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Computer Knowledge: Report from a Student Self Evaluation

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Abstract

This paper reports the results of a self-evaluation survey of computer skills taken by students in introductory courses in the Department of Technology and the Department of Family and Consumer Sciences at Illinois State University. The students were asked to rate their ability on tasks that included Windows file management, word processing, spreadsheets, e-mail and graphics imaging. The goal of this research is to improve the mastery of student computing skills by determining the competencies that should be taught in an introductory computer course. From the analysis of the self-competency survey the researchers are working to create and field-test a competency exam for incoming students.

Overview

The ability to move between software packages has reached the point in the marketplace where computer literacy means generic or transferable skills that changes the focus from the technical issues of hardware (platform) and software (programming), to a more skill-based approach to computer literacy (Lawson and de Matos, 2000). The researchers believe that a basic grounding in entry-level software skills is essential for success in the field of Industrial Technology and Family and Consumer Sciences. Experience by the authors has indicated that students enter our courses with a varying range of computing skills from novice to highly competent. The researchers found that the faculty became mired in teaching computing basics to upper division students that do not have a strong computer literacy background. Faculty also believe students are missing out on powerful learning opportunities that technology provides to increase learning in academic subjects and increase student's skills (Sweaney, Manley, Meeks, 2001). In an effort to determine the true abilities of incoming students in the Department of Family and Consumer Sciences and the Department of Technology the researchers developed a student self-reported survey based on competencies that students should be able to perform in junior and senior level classes. While there may be some concern about the value of self-reported information, numerous studies have indicated that self-reports produce valid and reliable information (Baird, 1976). This paper presents the results of the survey that students in the Introduction to Technology course in the Department of Technology (Technology) and Practical Problem Solving in Family and Consumer Sciences (FCS) classes completed during the Fall 2002 and Spring 2003 semesters.

Literature Review

The ability to use computers is required for success in nearly every discipline including Industrial Technology (Zhang and Espinoza, 1997, Gathercoal, 1999). Computer literacy has evolved beyond basic word processing and file management, to desktop publishing, knowledge of spreadsheets, and Internet skills (Lawson and de Matos, 2002). One of our roles as faculty is to help our students gain computer literacy (Kryder, 1999).

One of the most important social cognitive factors that affect a student's use of technology is attitude and self-efficacy (Dusick, 1998). Bandura (1986) has suggested that self-efficacy has the

greatest impact on a person's individual mastery of skills. Compeau and Higgins (1995) found that computer self-efficacy was a significant determinant in computer usage. Students who have little confidence in their ability to use the computer, and who may be dissatisfied with their computing skills, or are uncomfortable using the computer may be said to have a poor self-efficacy image (Cassidy and Eachus, 2002). .Self-efficacy is not designed to measure existing skills, it reflects what people believe that they can do with the skills they already have (Eastin and LaRose, 2000). Bandura (1982) suggests that persons with low self-efficacy would be less capable to perform related activities in the future than those with a high degree of self-efficacy. "Self-efficacy is essential to overcome the fear many novice users experience" (Eastin and LaRose, 2000, pg 2). Lim and Lee (2000) observed, "most students have some reasonable computer skills at the start of their university studies, but the level of skill is not uniformly high." Experience has shown that students do not have the specific software skills needed in the areas of Industrial Technology and Family and Consumer Sciences. The differences students experience in access to computers impacts the dynamics of their computing self-efficacy once they reach the college classroom.

There is an expectation that graduating high school students in Illinois are moderately software proficient. A number of colleges and universities have begun to require competency exams for incoming freshman regardless of major and some high schools are requiring exams before graduation (Mendels, 1999). A knowledge gap continues to exist between what a student is expected to know and what they actually know in order to properly use a computer and computing software to its fullest potential as evidenced by reports to the State Board of Education (Silverstein, Frechtling, Miyaoka, 2000). Unfortunately, the authors have found this is not the case and that students are unprepared to use technology to its fullest potential.

