

Lessons Learned from Piloting a Computer Literacy Test for Placement and Remedial Decisions

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ABSTRACT

Computer literacy, like mathematical literacy or reading literacy, has become part of a student's basic education. Many students are routinely exposed to computers in grades K through 12. If sufficient numbers of incoming freshmen have already mastered basic computer skills and concepts then the question facing our university is whether computer literacy should continue to be taught at the college level or if this course should be treated as a remedial college preparatory course? To answer this question, a computer literacy test was devised to ascertain the computer literacy level of incoming freshmen. The results of the test will help determine which students should be placed out of our computer literacy course. In addition by understanding the strengths and weaknesses of the students that remain in the course, instructional adjustments can be made to address the current computer literacy needs of the student body.

Keywords: Computer Literacy, Skills Assessment

1. PROBLEM STATEMENT

Micro-based Computer Literacy became part of the formal curriculum offering at our university in April of 1989. It is a three credit introductory course designed to provide students with a fundamental understanding of computers. The course familiarizes students with the interaction of computer hardware and software. Emphasis is placed on the application of microcomputers, the use of productivity software (word processing, spreadsheet management, file and data base management, presentation graphics, email and web browsers), and the social and ethical aspects of the impact of computers on society.

There are currently three departments (Computer Science, MIS & Decision Sciences, and Technology Support & Training) that offer Micro-based Computer Literacy classes. Because each section is taught in a

computer lab, seating capacity is limited to approximately 30 students. Last year our university was able to offer 64 sections of Micro-based Computer Literacy over the course of the fall, spring, and summer terms.

Despite the large number of sections, the three departments are still not able to accommodate all the students who need or wish to take the course. At the present time, there are approximately 20 majors that require Micro-based Computer Literacy as part of their Liberal Studies requirements. This number is expected to grow in the future as more departments decide that their discipline requires that their students be able to use computers to access and analyze information.

At the same time, all three departments that offer this course are experiencing significant enrollment growth. The technology sector of the economy is booming and

this has attracted undergraduate students interested in taking majors, minors, and selected courses from the three departments. Within the current graduate program, both MIS & Decision Sciences and Technology Support & Training are under pressure to offer more electives to the MBA students. In addition, all three departments wish to offer a joint Masters in Information Technology program that will consume additional faculty resources.

To complicate matters, many students coming to IUP have already acquired computer literacy skills through high school course work or other college courses, work experience, or self-study. Others may possess some but not all of the required skills, and still others may possess none of the required computer literacy skills. Without the ability to test out of the course, many students are forced to take a course whose material they find redundant.

2. OBJECTIVE

To address this problem, faculty members from the three departments have examined a number of alternatives including hiring more personnel, allowing other departments to teach Micro-based Computer Literacy and changing the format of the course so it can be taught to a larger class size. The creation of an exemption exam has particular appeal because it would enable our university to achieve the following objectives.

1. Identify students who already have a good foundation in computer literacy and allow them to exempt out of the Micro-based Computer Literacy course for credit. This would open seats for students who lack the required computer skills.
2. Use the results of the exemption test to recommend instructional changes to Micro-based Computer Literacy to better serve the needs of students who are taking the course.

3. LITERATURE REVIEW

A review of the literature reveals three main areas of computer literacy research. The first area seeks to answer the question of what does it mean to be computer literate. Appendix A contains a few examples of definitions that individuals have used over the years to describe what it means for an individual to be computer literate. Rosenberg and Comport (1991) argued that computer literacy is more than a set of technical and programming skills and that it should include a broad view of the impact of social, economic, ethical, and political factors on technology. Kay (1992) conducted

an extensive review of the literature and concluded that the definition for computer literacy is an evolving work in process. Kay classifies the definitions that have emerged over time into six stages: mainframe computer awareness, microcomputer programming, evolving concept/strong need to plan, behavioral approach to application software, a focus on reaction and process, and finally, to a personal needs approach. Kay's conclusion was that computer literacy was now about teaching students how to apply the computer rather than just how to use the computer. Other articles have focused on discipline specific definitions of computer literacy. Garrison (1995) look at the computer literacy requirements for reporters while Morgan (1998) examined the same issue for librarians.

