# Computer Literacy: Use IT or Lose it!

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## Abstract

Employers have raised their expectations of Business Management graduates in the area of computer literacy. As Business Schools attempt to provide an environment where students obtain expertise in using computer applications to solve business problems, questions about the success of such programs should be asked. Are students retaining these computer application skills as they advance through their programs, or is there a gap between expectations and students' actual performance? This study will present an assessment of Business Management students at Utah Valley State College (UVSC) in the area of office suite computer skills. Findings from hands-on testing and surveys of students and local employers indicate that if students were skilled and confident in their computer skills at one time, by graduation, most students are sadly deficient and have nearly reverted back to their pre-training levels.

## Introduction

More than two decades ago the U.S. economy entered what has become known as the "Information Age." Businesses small and large have invested considerably in computers, networks, and information systems so that today these infrastructures cross all business functions and management levels. In fact, businesses have become totally dependent on information technology (IT) and information systems (IS) for survival. This dependence brings with it an overarching need for technical professionals to install and maintain these infrastructures, but even more importantly is the need for computer and information literate business managers and staff who can use information systems and technology to appropriately operate the business and solve business problems. This need is well documented by surveys of employers who hire business management graduates. Davis (1998), for example, found that 83 percent of 300 corporate recruiters surveyed indicated that basic computer literacy plays an "important" or "very important" role in the hiring process.

The purpose of this study is to investigate the extent to which higher education is preparing computer literate business majors who are ready to meet this critical business need. The impetus for the research arose from the observation that a large percentage of business management majors in junior level MIS classes at two different higher education institutions had considerable difficulty in using Microsoft Excel and Access to solve simple business problems. These observations led to this further attempt to measure the extent of this problem and to assess the computer literacy skill levels of business graduates.

The next section provides a working definition of computer literacy. Following this is the approach that most colleges and universities take toward students' attainment and maintenance of computer literacy skills. Next is the description of the research questions and methods utilized to better understand and measure the computer literacy skills of business students as they progress through their educational experience at UVSC. The findings of the research are then presented, and the study concludes with a discussion of the implications of the findings and recommendations for future actions and research.

## What is Computer Literacy?

Students, educators, and employers differ in their perspectives when it comes to computer literacy. Students may think they are computer literate if they can beat their friends in a computer game or spellcheck a word document. A teacher may feel students are computer literate if they can use a computer application to complete an assignment without additional tutoring or hand-holding. Employers want productive, highly motivated, computer-savvy employees who can make things happen, now. Every time an employer has to resort to additional training for an unskilled employee, it costs the employer time and money. Whose viewpoint of computer literacy is most valid?

The younger generation of students has a universal view of computer literacy; they want to know how to use the computer for activities that are important to them. Students can be highly motivated to use a computer if peer pressure, entertainment, or saving money is involved. Teachers have an immediate view of computer literacy, often referred to as computer competency. Teachers just want students to be successful solving computer-based problems without any additional work on the teacher's part. Work conducted by Tanyel et al (1999) shows that faculty and employers do not always agree upon the same definition of computer literacy. An employer wants workers who are competent in industry specific computer applications, who can easily learn new computer skills, and who can adapt to new situations. Employers value computing fluency and

expertise. In reality, each of these viewpoints is valid if one views computer literacy as a continuum: beginning with computing awareness, computing literacy, computing fluency, and ending with computing expertise (Halaris, 1985). The skills and knowledge of this continuum are ordered by complexity and evolving levels of independency.

The meaning of "computer literacy" has evolved over the last 50 years. Early in the history of computing, computer literacy meant having the ability to program a computer in COBOL or Assembly Language. The advent of integrated computer environments and application suites and the prevalent use of microcomputers instead of mainframes have shifted the classification of computer literate persons from those that are low-level tool builders to those who are high-level tool users (Chung & Keith, 1994). Modern definitions of this term focus on two areas: "whatever a person needs to know and do with computers in order to function competently in our society" and "a measure of competency to exploit computer technology"(Halaris, 1985). Chung and Keith (1994) also state that the teaching of computer literacy for business majors should emphasize a "personal needs" approach that recognizes the diverse needs for computer knowledge and skills of individuals in different functional area.