Many variables have been cited for this "knowledge gap" including:

- Computer anxiety (Burkett, Compton and Burkett, 2001)
- Inadequate instructor training and support (Dusick & Yildrim 2000, Pugalee & Robinson, 1998)
- Lack of student motivation (Gibson, 2001)
- Scarcity of classroom time (Riley, 1998, Charp, 1998)
- Socio-economic class (Knapp and Glenn, 1996)
- Gender (Furger, 1998)
- Computer ownership (Loyd & Gressard, 1984, Hayek and Stephens, 1989)

Since basic software operating skills are required in upper division classes and the business world, it is evident that students must be well grounded in using software if they are to be successful (National Research Center for College and University Admissions, 2000). The demand in the workplace goes beyond the basic computing skills or what Lawson and de Matos (2000) identify as first tier competencies such as word processing, file management, and electronic communication. Lambrect (1999) observed that students must be able to transfer their knowledge from school to the business setting and continue to learn new software and software upgrades if they are to be successful.

Purpose of the Research

The purpose of this research was to improve the mastery of student computing skills by determining the competencies that should be taught in an introductory computer course. The following questions were investigated by the researchers.

1. What are the basic computer software competencies needed in upper division industrial technology courses?
2. What is the level of computing skills self-efficacy of students in the field of industrial technology?
3. What is the level of computing skills self-efficacy of students in family and consumer sciences courses?

Survey development and application

Self-assessment of computing skills was chosen as the mechanism for finding the level of computer literacy because it allows students to rate their own ability without fear of failure. Students were asked to assess their performance accomplishments on successful computer usage. By not testing performance on the computer it relieves the student of performance anxiety and allows the person to provide a better assessment of their computing knowledge.

To find out what computer competencies are required in the area of Industrial Technology, by other universities, the authors examined the technical degree programs offered at 30 other National Association of Industrial Technology accredited colleges (See Appendix 1). It was found in some cases that these competencies are taught in an introductory computer course or as part of a larger course, for example, a class in Technical Communication. Some colleges have even made ownership of a computer a requirement for entrance while others have distributed computers to each of their students (Young, 1997). Furthermore, the faculty members in both departments, FCS and Technology at the researcher's university were polled regarding the computer skill requirements in their classes. From this research an initial set of computer skills required in upper division courses was identified. A set of competency skills required for entering students in Industrial Technology and Family and Consumer Sciences was developed with 21 categories of skills including file management, word processing, spreadsheets, graphics communication or presentation software, imaging and electronic communication software.

The researchers examined several measures of computer self-efficacy and were particularly interested in what Compeau and Higgins (1995) identify as "component skills" or as an example the ability to enter formulas in a

spreadsheet cell. There are a number of scales that have been developed to measure self-efficacy in the domain of computer usage; Easton and LaRose (2000) created and tested an eight-item Internet self-efficacy test to examine the psychology of novice Internet users, Lim and Lee (2000) developed a survey to find the core information technology skills of freshman students in college, Cassidy and Eachus (2002) developed a 30 item self-efficacy scale which was designed to measure general computing self-efficacy in adults. As a result of this research and consultation with their colleagues at their own and other universities, a quantitative survey was created where the university students were asked to rate themselves on a 3 point Likert-type scale where response options covered the range from novice to average with complete familiarity of the task. A copy of the survey can be found in Appendix 2. The three classifications are:

a. Novice - with little or no task familiarity.
b. Elementary – have done it a few times, but am not sure exactly how to do it without assistance.
c. Average – consider myself very competent, do this all the time.

Methodology

The survey was distributed to registered students enrolled in required introductory courses in the Department of Technology and the Department of Family and Consumer Sciences during the fall semester 2002 and spring semester 2003. Students enrolled in FCS 200 and TEC 100 includes both freshman, sophomores and new transfer students that began their college career at Illinois State University. Many transfer students are considered Juniors or Seniors because of the number of previous credits they have earned at other institutions, but are still required to take these introductory courses. Because the transfer students within the Department of Technology are nearly half of all students enrolled and are approximately twenty percent in the Department of Family and Consumer Sciences they cannot be ignored when considering the skills of students enrolled in upper division classes.

Students were surveyed during the second week of classes during each term. A graduate student proctor and the instructor for each class administered the survey during the last 15 minutes of class with a standard set of instructions to read, thus ensuring that each group received identical instructions. All participants were assured that their responses would be kept confidential.