The content of our own Micro-based Computer Literacy course is very similar to that of courses developed at other institutions. Clements and Carifio (1995) used a survey of textbooks to identify word processing, spread sheets and database skills as being an integral part of any computer literacy course. Fenske (1998) included these skills as well as graphics, telecommunications software, and societal issues in her course. Canada's Information Technology Association and the Canadian Information Processing Society have developed a workplace standard for computer literacy similar to the ECDL program in the European Union. ECDL (1999)'s syllabus of record which mirrors our own is based on seven modules: Basic Concepts of Information Technology, Using the Computer and Managing Files, Word Processing, Spreadsheets, Database, Presentation Graphics, and Information and Communication Tools.

The second area of computer literacy research seeks to answer the question of how does one measure computer literacy. Most studies have used some type of questionnaire or multiple-choice exam to infer the computer literacy levels of their subjects. In their study, Hignite and Echnacht (1992) used the Standardized Test of Computer Literacy (STCL) to assess the level of computer literacy. The STCL is a three-part test designed to measure competencies in the areas of (a) computer systems, (b) computer applications, and (c) computer programming. Kay (1993) used a combination of questionnaire, interviews, and videotaped sessions of his subjects using the computer to assess their computer literacy levels. In another study, Smith and Necessary (1996) used a Computing Ability Scale, a 22-item Likert-type instrument, with three subscales: Software Knowledge/Awareness, Programming Knowledge, and Perceived Control to measure computer literacy of undergraduate college students. Jones and Pearson (1996) devised an objective test (multiple choice instrument that consists of 12 questions) and a subjective test (survey consisting of 26 indicators of respondents' perceptions of their own

computer skills) to test the computer literacy levels of undergraduates in an introductory computer course in a university business school. Patrikas (1999) used a questionnaire with sections on telecommunications use, application use, operating systems skills, and knowledge of computer terms to assess the computer literacy levels of all students entering her school's Health Information Management program.

In addition to these techniques, there are now computer skills assessment software packages that enable individuals to test their level of computer proficiency in various software packages. In his article, Brown (2000) offers advice for choosing the right assessment package. Because individuals are completing tasks in a simulated environment, these types of tools provide an effective and efficient way to get a true reading of computer proficiency. In our study, we decided to take advantage of both the questionnaire and software skill assessment approach in order to more thoroughly test the various components of computer literacy.

The third area of computer literacy research seeks to answer the question of what factors influence a person's level of computer literacy. Although our study does not address this area in any real depth, several other studies provide insights to this issue. Kay (1990) found a significant and positive correlation between high scores on his computer literacy scales and an internal locus of control. Kay categorizes individuals who have a high internal locus of control as believing that interaction with computers is determined by personal actions. Winfred and Hart (1990) reported that high scorers on the cognitive ability tests were significantly more familiar with computers. In addition in their study, they found no gender differences in either computer familiarity or cognitive ability. Brock and Thomsen (1992) found that access to a computer at home and exposure to video games appear to be the most significant factors in influencing the computer literacy of incoming college freshmen. Interestingly, they found that prior exposure to information systems at either the high school or community college level barely affects their computer literacy levels. Hignite and Echernacht (1992) found evidence that there is no correlation between the knowledge of a prospective teacher's level of computer literacy and that person's corresponding attitudes toward computers. Woodrow (1992) echoed these findings that computer attitudes and computer literacy were two separate issues; however, she felt programming training could positively influence both. Compeau and Higgins (1995) found computer self-efficacy exerted a significant influence on individuals' expectations of the outcomes of using computers, their emotional reactions to computers as well as their actual computer use. Karsten and Roth's (1998) results suggest that although a wide variety of computer experiences

enhance student perceptions of their computer competencies, only those experiences that develop or enhance the specific computer skills defined to comprise computer literacy in a particular context are likely to have an impact on computer-dependent course performance.