The term, "computer competency," places emphasis on learning a specific, valued set of computer skills. Many industry-specific computer competency standards have been set. There are skills assessments and industry certifications such as Microsoft Office User Specialist (MOUS) or other vendor-independent certifications such as $IC^3$ conducted by Certiport Inc., which integrate both performance and knowledge-based modules. The National Educational Technology Standards for Students (NETS) is a project of the International Society for Technology in Education (ISTE). Skill levels that every student should obtain are defined (McCade, 2001). The difficulty in creating a "laundry list" of skills is separating the nice to know from the need to know. The local employment environment may determine a refinement of the skills that are required for computer competency at different educational institutions.

In addition, professionals in the area of Library Science have coined the term "information literacy." People who are information literate change their focus from "how" to use computers to "when" and "why." According to McCade (2001), it is essential that all students learn to access information from a variety of sources, both electronic and non-electronic, evaluate the validity of what they find, use the information to solve real problems, and communicate their conclusions using a variety of formats (McCade, 2001). Information literacy requires frequent use of computer skills as students follow the information inquiry process related to their specific disciplines.

For the purposes of narrowing the research focus, a limited view of computer literacy is used in this study. The focus is on measuring business students' computer competency in using a productivity suite of applications, namely the Microsoft office suite that includes: Word, Access, Excel, and PowerPoint.

**Attaining and Maintaining Computer Literacy**
In 1999, 12 of the higher education institutions in Utah collaboratively developed a computer competency standard for business students. This process was necessary to ensure articulation among these institutions when students transfer credits. Students must pass hands-on production tests at 80 percent accuracy in six categories. Windows Operating System and General Computer Information, Word Processing, Spreadsheets, Database, Presentations, and Internet and E-mail. See Appendix A for a listing of these specific Business Computer Proficiency Requirements.

All two-year and four-year degrees in the School of Business at UVSC require this computer competency in one form or another as a prerequisite for students entering these programs. In order to meet this need, the School of Business offers a series of course modules that teach the techniques and concepts needed to pass these hands-on tests. Students who have learned these skills on their own or in high school may choose to take the production tests without being enrolled in a course. By the end of their freshman year, most business students should have completed this computer proficiency requirement. Unfortunately, because UVSC does not enforce course prerequisites, some students enroll for advanced courses without having yet completed this computer proficiency.

Business Management majors are also required to take a junior-level Management Information Systems course that is taught as a service course by the Business Computer Information Systems Department. This course incorporates many activities that require students to use the applications found in the office suite to solve basic business problems, or to conduct research and report their findings. Anecdotal

evidence suggested to faculty teaching this course that many students were struggling with how to use these computer tools. Some remediation of skills was required to help students successfully fulfill assignments. If faculty were seeing a lack of computer competency as students were given problem solving tasks, were employers of these graduates also dissatisfied with the students' skill level when they entered the workforce? This question prompted research into the area of student retention of computer competency skills and knowledge that are required at an institution of higher education.

## Research Questions and Methodology

Following the narrowed, foundational, definition of computer literacy discussed previously, this section details a number of research questions aimed at obtaining a better understanding of how computer literacy skills are attained and maintained as business graduates prepare for employment. These research questions include:

- What are the computer literacy expectations and assessment from employers of business graduates?
- What are the various mechanisms for assessing computer literacy skills and which are most appropriate for the environment?
- What are the computer literacy skill levels of business majors as they progress through the business curriculum?
- Are there differences in the computer literacy skill levels between various business majors?
- To what extent do non-computer related business courses build on computer literacy skills taught in the basic computer literacy class?
- To what extend are computer literacy skill levels dependent on other factors such as time since taking the basic computer literacy course, delivery method (in-class vs. online), and specific course/location where computer literacy skills were learned?
- Are there differences in computer literacy skill levels between students at different higher educational institutions?