A total of 271 students were surveyed during the 2002-2003 academic year with three surveys returned that were non-responsive or not interpreted by the OpScan machine. Students under the age of 18 were dismissed from taking the survey in keeping with federal regulations on the testing of protected populations, however this amounted to less than five students in the survey population.

Survey results and discussion

Due to the length of the survey the authors have restricted their discussion to specific areas of significant findings. The entire results of the survey can be found in Appendix 3.

Table 1- *File Management Skills* shows the results of the self-reported file management skills from both departments during two semesters. The majority of students report a high self-confidence in their ability regarding folder management. Folder management skills were defined as creating, renaming, moving or adding folders, finding files or checking file properties. There remain nearly 30 percent of the students that rate themselves as either novice or elementary users and not highly proficient at these skills. When asked about their ability to perform file management tasks like saving a file or deleting a file, students rated themselves as being knowledgeable to perform those tasks without assistance. Two areas of concern were identified: nearly 40 percent of the students reported they were less than confident retrieving a deleted file from the recycle bin without assistance and nearly 65 percent were unable or not confident in their ability to zip and unzip files.

Table 1. File Management Sills

Q No.	Competencies	Percent breakdown of sample Novice	Elementary	Average
1	Create a folder	9.0	22.8	68.2
2	Rename a folder	9.0	20.7	70.3
3	Move a file from one folder to another	12.7	20.6	66.7
4	Save a file	1.9	10.1	88.0
5	Delete a file	3.0	11.2	85.8
6	Find a file using Windows Explorer	11.9	27.2	60.8
7	Add a folder using Windows Explorer	16.9	31.8	51.3
8	Find a file using the My Computer option	7.9	20.2	71.9
9	Check properties of a file	16.9	24.3	58.8
10	Zip and unzip files	40.4	25.5	34.1
11	Empty the recycle bin	8.6	16.4	75.0
12	Retrieve a deleted file from the recycle bin	14.9	21.6	63.4

Table 2 - *Disk Basics* shows the results of operations such as formatting, naming, protecting the disk from overwriting and checking for available free space on a diskette. It was found that student's confidence in their ability to manipulate disks was low and mirrors what the researchers found in the classroom. This is anticipated to become less important as computer manufacturers continue to move away from providing floppy drives.

Most students believe they are highly competent users of electronic mail as shown in Table 3, *Electronic Mail Fundamentals*. The researchers found that there remain four skills that students need additional training to perform including their ability to set up mailboxes, create address books, and creating and attaching a signature to an e-mail message. Depending upon the type of e-mail program being used, for example a commercial on-line service, these program options may not be available to all students.

The large majority of students consider themselves as average in the area of Word processing. Table 4-*Word Processing Text Functions*, shows high self-efficacy of the students. Since students are required to write papers for many of their classes they consider themselves competent in manipulating the text and using the tools inherent in most word processing software.

This level of self reported competency extends beyond word processing to include text and editing functions in spreadsheets as shown in Table 5– *Electronic Spreadsheet Text and Editing Functions*. This result was anticipated as text manipulation in spreadsheets (e.g., bolding, highlighting, text alignment) is similar to text manipulation in word processing with the same icons and text commands built into programs that are within the same office suite.

Unfortunately, spreadsheet functions that were not text related are a particular weakness for students. More than

Table 2. Disk Basics

Q No.	Competencies	Percent breakdown of sample Novice	Elementary	Average
13	Format a diskette	22.0	27.0	50.4
14	Name a diskette	20.5	23.1	56.3
15	Protect a diskette	33.2	25.4	41.4
16	Check available free space	27.6	19.8	52.6

Table 3. Electronic Mail Fundamentals

Q No.	Competencies	Percent breakdown of sample Novice	Elementary	Average
44	Check mail	2.6	8.2	89.1
45	Set up address book	11.2	17.6	71.2
46	Send mail to more than one address simultaneously	7.1	15.7	77.2
47	Send an attachment	9.0	18.7	72.3
48	Set up mailboxes	17.2	22.8	59.9
49	Forward mail to someone else	5.6	9.7	84.6
50	Compose and send a new message	3.0	8.3	88.7
51	Delete and attachment	11.8	16.0	72.2
52	Print a message	4.9	9.8	85.2
53	Create and attach a signature to an e-mail message	31.2	19.5	49.2