4. METHODOLOGY

To develop our assessment test of computer literacy, we employed several methods to identify the material presently being covered in the multiple sections of Micro-based Computer Literacy.

- The syllabus of record was examined to identify course topics.
- A survey was sent to all faculty members who teach Micro-based Computer Literacy to obtain their feedback on what they currently teach in the course.
- The textbooks used by instructors were examined to identify course subject matter.

From this material, a consensus was reached among the instructors that any exemption test should cover the following areas:

- Application and System Software Concepts
- Parts of a Computer (Internal and Peripherals)
- Communications and Connectivity (Internet and network terminology)
- Files and Database Management
- Different Types of Information Systems
- Workplace Issues (Ergonomics, Ethics, Security, and the Environment)
- Competency using Microsoft Word, Excel, Access and PowerPoint.

After reviewing several different skill assessment and test bank packages from publishers, we decided to create a one-hour test composed of two parts. Part I is a 30-minute Computer Literacy Concept Exam using 55 selected multiple-choice questions from the McGraw-Hill test bank to test the student's knowledge of computer concepts. Part II is a 30-minute exam to test the student's knowledge of computer skills in four different areas (Word, Excel, Access, and PowerPoint) using Prentice-Hall SkillCheck Professional software. Prentice Hall's SkillCheck Professional software places the student into a simulated Microsoft Office Environment where the student is asked to complete a variety of tasks. For our exam, each student had 7 minutes per package to complete as many tasks out of a total of 25* different tasks as they could. (*Note: The Access section only had 20 questions.)

Next, we conducted a pilot study to test the exam.

Approximately 170 students representing a variety of majors were randomly selected from our freshmen orientation program to take the pilot Micro-based Computer Literacy Exemption Exam. At the end of the exam, the student's responses on the concept questions as well as their completed tasks in each of the four software packages (Word, Excel, Access, PowerPoint) were recorded and scored. In order to pass the exam, we believe students have to meet at least one of two criteria:

- Achieve 60% or better correct responses in each category
- Achieve a weighted average of 70% or better where their concept score received 50% of the weight and each of the four-software packages received 12.5% of the weight.

This criterion is based in large part on the grading standards for the course since students taking Micro-based Computer Literacy must achieve a minimum of 60% on exams and assignments to pass the course with a D. The 70% rule was developed to account for students who performed well on most parts of the exemption exam, but showed some weakness in one or two areas. We felt that these students were sufficiently computer literate that they too should be allowed to exempt out of the course.

In addition to the exam itself, students were asked to complete a short survey where they rated themselves on a scale from 1 to 10 on how knowledgeable they felt they were in each of the test areas. By comparing this data to the actual test results, we hoped to gauge whether or not the test matches the students' perceptions of their own abilities.

5. RESULTS

Out of the 170 students who participated in the pilot, 9 students satisfied at least one of the exemption criteria and were exempted from the course for a pass rate of approximately 5%. Students performed best in the Concept area, on average knowing slightly more than half of the questions. In terms of the software skills, the median for all four software packages ranged between 40 and 45% of the tasks completed correctly.

Students were most familiar with Concept questions pertaining to multimedia software, basic computer operations such as formatting a diskette, and the use of common peripherals such as the mouse, keyboard, and printer. Students also appeared knowledgeable about questions pertaining to the Internet and workplace issues, particularly when it involved topics concerning computer security. The questions that gave students the most trouble were questions pertaining to the more

technical aspects of how the computer works. For example, students had difficulty with terminology such as what is meant by the system bus, bandwidth, disk sectors, ASCII codes, and network packets.

In Word, students were most familiar with tasks involving basic File Management, Editing, and Printing. For example, most students knew how to create, open and save documents and to apply simple fonts and text effects like Bold and Italicize. They also knew how to copy and paste text and to use the Undo feature. However, many students had difficulties with applying other Word features such as justifying text, setting margins and tabs, adding page breaks, page numbers, and footnotes, and using the Find Text and Spellchecker tools.

