spring of 2005. At the beginning of the semester, the students completed a two-part exam. The first part was an objective exam consisting of 50 multiple-choice questions. The second part was a performance-based exam that included two word processing problems, two

Internet problems, one e-mail problem and one spreadsheet problem with a bar chart. To determine if student learning had occurred in the lecture section of the course, the students retook the objective exam at the end of the lecture section.

In fall of 2002, Creighton, Kilcoyne, Pollacia, and Tarver (2002) conducted a study to determine the computer-literacy level of students enrolling in CIS 1800. They limited the CIS 1800 course enrollment to 24 students. The course was divided into a lecture component and a performance-based component taught randomly throughout the semester. The performance-based component was equally divided between Word and Excel. The analysis of the study's results revealed an average of 71% or better on the word processing problems and only an average of 27% on the spreadsheet problems. They decided to make adjustments to the course's performance-based component. The instructional time spent on the word processing problems was reduced and the instructional time spent on the spreadsheet problems was increased.

The purpose of this research study was to determine if "new freshmen" college students are computer literate. Therefore, the objectives of this study were:

- To report the computer literacy levels, as determined by pretest scores, of students enrolled in CIS 1800: Microcomputer Applications I—Introduction to Information Technology at Northwestern State University for 2004-2005;
- To determine if there are significant differences in the following:
  - Total pretest scores of entering freshmen and other freshmen;
  - Total pretest scores of students enrolled in the course in the fall semester and those enrolled in the course in the spring semester;
  - Total pretest scores of the groups of students in different sections, that is, those who participate in the lecture section for the first half of the semester and those who participate in the performance-based section for the first half of semester.
- To determine if there is any correlation between the following:
  - ACT scores and objective pretest scores;
  - ACT scores and total pretest scores (objective test plus performance-based scores);
  - Year last computer course was taken and objective pretest scores;
  - Year last computer course was taken and total performance-based score;
  - Year last computer course was taken and total pretest scores (objective test plus performance-based scores).
- To determine if learning occurred in the lecture section of the course by comparing the objective pretest scores with the objective post-test scores.

THE COURSE

The course, CIS 1800: Microcomputer Applications I–Introduction to Information Technology, has been taught in the College of Business since 1988. The curriculum committee has made several revisions to the course since 1998. In fact, the design used for the 2004-2005 semesters was the 10th version of the course since its development. The latest version of the curriculum covers various areas of general technology information and has a performance-based application component covering word processing, spreadsheet, and presentation applications.

Each summer Northwestern State University offers a program called Freshmen Connection for students who will be entering the university in the fall semester. During Freshmen Connection, students are registered by their department or college for fall semester classes. Since CIS 1800 is a required core course for all College of Business majors, the first 96 College of Business Freshmen Connection students were put into the 01N section (1:00 p.m.–2:15 p.m., Mondays and Wednesdays). Once the 01N section was full, others were enrolled in the 02N section (2:30 p.m.–3:45 p.m., Mondays and Wednesdays). Section 01N was reserved for entering freshmen,

and any student could register for the 02N section.

Before the first fall class meeting, the 96 students in each of the two sections were randomly selected and put into four different groups of 24 students each–Group A, B, C and D respectively. Group A and Group B of each section were assigned to two different computer labs. Each of these groups spent eight weeks studying the microcomputer software applications Microsoft Word, Excel, and PowerPoint.

On the first day of class, Group A students and Group B students were directed to their computer lab for the performance-based application section. Group C students and Group D students remained in the lecture classroom and received lectures on a variety of subjects such as computer systems, computer hardware, terminology definitions, and communication. At the end of eight weeks (midterm), the 48 students in the lecture section of the course swapped with those in the performance-based section. The 48 students in the labs reported to the lecture classroom.

For spring 2005, the two sections of CIS 1800 (01N and 02N) were limited to 48 students with 24 students randomly selected and placed in Group A and Group B respectively. Group A in each section was sent to the lab first with Group B assigned to the lecture section. Any students needing or wanting CIS 1800 could enroll in either section.

INSTRUMENT-PRETEST

To collect the data for this study, the students enrolled in CIS 1800: Microcomputer Applications I–Introduction to Information Technology completed a two-part exam. Only those students who completed both parts of the pretest exam and completed the course were included in the study.

The test consisted of two parts, an objective test given to the sections in the lecture portion of the class and a performance-based production test given to those assigned to the computer labs. The objective test was a multiple choice test consisting of 50 general technology questions worth 2 points each taken from the questions at the end of several main chapters in the course textbook. Each of the students in the four sections used a Scantron sheet to record his or her answers on the 50 question objective test. The exam featured questions similar to the following two questions:

1. In database fields, character-type data, including numbers or characters that will not be manipulated or used in calculations are considered to be _____ data.
2. Images are made up of a grid of small points called _____?