Table 4. Word Processing Text Functions

Q No.	Competencies	Percent breakdown of sample Novice	Elementary	Average
59	Bold, italicized or underlined text	1.5	6.4	92.1
60	Change the text alignment	1.9	9.0	89.1
61	Change the color of text	3.4	10.5	86.1
62	Highlight text	2.3	8.3	89.5
63	Change the font of text	1.9	6.4	91.8
64	Check the spelling in a document	2.2	6.7	91.0

half of the students, as shown in Tables 6-*Formula Functions*, admit that their knowledge of worksheet functions (e.g. formula writing, formula checking, cell addressing) are competencies they have not previously mastered. Tasks such as page layout and screen view manipulation (e.g., split screen) are not used enough that students become comfortable with those functions. General editing functions (e.g., sizing cells or columns in spreadsheets) and special operations (e.g., inserting objects) also remain areas of weakness for students with almost 50 percent in each category reporting their skill is in the novice or elementary range.

The ability to navigate the Internet requires additional computing skills. Easton and LaRose (2000) suggested that Internet self-efficacy is an important component in closing the digital divide separating the experienced users from novices. The large majority of students in the Technology and FCS classes believe that they can perform at the average level without additional assistance. There remains at this university a significant portion of students unable to fully utilize the Internet and search engines for educational purposes and will need training. Table 7 – *Internet Use*, shows the majority of the students can use search engines, but appear to have little confidence in their ability to use bookmarks to link websites.

Throughout all of the survey information collected, there appears to be a cluster of students that rate themselves as novice or elementary users in nearly every category. There are potentially several reasons for this particular group. This group of students may have limited access to a computer prior to attending this university or have other reasons that have handicapped their computer competencies or self-efficacy.

Conclusions

Data from two semesters of introductory classes within the Department of Technology and the Department of Family and Consumer Sciences were collected and analyzed for changes in

Table 5. Electronic Spreadsheet Text Functions

Q No.	Competencies	Percent breakdown of sample Novice	Elementary	Average
80	Bold, italicize or underline text	3.4	7.9	88.7
81	Change the text alignment	4.5	10.5	85.0
82	Change the color of text	4.9	10.9	84.2
83	Highlight text	3.8	9.8	86.4
84	Change the font and font sizing	2.3	8.3	89.5
85	Edit text using copy, cut and paste	4.2	7.5	88.3

Table 6. Formula Functions

Q No.	Competencies	Percent breakdown of sample Novice	Elementary	Average
93	Write a formula to add, subtract, multiply, or divide	26.1	32.6	41.1
94	Edit a formula	29.2	32.7	38.1
95	Check a formula if incorrect	29.2	34.2	36.5
96	Enter a function in a table (e.g. average)	30.0	31.9	38.1
97	Create an absolute cell address	33.2	34.4	32.4
98	Copy and fill using the mouse	28.5	30.4	41.2

Table 7. Internet Use

Q No.	Competencies	Percent breakdown of sample Novice	Elementary	Average
106	Bookmark a web site	16.7	14.7	68.6
107	Edit or modify bookmarks	17.8	19.0	63.2
108	Use a search engine	4.7	10.9	84.4
109	Change search engine	5.0	12.8	82.2
110	Search using keywords	4.3	10.9	84.8
111	Reload a page	10.1	10.5	79.4
112	Stop loading a page	8.9	12.1	79.0
113	Save an image to a file	8.9	13.6	77.5
114	Print the screen	4.7	11.2	84.1
115	Download and save a file	6.6	12.0	81.4

the self-reported confidence level of computing skills from incoming students. Consistency in reporting between semesters indicated that students have a need for further training in developing their computing skills. It was found that there was improvement from one semester to the next between the classes, but the authors attribute this to more Technology students taking the survey in the second semester. Technology students generally rate themselves more proficient in computing skills than Family and Consumer Sciences students regardless of skill being assessed.

Students indicated that they require more training in the use of computer file management basics and spreadsheet functions. While 80 percent of the students reported competency in word processing, additional skills and training is required so that all students can perform at a minimum competency level when reaching upper division classes. Significantly, the researchers found that in most categories there is a notable percentage of students that report having little or no computer competency regardless of the task.