In Excel, students were most familiar with the basic File Management tasks and the simpler formatting and editing features of Excel. We found most students were familiar with how to open and save a workbook. They were comfortable editing, copying, pasting, or aligning cell contents and applying simple text effects like Italicize. However, many students were not able to specify a number format, to set up a function or formula, and to take advantage of features such as the Fill Command, Chart Facility, Centering Across Columns, or Freezing Panes in the allotted time.

In PowerPoint, students were most familiar with how to start and exit PowerPoint, how to save a presentation, and how to do basic editing like deleting an object in Slide View. Students had their greatest difficulties in completing tasks involving hiding slides, inserting objects, timing slide shows, modifying the slide format and displaying summary information.

In Access, many students were familiar how to create a new database, display a list of database tables, and to do basic editing such as inserting, deleting, viewing, or renaming database objects or records. At the same time, students appeared uncomfortable with how to set up a report, to search and query data, and to export or import data.

In terms of the correlation between self-assessment and actual results, Power Point had the highest Spearman Rho Rank correlation (.534) between student self-assessment and actual performance, followed by Excel (.444), Word (.428), Access (.315), and Concepts (.213). It appears that students as a whole were not severely or randomly over or underestimating their abilities. For the software, we had expected the correlation to be strongest for Word because it is the most widely known; however, the correlation was strongest with PowerPoint.

This may be partially due to the testing environment. Feedback from students indicated that they did feel the

limited time to complete tasks as well as the structure of some of questions inhibited their test performance. It should be noted as well that we tested Word first, then Excel, PowerPoint and Access. It may be that students' test performance improved as they gained more experience with the testing software as well as taking advantage of basic knowledge of how MS windowed applications tend to work. Finally, there may be a tendency for people to overestimate an area in which they have the most experience, which may further help to explain the correlation results.

The tables and charts in Appendix B present the detailed results from our pilot study of the Micro-based Computer Literacy Exemption Exam.

6. CONCLUSIONS

Despite the low pass rate of students during Freshmen Orientation, we still feel it is worthwhile to have an exemption test for students. We would recommend; however, that several changes be made to the exemption exam.

1. Offer test at specific times. Many students in their self-assessment indicated that they had been exposed to these packages in high school, but had not used the packages recently. Allowing students who feel that they are computer literate to sign up for specific dates will enable the students to obtain the study guide and adequately prepare for the exam.
2. Increase time for skill based portion of the exam. During Freshmen orientation, time is a precious commodity because the students have so many other meetings and tests to attend. By scheduling our own test dates, the exam can be lengthened in the Computer Skills area to give students more time to complete the tasks so that we can be confident the exam measures accurately what students do know. Along with the increased time length, we also planned to increase the criteria for task completion to 70% overall which would correspond to a course grade of C or better.
3. Offer an information session prior to the actual exam so that students could gain experience with the testing software. To complete a task correctly, students must execute the task without any intervening keystrokes such as using the Help facility or searching through the menu options. We feel most students would benefit from a practice session so that they could acclimate themselves to the exacting nature of the skills assessment software.

In terms of changing the current offering of Micro-based Computer Literacy, it appears that while many students

know something about different aspects of computer literacy, there does not seem to be a clear consensus that a large number of students have mastered certain areas. If continued testing reveals a pattern of competency, it would be possible in the future to create a course based on modules so that students could choose areas of weaknesses to address and could work on these areas at their own pace. In the meantime, we plan to continue offering the present version of Micro-based Computer Literacy as part of our students' liberal studies course work.

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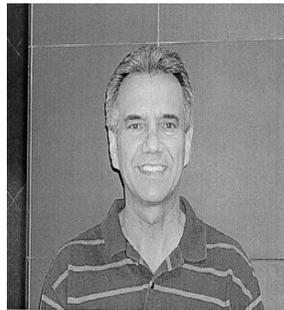
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Analysis, and Systems Design.

APPENDIX A.