To help answer these questions, both subjective and objective measures of computer literacy were collected from students at two institutions, and from other studies reported in the literature. The need for both objective and self-appraisal testing has been previously recognized (van Vliet et al.,1994). Their research indicates, however, that self-appraisal tests are typically more lenient indicators of performance than objective tests. The research of Karsten & Roth (1998), Compeau & Higgins (1995), and Wortham & Harper (2003), further suggest that measures of student computer self-efficacy can contribute meaningful and demonstrable outcomes assessment information.

Based on these results, several survey instruments were developed to collect data at key points along the business curriculum. The first survey was taken immediately following the freshmen computer literacy class. The second survey was administered at the beginning of the junior level Management Information Systems class required of all business management majors. At the same time, an objective, hands-on, basic Excel spreadsheet competency exam was administered in order to compare students' self-assessment scores with their actual performance. A final student survey instrument was used to collect data from business majors in their final semester prior to graduation. In addition to these student-focused data collection efforts, data from employers of the graduates was also collected. One area that was not surveyed was the competency level of incoming freshmen. This was because several other incoming student assessments have been reported elsewhere (Radford, 2001 and Amini, 1993).

In order to help answer the research questions posed above, several statistical approaches were utilized in addition to descriptive statistics. These included correlation, regression, ANOVA, and t-tests.

## Findings

This section contains the results of these data collection and analysis. The organization of these findings will parallel the research questions posed in the previous section. It was discovered that the general practice of declaring students as computer literate following a freshman computer literacy class in not necessarily sufficient. If the newly acquired computer literacy skills are not reinforced and applied throughout the curriculum they are lost at an alarming rate. The end result is that the average computer literacy skill level of Business Management seniors is only slightly higher than that of incoming freshmen – hence the title of this study, "Use IT or Lose it!"

## Computer Literacy Expectations and Assessment from Employers

Previous studies (Verville, 1995; Levenburg, 1996; Thornburg, 1997) have looked at the question of employer expectations. In each of these studies, computer knowledge and skills are high on the list. Of particular interest to this research is the work of Davis (1999) who surveyed potential employers of students at Cornell University concerning the use of office suite applications. He found that 96 percent of the employers expected at least basic word processing skills, 86 percent basic spreadsheet skills, and 75 percent a basic understanding of presentation software.

As Tanyel et al. (1999) point out, a mission driven business school seeking to meet the needs of area employers must continually assess the local environment. To help better understand these needs, phone and mail surveys were conducted with 23 local employers of the graduates as indicated on recent alumni surveys. Table 1 summarizes employers' computer literacy expectations of business management graduates.

Table 1: Computer Literacy Expectation of Local Employers

|  | Not Important | Somewhat Important | Important | Very Important |
|---|---|---|---|---|
| Word Processing | 11% | 5% | 21% | 63% |
| Spreadsheet | 5% | 0% | 32% | 63% |
| Database | 5% | 21% | 53% | 21% |
| Presentation | 11% | 31% | 42% | 16% |

In summing the important and very important columns, the results are as follows: 84 percent for word processing, 95 percent for spreadsheets, 74 percent for database, and 58 percent for presentations. These expectations are comparable to those reported by Davis (1999).

As part of the same survey, employers were asked to express their confidence in the computer literacy skills of our business management graduates that they have hired. Table 2 contains these results.

To test statistically if employer assessment is less than expectation, a paired t-test was performed for each aspect of computer literacy. The statistical significance for Word was ($p=.09$), Excel was ($p=.005$), and Access was ($p=.017$), but no statistical significance for PowerPoint was found.

Table 2: Employer Assessment of Computer Literacy Skills

|  | No Confidence | Little Confidence | Moderate Confidence | High Confidence |
|---|---|---|---|---|
| Word | 7% | 20% | 47% | 27% |
| Excel | 10% | 37% | 37% | 17% |
| Access | 42% | 25% | 25% | 8% |
| PowerPoint | 8% | 33% | 42% | 17% |

## Subjective and Objective Assessment of Computer Literacy Skills

As discussed earlier, most of the data have been collected as the result of students' self-efficacy assessment of their level of computer literacy. In an effort to help understand the differences between subjective, self-efficacy evaluations and objective assessment, a hands-on, basic Excel proficiency laboratory exercise was developed by an Information Systems Ph.D. professor with 25 years of industry experience. This test was given to students in the junior level MIS class during the class period following their self-assessment questionnaire. A scoring rubric was defined to assess basic proficiencies such as column and row headings, simple formulas, summation, and simple graphics. To facilitate the comparison of student self-efficacy ratings with their actual score on the above test, the following transformation in the self-efficacy ratings were made. "High Confidence" was given a score of 90, "Moderate Confidence" a score of 75, "Little Confidence" a score of 60, and "No Confidence" a score of 45. The basic statistics for the two assessments are shown in Table 3.