The researchers are of the opinion that a required competency test for all entering students will eliminate the knowledge gaps. The lack of knowledge in software use has been found to be a source of considerable frustration and stress by many students (Davis, 1999). Responding to the realities of a new age requiring transferable technology skills the researchers suggest that two levels of computer skills training is necessary. Level one would be an introduction to computing basics course for novices or students with elementary computing skills. Level two training, such as that provided by an introductory course in computer sciences, would be required of all students to extend their skills beyond word processing by providing the benchmarks in advanced skills necessary for success in their upper division courses. The second level course would be adaptable for use in multiple contexts to diminish gaps in achievement in upper-level courses. Placement for each class would be performed by a self-assessment of a student's own computing competence.

Future development and research efforts will be focused on creating a standardized competency exam for all majors. This would allow students who are more competent with computing applications to demonstrate their level of competency and focus on specific skills for additional training. The students would then be able to master greater levels of understanding in their advanced core courses and narrow the gap in student performance.

Implications

The researchers believe that proficiency in computer skills for freshman or transfer college students is necessary for entry into Junior and Senior level courses in Industrial Technology and Family and Consumer Sciences and ultimately in the workforce. Students must be comfortable using advanced computing applications and specialized software in the technology rich environment of upper division courses in order to embrace the powerful learning opportunities afforded by technology. The implications for faculty in Industrial Technology and Family and Consumer Sciences is that this low level of self-efficacy of basic software skills prevents students from learning to use higher level software programs (i.e., Computer aided design programs, PhotoShop, Unigraphics). By improving student computing skill self efficacy the Industrial Technology instructor will no longer be mired in teaching software basics.

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Appendix 1

Q#'s	Survey Questions	Novice	Elementary	Average
	File Management			
1	Create a folder	9.0	22.8	68.2
2	Rename a folder	9.0	20.7	70.3
3	Move a file from one folder to another	12.7	20.6	66.7
4	Save a file	1.9	10.1	88.0
5	Delete a file	3.0	11.2	85.8
6	Find a file using Windows Explorer	11.9	27.2	60.8
7	Add a folder using Windows Explorer	16.9	31.8	51.3
8	Find a file using the My Computer option	7.9	20.2	71.9
9	Check properties of a file	16.9	24.3	58.8
10	Zip and unzip files	40.4	25.5	34.1
11	Empty the recycle bin	8.6	16.4	75.0
12	Retrieve a deleted file from the recycle bin	14.9	21.6	63.4
	Disk Basics			
13	Format a diskette	22.0	27.0	50.4
14	Name a diskette	20.5	23.1	56.3
15	Protect a diskette	33.2	25.4	41.4
16	Check available free space	27.6	19.8	52.6
18	Find/use the character	34.3	20.9	44.8
19	Find/use Paint	8.6	16.5	74.9

	Operations			
	Start a program	2.3	8.6	89.1
20	Use Task bar	4.1	8.2	12.4
21	Use the Tool Bar	1.9	8.2	89.9
22	Use the undo and redo functions	3.7	9.7	86.5
23	Right-click on a mouse and bring up special menus	2.2	7.5	90.3
24	View/hide a toolbar	3.7	13.5	82.8
25	Close a program	1.5	8.0	90.5
26	Open a recently used file	3.0	12.8	84.2
27	Shutdown the computer using the Start key	2.6	7.5	89.8
28	Reboot the computer using the shut down key on the start function	2.6	8.6	88.8
30	Access your computer settings through the start function	4.5	13.1	82.4
31	Use the Find function on start toolbar	10.1	15.4	74.5
32	Minimize, restore, or resize your program	5.6	10.5	83.9
33	Set the default saving time frame and location for file backup	27.3	27.7	44.9
34	Create a shortcut to a program on your desktop.	18.4	20.2	61.4
	Printing management basics			
35	Setup a page in portrait or landscape orientation	15.7	9.0	75.3
36	Use print preview	1.9	9.0	89.1
37	Send a document to a printer	1.9	9.0	89.1
38	From the print settings change printers	6.8	13.2	80.1
39	Pause or delete a print job	6.0	15.0	78.9
40	Change print quality	10.2	16.2	73.7
41	Set the default printer	13.2	22.2	64.7
	Advanced Keystroking			
42	Use alt and control keys for menu options	13.9	22.1	64.0
43	Use the key board to cut, copy and past	13.9	19.2	66.9
	Electronic mail fundamentals			
44	Check mail	2.6	8.2	89.1
45	Set up address book	11.2	17.6	71.2
46	Send mail to more than one address simultaneously	7.1	15.7	77.2
47	Send an attachment	9.0	18.7	72.3
48	Set up mailboxes	17.2	22.8	59.9
49	Forward mail to someone else	5.6	9.7	84.6
50	Compose and send a new message	3.0	8.3	88.7
51	Delete and attachment	11.8	16.0	72.2
52	Print a message	4.9	9.8	85.2
53	Create and attach a signature to an e-mil message	31.2	19.5	49.2
	Word processing documents function			
54	Create a new document	3.0	6.0	91.0
55	Save a document	2.2	7.1	90.6
56	Save a document to a different drive	2.6	10.9	86.5