Table 1. Definitions of Computer Literacy
Essential criteria for becoming computer literate have included computer awareness, programming ability, and competency in computer software applications. (Kay 1990)
The term, "computer literacy" has been taken to mean either the ability to operate a computer (how to insert diskettes, how to call up a program, perhaps how to type into a word processor) or a technical knowledge of programming and concepts of computer science. (Bolter 1991)
Computer literacy is the ability to read and write in the computer medium and an understanding of how the computer fits into the long tradition of the technologies of writing. (Bolter 1991)
The Standardized Test of Computer Literacy and Computer Anxiety Index evaluates computer literacy on four levels: computer systems (functions, configurations, hardware, software, historical development, operations); computer applications (standard general production applications, information processing tasks, decision support applications, societal impact, educational applications, evaluation and selection); computer programming (problem solving strategies, algorithms/flowcharts, languages, simple programming logic); and attitudinal competencies (appropriate use as a fast and accurate problem solving tool, responsible use, acceptance of use, freedom from fear and intimidation). (Wolfe 1992)
There are three levels of computer literacy. 1. Knowledge of what a computer is and how it works. This requires understanding certain terminology because the terms are unique and descriptive. 2. Interaction with a computer. This includes the ability to understand and properly use specific types of software for specific purposes. 3. Computer awareness. This involves understanding the importance, versatility, pervasiveness, and potential uses of computers for both positive and negative purposes within society. (Brock and Thomsen 1992)
Gaining and retaining computer literacy requires five complementary levels: (1) Understanding the role of the computer in society; (2) Being comfortable with computers as machines; (3) Using computers as tools to support routine business activities; (4) Understanding the advantages/disadvantages of computers; (5) Gaining some knowledge of programming, and developing the ability to designing computer applications. (Amini 1993)
An individual who is able to use the computer to satisfy the personal needs of his professional area is computer literate. (Kim and Keith 1994)
A computer literate is someone who can program using a language such as FORTAN, BASIC, or COBOL. (Kim and Keith 1994)
Computer literacy means being able to compute, read, write, and solve problems. Computer literacy involves developing the skills of accessing, assessing, and using information. (ClamDyp 1995)
Computer literacy is the knowledge of the productivity tools (i.e. word processing, database, spreadsheets) and their applications. (Clements and Carifio 1995)
Computer Literacy for most journalists can be accomplished in five distinct stages that build one on the other. Stage 1 is basic operational mastery. Stage 2 is remote access capabilities. Stage 3 is intermediate personal computer skills. Stage 4 is database creation and analysis skills. Stage 5 is developmental computer skills (i.e. programming). (Garrison, 1995)
Computer literacy is an understanding of computer characteristics, capabilities, and applications, as well as an ability to implement this knowledge in the skillful, productive use of computer applications suitable to individual roles in society. (Smith, 1996)
Computer literacy means taking control of your computer and not letting it control you. You are computer literate when you feel you are telling the computer what to do and not the other way around. It's the ability to manage the relentless bits and bytes flooding your electronic desktop on a regular basis. It's the ability to systematically--yet flexibly--communicate this management process to other people. It's not necessarily knowing what button to push, but it's knowing the difference between a word processor and a text editor, a spreadsheet and a database program, or a local disk drive and a networked file server. (Morgan 1998).
The International Computer Driving License (ICDL) establishes standards for computer literacy. To qualify, each candidate must demonstrate skills in each of seven computer-related modules (Basic Concepts of Information Technology, Using the Computer and Managing Files, Word Processing, Spreadsheets, Database, Presentation, Information and Communication). (ECDL 1999)
At the lowest level, technical literacy involves knowing how to turn on a computer or other devices, to start and stop application programs, communicate with networks, obtain intended information from the Internet and use e-mail. It includes the ability to save, print, file and transfer files electronically. At higher levels, computer literacy becomes more detailed, involving the ability of power uses to manipulate complex applications, install and remove software, organize and maintain file systems, keep up with technical bulletins, and to fully exploit the multimedia capabilities of computers and software, including installing simple add-ons such as memory, modems, and storage devices. (Charp 1999).
Computer Literacy goes to the issues of understanding how a computer works and the language of computing, such as what a CPU is. (Monroy 2000)

APPENDIX B.