The Scantron sheets were then machine graded with the scores recorded in an Excel spreadsheet.

The second part of the test consisted of a demographic data sheet, two word processing problems, two Internet problems, one e-mail problem and one spreadsheet problem. Students completed the problems in the computer labs.

In the demographic section, each student was asked to provide his or her name, section number, group assignment, classification, ACT or SAT score (self-reported), computer courses taken previously (if any), the year of the last computer course taken, if taken at the secondary level, what grade they received for the computer course, and finally whether they have access to a computer in their current living environment.

The two Microsoft Word problems were (1) to format a given letter into block style using the given margins, and (2) to duplicate a given flyer including several font styles and formats plus inserted clip art. The first problem required the students to type a block letter from the test document, change the top, left, and right margins, spell check the document, and print the letter. The letter was short and not in the proper form. The second problem asked the students to duplicate an attached flyer that had two different font sizes and styles, two pictures that were provided, and one Word Art exercise.

The two problems were worth 20 points total with major errors such as improper margins, line spacing, and misspelled words being two point deductions. The students were instructed to print out their documents and turn them in with the other problems. The Word problems were worth

a total of 20 points with most key points worth two points each.

For the Internet problems, the students were to log onto Internet Explorer, then (1) type in a given URL address for eBay and answer a question about eBay's home page, and (2) using a search engine such as Google or Yahoo, find the URL address of the *New York Times*. The students were to write the answers on the pretest form. The eBay exercise was worth three points and the *New York Times* exercise was worth two points for a total of five points for these problems.

To complete the e-mail problem, the students were directed to use any e-mail client they were familiar with to e-mail a given short subject line and a message containing their name, section number, and group to a given address. This exercise was worth 10 points.

The last part of the performance-based exam consisted of an Excel spreadsheet file the students had to open from a network location and complete. The students were instructed to total appropriate columns, enter certain formulas, center column headings, format numbers, make a 3-D bar chart of totals, and save the file to a network location. The problem consisted of a Sales Report, worth 15 points, on which they were (1) to fill in totals for four columns, worth three points, and four rows of sales numbers for three months, worth three points, (2) calculate a sales discount of 10%, worth two points, (3) calculate net sales, worth two points, (4) total expenses, worth two points and (5) calculate net profit, worth three points. The second part of the Excel problem instructed the students to make a bar chart of the total sales for the three months, worth five points, with the chart body worth three points and the legend and titles being worth two points.

The students could do the problems in any order but were limited to 75 minutes to complete the tasks. To maintain consistency in grading, only one researcher graded the various parts of the performance-based tests and then recorded the scores in the same spreadsheet as the objective test results.

After all demographic, objective test, and performance-based test data were entered into the Excel spreadsheet, 228 student scores were processed. Sixty students had incomplete data or withdrew from the course and were not included in the study. The final spreadsheet included each student's identification number, classification level, major code, objective pretest score, objective final score, word processing score, e-mail score, Internet score, spreadsheet score, total performance-based pretest score, total score for the objective pretest plus total performance-based pretest score, group assignment code, ACT score, computer courses previously taken, last year previous computer course taken, whether the student had access to a computer, final letter grade received in the course and which semester the student was enrolled in the course.

Results

Numeric data were input into SPSS 10, a statistical software package. Data were analyzed using descriptive statistics for objectives 1 and 4, a *t*-test for objective 2, and Spearman's rho for objective 3. All tests of significance were conducted at alpha = .05 *a priori*.

Demographic Data

Of the 228 students, 98 (43%) were entering college freshmen, 51 (22.4%) were second semester freshmen, 51 (22.4%) were sophomores, 18 (7.9%) were juniors and 10 (4.4%) were seniors. There were 169 students reporting their ACT scores with an average of 20.0. Five students reported SAT scores with an average of 1068 (these scores were not included in the statistical testing). Of those reporting having taken a previous computer course, the average number taken was 1.7, with the most reported previous computer course a secondary course called "Business Computer Applications." The average year of the last computer course taken was 2002 and at an average grade level of 11.2. Finally, 196 (90%) of the 218 responding students reported having access to a computer in their current dorm, apartment, or home. See Table 1.

Table 1. Demographic Data

	ACT	*n*	Last Year Taken	*n*	Grade Taken	*n*	Computer Access	*n*
Entering Freshmen	20.5	85	2003	85	10.8	85	90%	97
Freshmen	18.2	37	2002	29	10.8	27	84%	50
Sophomores	20.4	30	2002	28	11.3	31	98%	46
Juniors	19.9	11	2001	8	12.9	8	88%	16
Seniors	20.0	6	1999	4	11.0	4	89%	9
Composite	20.0	169	2002	154	11.2	155	90%	218

OBJECTIVE PRETEST

The students took the pretest objective exam in the lecture portion of the course. The objective test consisted of 50 multiple choice questions, worth two points each, for a total of 100 points. The average score for the 228 students was 52.3%, (n=218). The percentages for each level of students were distributed as follows: entering freshmen, 54.1%, (n=93), freshmen 49.9% (n=49), sophomores 50.8% (n=50), juniors 53.9% (n=16) and seniors 51.9% (n=10). See Table 2.