57	Save a document with a different name	1.9	9.4	88.8
58	Save a document as a different file type	7.1	16.5	76.3
	Text functions			
59	Bold, italicized or underlined text	1.5	6.4	92.1
60	Change the text alignment	1.9	9.0	89.1
61	Change the color of text	3.4	10.5	86.1
62	Highlight text	2.3	8.3	89.5
63	Change the font of text	1.9	6.4	91.8
	Editing functions			
64	Check the spelling in a document	2.2	6.7	91.0
65	Check the grammar in a document	2.2	7.9	89.9
66	Turn on/off the auto correct function	9.8	17.3	72.9
67	Enter bullets	4.9	17.7	77.4
68	Edit text using copy, cut and paste	3.4	9.1	87.5
	Special operations			
69	Insert a table	9.1	24.2	66.8
70	Insert a graphic into a documents	9.4	22.6	67.9
71	Insert headers or footers	6.8	20.7	72.6
	Formatting functions			
72	Set a tab	8.3	20.8	70.8
73	Force a page break	13.5	21.1	65.4
74	Change the margins	5.7	17.4	77.0
75	Set the line spacing between sentences	6.0	13.5	80.5
76	Create outlines using a tool	15.6	28.5	55.9
	Electronic spreadsheets			
77	Label worksheet tabs	24.3	29.0	46.7
78	Change from one worksheet to another in the same workbook	25.0	22.0	53.0
79	Color selected cells	24.8	25.9	49.2
	Text functions			
80	Bold, italicize or underline text	3.4	7.9	88.7
81	Change the text alignment	4.5	10.5	85.0
82	Change the color of text	4.9	10.9	84.2
83	Highlight text	3.8	9.8	86.4
84	Change the font and font sizing	2.3	8.3	89.5
85	Edit text using copy, cut and paste	4.2	7.5	88.3
	Editing function			
86	Size cells by dragging	13.2	18.9	67.9
87	Size cells by using the auto-fit function	21.8	25.6	52.6
88	Size cells by specification	22.6	27.9	49.4

89	Delete or insert a row or column	11.7	24.1	64.3
90	Formatting cell boarders	22.6	27.1	50.4
91	Merge adjacent cells	24.1	28.2	47.7
	Graphing functions			
92	Graph a chart of data in the spreadsheet	17.0	32.5	50.6
	Formula functions			
93	Write a formula to add, subtract, multiply, or divide	26.1	32.6	41.1
94	Edit a formula	29.2	32.7	38.1
95	Check a formula if incorrect	29.2	34.2	36.5
96	Enter a function in a table (e.g. average)	30	31.9	38.1
97	Create an absolute cell address	33.2	34.4	32.4
98	Copy and fill using the mouse	28.5	30.4	41.2
	Special operations			
99	Insert an object or a graphic	16.5	25.4	58.1
100	Hide/unhide columns and rows	26.0	24.0	50.0
101	Set split screen options	35.1	28.2	36.7
102	Set your spreadsheet to show formulas of instead of results	32.4	29.3	38.2
103	Use the summation key to add cells	33.2	24.3	42.5
	Printing operations			
104	Place a header on a printout	17.8	27.5	54.7
105	Print selected cell ranges	24.0	23.3	52.7
	Internet use			
106	Book mark a web site	16.7	14.7	68.6
107	Edit or modify bookmarks	17.8	19.0	63.2
108	Use a search engine	4.7	10.9	84.4
109	Change search engine	5.0	12.8	82.2
110	Search using keywords	4.3	10.9	84.8
111	Reload a page	10.1	10.5	79.4
112	Stop loading a page	8.9	12.1	79.0
113	Save an image to a file	8.9	13.6	77.5
114	Print the screen	4.7	11.2	84.1
115	Download and save a file	6.6	12.0	81.4
	A graphics editing program			
116	Crop an image	16.7	21.3	62.0
117	Resize an image	12.0	18.6	69.4
118	Rotate an image	15.1	16.7	68.2
119	Change the file formula from one type to another	18.3	21.0	60.7
120	Edit the image (e.g. change the image color)	15.7	21.7	62.7