Area	Actual Performance			Self Assessment		
	Mean Score	Median Score	Standard Deviation	Mean Score	Median Score	Standard Deviation
Concepts	51.06%	51%	12.26%	5.16	5.00	2.04
Word	47.11%	44%	16.78%	6.72	7.00	2.09
Access	43.68%	45%	22.72%	2.95	3.00	2.40
Excel	42.54%	44%	13.83%	4.36	4.00	2.59
PowerPoint	41.95%	40%	20.34%	4.37	4.00	2.98

Percent	Category	Question (Answers in Boldface Type)
65%	Software	Software that forms the "background" of the computer is called system software .
52%	Software	Windows 98 is an example of a(n) operating system .
37%	Software	The name for the kind of software that performs tasks like word processing or database management is application software .
81%	Software	Integrating video, voice, music, and even graphics in a presentation is called multimedia .
31%	System Unit	The CPU of the computer is composed of an arithmetic-logic unit and a control unit.
53%	System Unit	All the information used by the processor is loaded first into RAM .
25%	System Unit	Data stored in ROM chips cannot be modified and is not lost when power to the computer is turned off.
48%	System Unit	How fast does the clock beat in a computer that is rated as running at 400 MHz? (400 million times per second).
83%	System Unit	A(n) port connects the system unit to devices like keyboards that are outside the system case.
16%	System Unit	The circuit that connects the parts of a computer together and allows data exchange is called a(n) bus .
68%	Input/Output	Monitors consist of thousands, or millions of pixels arranged in rows and columns that can be used to create images.
47%	Input/Output	Photoelectric devices that are used to read UPC codes are called bar-code readers .
78%	Input/Output	Common pointing devices include all of the following (scanner and digital camera, mouse and light pen, trackball and pointing stick, touch pad and touch screen.) except for the scanner and digital camera .
30%	Input/Output	The Super Video Graphics Array (SVGA) standard has 16 million possible simultaneous colors.
85%	Secondary Storage	Before a new floppy disk can be written on, it must be formatted .
22%	Secondary Storage	A sector is a pie or arc-shaped section of a floppy disk.
36%	Secondary Storage	Secondary storage is non-volatile , which means it keeps its data after the power is turned off.
35%	Secondary Storage	One gigabyte is approximately a billion bytes.
55%	Secondary Storage	One or more metallic platters sealed inside a container that is mounted inside the system unit describes a(n) internal hard disk .
19%	Secondary Storage	A WORM CD-ROM drive allows the user to write data once, but read it many times .
50%	Communications	The method of increasing the amount of data stored on a disk by replacing repeating patterns is file compression .
59%	Communications	A compute network is the term used to describe a communications system connecting two or more computers together .
49%	Communications	Computers send and receive data in the form of digital signals.
86%	Communications	Data is transmitted using light through a fiber-optic cable.
16%	Communications	The capacity of a data transmission medium is measured in bits-per-second. The name for this capacity is bandwidth .
48%	Communications	The rules used to allow successful data transmission are called protocols .