The hypothesis that the Excel proficiency exam scores were greater than or equal to the self-efficacy scores was tested using a paired t-test for

means. This hypothesis was rejected (p=.00004), leading to the conclusion that objective scores are less than subjective scores. For our sample the difference in the means was nearly 20 points. More about the relationship between objective scores and subjective scores can be found in the section below discussing the factors affecting computer literacy.

Table 3: Basic Statistics for Objective and Subjective Assessments

| Excel Prof. Exam | | Excel Self-Efficacy | |
|---|---|---|---|
| Mean | 62.24138 | Mean | 82.03125 |
| Standard Error | 4.469837 | Standard Error | 1.903141 |
| Median | 73 | Median | 90 |
| Mode | 90 | Mode | 90 |

## Assessing Computer Literacy Skills Across the Curriculum

Business Management majors were asked to self-assess their computer literacy skills at three points along the curriculum. The first point was immediately following their freshman computer literacy class, the second at the beginning of their junior-level MIS class, and the third during their senior level capstone course.

Table 4 shows the percent of students that reported a positive confidence in their abilities. A positive confidence is defined as any response in the upper 50 percent of the confidence rating scale.

Table 4: Computer Literacy Skill Levels across the Curriculum

| | Incoming Freshmen | After Literacy Class | Prior to MIS Class | Senior Level Capstone Class | Employer |
|---|---|---|---|---|---|
| Word Processing | 72.2% | 97.5% | 95.5% | 85.0% | 74% |
| Spreadsheet | 43.1% | 94.0% | 75.0% | 52.0% | 54% |
| Database | 29.0% | 89.0% | 44.0% | 44.0% | 33% |
| Presentation | 34.7% | 95.0% | 78.0% | 53.0% | 59% |

Included in Table 4 are two additional columns (shaded). The first shows similar data for incoming freshmen reported in Radford (2001) and Amini (1993), and the last shows employer ratings of the students' computer literacy levels.

An interesting twist to the above data is that 96 percent of Business Management majors on the senior survey reported positive confidence in their ability to use computers. This paradox mirrors similar data reported by Amini (1993) who reported 74 percent of students considering themselves computer literate, yet only 38.5 percent were comfortable with their knowledge of computer software. Figure 1, shows the average of the percentages from Table 4.
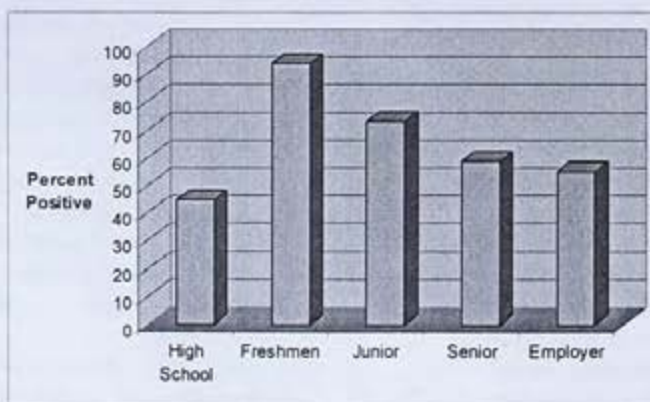


Figure 1: Average Computer Literacy Levels from Table 4

## Comparing Computer Literacy Skills of Different Business Majors

The previous analysis focused exclusively on Business Management majors. In this section attention is given to comparisons with other business majors. The data is taken from the senior survey of other majors including Accounting, Information Systems, Finance, Marketing, and International Business. In Table 5, Finance, Marketing, and International Business were combined due to the limited number of observations. As stated earlier, percentages are positive confidence with the specific application.