Appendix 2. University Technology Programs

# Faculty	# Majors	# Graduates	web site	Type of Degree Program	"ACS 155" Course Required
28	500	135	www.indstate.edu	(IT) Manufacturing and Construction Technology	None required.
21	500	130	www.pittstate.edu	Engineering Technology in the College of Technology	Required: **CSIS 121 Programming in BASIC**. (3) Not required (but in catalog) **CSIS 101 Computer Applications**. (2) Intro to computers and basic computer applications - word processing, spreadsheet, database, graphics, and networking. **CSIS 130 Computer Information Systems**. (3) Intro to computer systems in business and industry. Hardware and software, data communications, computer-based info systems. Intro to word processing, spread-sheets, databases, and a survey of programming languages.
32	510	91	www.CMSU.edu	Dept. of Electronics Tech, Graphics, Manufacturing & Construction in College of Applied Sciences and Technology	**CIS 1610 Impact of Computer-Based Technology** (2) Focuses on the synergistic relationship between humans and computer technology in individual, organizational, and societal contexts. Students gain experience in the use of computer-based technologies for decision-making and communication.
89	1292	136	www.uwstout.edu	Industrial Technology in the College of Technology, Engineering and Management	STAT 130 Elementary Statistics.(2)
23	745	122	www.tech.kent.edu	BS Industrial Technology in Division of Applied Sciences and Tech. In School of Tech.	TECH 10001 Information Technology (3)
14	516	244	www.siu.edu	Industrial Technology (Manufacturing Technology concentration)	**CS 200b. Introduction to Computing**. (3) Specifically designed for business students. Topics include an emphasis on business applications and associated

					software packages. OR **IT 270 Computational Methods for Industrial Technologists**.(3) Intro to problem-oriented computer language that is used to solve relevant problems that occur in industry.
21	465	140	www.ilstu.edu	BS Industrial Technology in Department of Tech. In College of Applied Sciences and Tech.	**ACS 155, Introduction to Microcomputers**. (3) Intro to microcomputers and programming with general and business applications emphasized. Visual basic programming; comparative analysis of microcomputer systems.
25	460	83	www.emiu.edu	Industrial Technology (Manufacturing Technology concentration)	**CADM 105. Computer Applications for Industry**. (3) Provides theory, general applications, and specific applications of microcomput ers. Students exposed to software packages commonly used for general and specific applications in industry. Lecture and laboratory course.
18	423	90	www.GaSou.edu	BS Construction Management & Manufacturing-Industrial Management in School of Technology	**CISM 1110 - Computer Application**s (1) Provides lecture and detailed instruction in application software using word-processing, spreadsheets, database, and presentation software. Co requisite: CISM 1120. **CISM 1120 - Computer Concepts** (2) Provides an introduction of computer concepts and the evolution of components, data representation & storage, software & multimedia, computer architecture, data communications & network configuration, data security & privacy, viruses, ethic, email, Internet, and the computer marketplace. Co requisite: CISM 1110.