66%	Communications	A device, connected to a network, which provides resources to other networked devices, is called a server .
58%	Data/Files	A single character can be represented by 8 bits. Another name for 8 bits is a byte .
22%	Data/Files	A coding scheme like ASCII is necessary to provide a common set of bit patterns for data .
39%	Data/Files	A collection of related records, like all the student grades at your school, is called a file .
54%	Data/Files	Sequential file organization is the simplest type, in which each record is stored physically one after the other.
56%	Internet	The Internet has its roots in a networking project started by the Pentagon's Advanced Research Projects Agency .
79%	Internet	Internet filtering software allows parents, teachers, and others to block access to certain materials on the Internet.
58%	Internet	Popular portals include AltaVista, Excite, InfoSeek, Microsoft Internet Start, Netscape Netcenter, Snap, and Yahoo!.
85%	Internet	Teleshopping, home banking, and Internet access are all examples of online services .
19%	Internet	Information sent over the Internet is divided into small pieces called packets .
52%	Internet	What is a URL? The address of a resource on the World Wide Web.
34%	Internet	To move files across the Internet from a remote computer to your computer you would use FTP .
79%	System Analysis / Programming	An information system consists of data and people, procedures, hardware and software .
30%	System Analysis / Programming	Systems analysis and design is useful because it can reduce the chances for making a mistake .
65%	System Analysis / Programming	A set of instructions for the computer that perform the task of changing data into information is a(n) program .
31%	System Analysis / Programming	The lowest level computer language would be a(n) machine language .
65%	System Analysis / Programming	Some of the multimedia on the Web is developed in Java , which is a programming language specifically designed by Sun Microsystems for use on the Internet.
48%	Workplace Issues	The ethical issue concerned with the correctness of data collected is accuracy .
56%	Workplace Issues	The ethical issue concerned with the ownership and rights of data and software is property .
38%	Workplace Issues	The new industry involved with gathering and selling data about individuals is called information reselling .
45%	Workplace Issues	Making copy of a program and giving it to a friend is an example of a theft crime.
71%	Workplace Issues	People who gain unauthorized access to computers for the fun of it, but do not intentionally do damage are hackers .
34%	Workplace Issues	A Trojan horse virus is a virus that hides within or is designed to look like a legitimate program.
72%	Workplace Issues	When a hard disk crashes, it is an example of a technological failure type of computer security threat.
65%	Workplace Issues	The most common cause for data errors is human errors .
46%	Workplace Issues	Organizations use firewalls to deny network access to outsiders and to restrict employees' access to sensitive data such as payroll or personnel records.
68%	Workplace Issues	One way to protect data from unauthorized access is to encrypt it.
62%	Workplace Issues	The safest way to prevent the irreplaceable loss of data is to back the data up frequently .
35%	Workplace Issues	The study of fitting computers to people is called ergonomics .

Table 4. Computer Skills Results by Tasks			
Note: (%) indicates percentage of students who were able to complete the task in the allotted time.			
Word	Excel	PowerPoint	Access
Create New Document - Blank (91%)	Open Workbook (95%)	Start Power Point (92%)	Create New Database (70%)
Open Document (95%)	Save Workbook (85%)	Create New Presentation - Template (44%)	Display Data Table List (81%)
Switch to Overtyping Mode (35%)	Modify Cell Number (81%)	Save Presentation (84%)	Rename Database Object (59%)
Cut Text (71%)	Modify Cell Formula (9%)	Exit PowerPoint (88%)	Delete Database Object (65%)
Paste Text (89%)	Clear Cells (59%)	Clear Object (71%)	Create New Table Manually (64%)
Bold Text (98%)	Copy Cells (88%)	Display Outline View (55%)	Use Table Design View (38%)
Change Fonts (98%)	Paste Cells (88%)	Use Slide View (74%)	Specify Date Data Type (35%)
Set Text Effects (Font Size, Outline) (34%)	Align Cell Contents (87%)	Use Slide Sorter View (47%)	Delete Field (71%)
Undo (92%)	Use AutoFit Column (41%)	Select All Slide Objects (51%)	Delete Record (69%)
Justify Text (39%)	Change Fonts (93%)	Select a Slide Format (3%)	Edit Data (75%)
Specify Margins (27%)	Italicize Cell Contents (93%)	Specify Slide Orientation (31%)	Select All Records (54%)
Set Tabs (44%)	Insert Row (67%)	Print Handouts (50%)	Export Data (4%)
Specify Page Orientation (22%)	Select Column (44%)	Display Summary Info (4%)	Import Data (13%)
Print Preview (82%)	Specify Scale of the Worksheet (13%)	Insert Blank Slide (44%)	Open Form (25%)
Save Document (63%)	Set Paper Size (33%)	Delete Slide (38%)	Create Report Manually (8%)
Print Document (57%)	Delete Sheet (18%)	Hide Slide (21%)	View Report (62%)
Help - Display Office Assistant (16%)	Apply Currency Format (28%)	Use Zoom (52%)	Save Report (44%)
Change Bullets / Numbering (35%)	Type a Formula (6%)	Switch to Black & White View (31%)	Save Filter As Query (44%)
Change Line Spacing (35%)	Use Auto sum Function (10%)	Use Timed Slide Show (21%)	Run Query (0%)
Find Text (11%)	Display List of Work Sheet Functions (8%)	End Slide Show (49%)	Specify Search Criteria (0%)
Use Spellchecker (25%)	Fill Cells (5%)	Display Drawing Toolbar (32%)	
Set Page Break (9%)	Center Across Cells (5%)	Insert Date (14%)	
Set Page Numbers (5%)	Print Gridlines (4%)	Insert Chart (25%)	
Insert Table (4%)	Freeze Panes (4%)	Insert Clip Art (22%)	
Insert Footnotes (2%)	Create Chart (0%)	Insert Table (6%)	