PRODUCTION-BASED PRETEST

Word Processing. The average for the 228 students in this section was 16.4 (82%). Entering freshman scored an average of 16.2 (81%). The most missed exercise was not putting the proper spaces between the salutation and the body of the letter. Students most frequently typed that part of the letter exactly as the example from the test document. Very few points were missed on the flyer problem with only some minor miss-arrangement of the pictures made by the students. See Table 2.

Internet. The average score for the students on the Internet assignment was 4.6 points (92%). The 98 entering freshmen had the same 4.6 average points and 92% rate as the total group. See Table 2.

Email. The e-mail problem was worth 10 points if the e-mail message was received and 0 if not received. Of the 228 participants, 201 (88%) were able to send the message successfully. Only 27 (12%) were not able to send the message. The results of the entering freshmen were almost identical to the group as a whole, with 87.7% able to send the message successfully. See Table 2.

Spreadsheet. Most students were unable to enter a formula in the proper cell, with many typing in the correct answer that they had either calculated by hand or with a calculator. Many students were able to make the chart but not fill in the formulas. The average score for all students for the Excel problem was 5.2 (26%). Entering freshmen had the highest average score with 7.4 (37%) with other freshmen averaging 3.3

Table 2. Test Averages and Scores

	Objective Test (100%)	Objective Final (100%)	WORD (20)	INTERNET (5)	EMAIL (10)	EXCEL (20)	Total Performance-based (55)	Total Pretest (155)
Entering Freshmen	54.1	91.1	16.2	4.6	8.8	7.4	37.0	91.8
Freshmen	49.9	92.7	16.3	4.6	8.4	3.3	32.5	82.4
Sophomores	50.8	90.6	16.8	4.6	9.0	4.3	34.8	84.6
Juniors	53.9	93.4	17.1	4.9	9.4	3.1	34.6	88.6
Seniors	51.9	95.2	16.2	4.5	9.0	1.8	31.5	83.4
Composite	52.3*	92.1*	16.4	4.6	8.8	5.2	35.1	87.3

**Paired Sample t-Test scores* (t = -36.448, df = 214, p=.000)

(16.3%). The ten seniors taking the pretest scored the lowest with an average of 1.8 (9%). See Table 2.

OTHER RESULTS

To determine if there was any significant difference between the total pretest scores of entering freshmen and other freshmen, defined as students who had previous college experience but less than 30 hours of college credit, a *t* test was performed on means of the two groups. The *t* score of 2.47 indicates a significant difference at the 2% level of significance. See Table 3.

To determine if there was any significant difference between the total pretest scores of the different randomly selected groups, those assigned to spend the first eight weeks in the classroom or labs to those assigned to the classroom or labs for the second eight weeks, a *t*-test was performed. The *t* score of .161 was not significant. See Table 3.

To determine if there was any significant difference between the total pretest scores of the students enrolled in the course in the fall semester and those enrolled in the spring semester, a *t*-test was performed. The *t* score of 2.38 indicates a significant difference at the 2% level of significance. See Table 3.

Nonparametric correlations were calculated to determine if relationships existed between the students' objective pretest score, the total performance-based score, the total pretest score, and selected personal demographic variables. The year that the student took his or her last computer literacy course (YEAR), the total pretest score, and the total performance-based production test score are interval data. The students' ACT scores (ACT) are ordinal data. Since these variables were mixed levels of measurement, Spearman's rho was used for data analysis.

The ACT score and the pretest objective score had a statistically significant positive statistical association (see Table 4), r_s (169) = .523 , $p < .000$. Using Davis' descriptors (Davis, 1971), the r_s of .523 indicated a substantial degree of relationship. The year the student completed his or her last computer course had a low, non-significant correlation, r_s (169) = .053, $p < .525$, with the pretest objective score. See Table 4.

The correlation coefficient for the ACT score and the performance-based production test score indicated that a significant positive relationship existed, r_s (169) = .35, $p < .05$. Using Davis' descriptors (Davis, 1971), the r_s of .35 indicated a moderate degree of relationship. See Table 5. The year the students had their last computer course was not significantly correlated, r_s (169) = .15, $p < .067$, with the performance-based production scores. See Table 5.