25	405	140	www.nku.edu	BS Industrial Technology and BS MET in Department of Technology	**CSC 130 Introduction to Microcomputers** (or IFS 100 Introduction to Computer Information Systems) CSC 130 Introduction to Computer Applications (3,0,3) Standard computer software packages for word processing, spreadsheets, and databases. Not open to students who have passed CSC 262 or IFS 205. Graded pass/fail. (3)
12	374	59	www.bgsu.edu	BS Aerotech, Construction Manage. Electronics & Computer Tech, Manufacturing Tech in Dept. of Technology Systems in College of Technology	**MIS 200 Introduction to Management Information Systems** (3) Principles of computer systems, role of information systems in organizations; introduction to microcomputer operating systems, spreadsheet and database software. (only Manufacturing Technology requires this class)
12	360	70	www.calpoly.edu	BS Industrial Technology in the **College of Business**	STAT 217, Intro to Statistical Concepts and Methods. (4)
24	354	201	www.ecu.edu	Dept. of Construction Management & Dept. of Industrial Tech. In School of Industry and Technology	Choose one: **ASIP 2112. Introduction to Information Processing Technology** (3) OR DSCI 2223. Introduction to Computers (3) OR ITEC 2000. Industrial Technology Applications of Computer Systems (3).
19	340	87	www.uni.edu	Industrial Technology in the College of Natural Sciences (CM: Construction Management; ET: Engineering Technology; ISM: Industrial Supervision and Management)	Computer programming: BASIC or C or C++ (3); Intro to Statistical Methods. (3)
11	326	50	www.uwplatt.edu	BS Construction Manage., Industrial Tech. Manage., Manufacturing Tech. In Industrial Studies Dept. in **College of Business**	

10	300	45	www.engr.sjsu.edu	BS Industrial Technology in the College of Engineering	Tech 168. Microcomputer Applications and Programming. (3) Computer application methods and concepts applied to testing, typical production lines.
8	285	118	www.mnstate.edu	BS Industrial Management in the Department of Technology	**CSIS 103 Computer Concepts and Applications** (3) Introduction to basic computer concepts including hardware and software. Introduction to and hands-on experience with Windows, spreadsheets, word processors and database management systems as used in a business setting.
10	250	66	www.purdue.edu	Industrial Technology	**CPT 136 Introduction to Computer Technology** (3) This course is a superset of CPT 135 and provides an intermediate coverage of PC technology and problem solving. Topics include computer hardware, operations, and ethics, and operating systems and environments. Students will gain hands-on skills with applications such as desktop and file management, word processing, spreadsheets, presentation graphics, electronic mail, personal information management, and Internet browsing, searching, and publishing.Technologies include Microsoft Office, Microsoft Internet Explorer or Netscape Navigator, and Microsoft FrontPage.
15	243	69	www.technology.smsu.edu	BS Construction Management and Industrial Management In Dept. Industrial Tech.	**IM 102 Technical Communication**. Practical aspects of preparing technical reports with emphasis on techniques of collecting and presenting scientific data. Use of microcomputer as it relates to preparing technical documents will also be covered. **MN260 Technical**

					Computer Programming Applications. This course will focus on high level programming languages and their applications in indus trial technology.
23	228	37	www.eku.edu	Industrial Technology (Manufacturing Technology) in the **College of Business and Technology**	
8	212	17	www.tamu-commerce.edu	BS Industrial Technology in the Department of Industrial and Engineering Technology in the **College of Business and Technology**	
7	211	32	www.kean.edu	BS Industrial Technology in **School of Business, Gov., & Tech**.	
8	190	66	www.educ.iastate.edu	BS Industrial Technology (Manufacturing Option) in the Department of Industrial Education and Technology in the College of Education	
10	180	48	www.wku.edu	BS Industrial Technology	
13	157	44	www.eiu.edu	Industrial Technology	
11	153	40	www.semo.edu	Industrial Technology (IT with Industrial Management focus) and Manufacturing Engineering Technology (MET) in the Department of Industrial & Engineering Technology in the School of Polytechnic Studies	
17	143	27	www.niu.edu	Department of Technology: BS Industrial Technology and BS Engineering Technology	none listed
14	120	34	www.colostate.edu	Industrial Technology Management or Construction Management in the College of Applied Human Sciences	
10	63	43	www.morehead-st.edu	(Some) Technology in the Department of Industrial Education and Technology	
14	57	39	www.wiu.edu	Engineering Technology	