Chart 1. Box Plots - Performance results for the different test areas
(CPercent = Concepts, WPercent = Word, EPercent = Excel, PPercent = PowerPoint, APercent = Access)

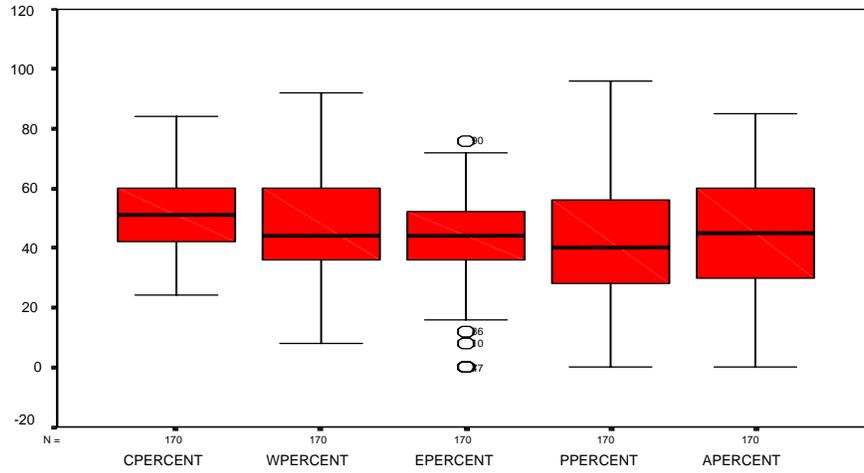
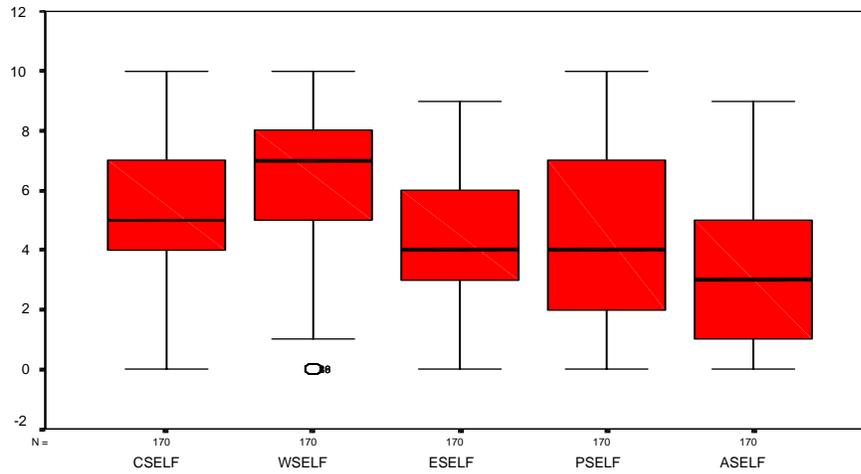


Chart 2. Box plots - Self Assessment results for the different test areas
(CSELF = Concepts, WSELF = Word, ESELF = Excel, PSELF = PowerPoint, ASELF = Access)





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