The ACT score and the total pretest score had a significant positive association, r_s (169) = .54, $p < .05$. Using Davis' descriptors (Davis, 1971), the r_s of .54 indicated a substantial degree of relationship. The year the students had their last computer course showed no significant correlation, r_s (169) = .12, $p < .167$, with the total pretest scores. See Table 6.

The average score on the objective pretest was 52.36%. The students were given the same test for their final in the lecture portion of the course with their average score being 92.17%. See Table 2. A paired sampled sample *t* test (t = -36.448, df = 214, p=.000) clearly indicates a significant improvement in the scores.

Table 3. *t* Test Results -Total Pretest Scores

	Data (1) #	Data (1) Mean	Data (2) #	Data (2) Mean	t score*
Entering Freshmen (1) vs. Freshmen (2)	98	91.8	49	82.4	2.47
Fall (1) vs. Spring (2)	157	88.6	71	81.4	2.38
1st Eight Week Groups (1) vs. 2nd Eight Week Groups (2)**	114	86.6	114	86.4	0.161

Level of Significance 5% - 1.9600; 2% - 2.3263*
Randomly selected groups**

Table 4. Spearman's rho Correlation Coefficients for ACT score, Year, and Objective Pretest Score

Variable	*n*	r_s	*p*	Descriptor
ACT	169	.523	.000	Substantial
YEAR	147	.053	.525	Low

Note. Davis' Descriptors (Davis, 1971): .10-.29 (low degree of relationship); .30-.49 (moderate degree of relationship); .50-.69 (substantial degree of relationship); .70-.89 (high degree of relationship); and .90-1.00 (very high degree of relationship).

Table 5. Spearman's rho Correlation Coefficients for ACT score, Year, and Performance-based Test Score

Variable	*n*	r_s	*p*	Descriptor
ACT	169	.35	< .05	Moderate
YEAR	147	.15	.067	Low

Note. Davis' Descriptors (Davis, 1971): .10-.29 (low degree of relationship); .30-.49 (moderate degree of relationship); .50-.69 (substantial degree of relationship); .70-.89 (high degree of relationship); and .90-1.00 (very high degree of relationship).

Table 6. Spearman's rho Correlation Coefficients for ACT score, Year, and Total Pretest Score

Variable	*n*	r_s	*p*	Descriptor
ACT	169	.54	< .05	Substantial
YEAR	147	.12	.167	Low

Note. Davis' Descriptors (Davis, 1971): .10-.29 (low degree of relationship); .30-.49 (moderate degree of relationship); .50-.69 (substantial degree of relationship); .70-.89 (high degree of relationship); and .90-1.00 (very high degree of relationship).

DISCUSSION

As mentioned in the review of literature section, defining computer literacy can be difficult. From the results, it appears that the students are computer literate in word processing, Internet, and e-mail skills, but lack general technology literacy and spreadsheet application skills. The word processing performance-based scores increased from the 2002 study with freshmen levels rising from 71% to 82%. The spreadsheet performance-based scores rose from 27% to 37%. We consider the latter scores to be low but improving and confirming the necessity of increasing the amount of instructional time spent on Excel currently in the course.

The fact that the higher the ACT scores the better the various pretest scores was no surprise. It was probably the reason for the significant difference in the pretest scores between the entering freshmen and the other freshman; that is, there were new and higher entrance requirements for the entering freshmen than the previous year.

It was interesting that there was a low correlation between the year the students' previous computer course was taken and the pretest scores, especially the total performance-based production scores. Perhaps constant use of software such as Microsoft Word keeps the students familiar with the software.

We were relieved to see that there was no significant difference in pretest scores between those who took the test at the beginning of the first eight week session and those who took the same test at the beginning of the second eight week session. We were concerned that the second group's pretest scores would be influenced by the first group, whether in the lecture or in the labs.

Finally, it seems that the new course structure was very successful in delivering textbook computer and technology literacy in the lecture portion of the class. The average score on the objective test went from 52.3% (n=218) on the pretest to 92.17% (n=225) on the final. The *t* test result implies that the teaching was effective and that the students achieved the desired level of competency.

CONCLUSION

Should an introductory computer applications course continue to be taught in the College of Business? Are students computer literate enough to focus resources on other areas? This research has shown that while the students are proficient in

word processing and e-mail, their general knowledge about computers and technology as well as their spreadsheet knowledge fall short of what is expected in the College of Business. The research has resulted in more time allotted to spreadsheet applications and less time allotted to word processing. The results of the research have also been presented to the Louisiana State Department of Education in hopes that there will be more emphasis placed on spreadsheets in the various computer classes taught in the secondary schools.

It is recommended that this research continue to be done at least on a bi-annual basis to test the computer literacy level of students, especially entering freshmen. The research can be used to determine if the computer course should continue to be taught and what the content of the course should be.

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