Table 5: Computer Literacy Skill Levels across Majors

|  | Word Processing | Spreadsheet | Database | Presentation |
|---|---|---|---|---|
| Information Systems | 100% | 100% | 92% | 92% |
| Accounting | 98% | 93% | 70% | 72% |
| Finance, Mktg., Int'l | 97% | 83% | 52% | 69% |
| Business Management | 85% | 52% | 44% | 53% |

To test statistically for differences between majors, ANOVAs were performed using the self-appraisal scores for each application. No statistical differences were found for word processing skills. Statistically significant differences were found for spreadsheets, however at (p=.001). When testing paired differences following ANOVA with alpha=.05, Business Management was found to be statistically different from Information Systems and Accounting. Statistically significant differences were also found for database (p=.0004). Again Business Management was statistically different from Information Systems and Accounting. Finally, significant differences were found for presentation software as well (p=.048). Here the only difference was between Business Management and Information Systems.

### Building on Skills Taught in the Basic Computer Literacy Class

In keeping with the theme of "Use IT or Lose it," students were also asked on a senior survey, developed by marketing students in a senior-level course, to estimate the number of times they used Word (during last term), Excel (total number of times), and PowerPoint (total number of times) during their tenure. Access was inadvertently left off the survey. Table 6 summarizes the averages.

Table 6: Average Student Usage of Applications

|  | Average # Word/Semester | Average # Excel Total | Average # PowerPoint Total |
|---|---|---|---|
| Business Mgmt. | 20.0 | 10.3 | 2.9 |
| Accounting | 31.6 | 56.3 | 3.4 |
| Finance | 41.3 | 30.8 | 6.8 |
| Marketing | 27.5 | 12.2 | 5.1 |
| Int'l Business | 16.3 | 12.3 | 2.9 |
| F,M,I - Combined | 24.7 | 15.4 | 4.5 |
| Information Systems | 32.8 | 18.3 | 7.6 |

Table 6 shows that Accounting majors indicate that they have nearly six times the usage of spreadsheets in their academic tenure as do Business Management majors. This may help explain, in part at least, the difference in their Excel literacy scores of 93 percent for Accounting and 52 percent for Business Management majors as shown previously in Table 5.

When testing for statistical differences between majors using ANOVA, there were statistical differences in Excel usage (p=.0003), and PowerPoint (p=.011). No statistical differences were found in the usage of Word. For Excel, Accounting was found to be different from the other majors. For PowerPoint, Information Systems was found to be different from the other majors.

### Factors Affecting Computer Literacy

In an attempt to ascertain the factors that might affect students' computer literacy scores, t-tests and ANOVAs were utilized to analyze the results from the objective Excel exam discussed earlier. The following factors were tested: gender, specific computer literacy class taken, form of computer literacy class (on-line or in-class), location

of computer literacy class, grade in computer literacy class, and time since taking computer literacy class were tested. No significant differences were found between these factors except for time since taking computer literacy class (p=.071).

Regression analysis was utilized with the student's objective score on the Excel exam as the independent variable and the student's self-efficacy assessment score together with the above factors as dependent variables. All variables except years since taking computer literacy class and student's self-efficacy assessment were eliminated, leaving the following regression equation.

(objective score = 1.25 * subjective score – 7.12 * years since literacy class - 25.46 )

This interesting result gives a sense of measure to the "Use IT or Lose it" hypothesis. Even assuming that an individual's subjective score stays the same over time, which it does not, the passage of time will lower the objective score approximately 7 percentage points each year.

**Comparing Computer Literacy Skills Across Institutions**

As was previously mentioned, this decreasing computer literacy phenomenon has been observed at several other higher educational institutions. In an attempt to solidify this anecdotal evidence, the same Excel competency exercise was administered to undergraduate Business Management majors at an AACSB accredited Business School in the Southern U.S. The same individual using the same rubric scored the exams. The results were compared using a two-sample t-test assuming equal variances. No statistically significant differences were found.

**Implications and Recommendations**

The result of this more formal quest to measure the computer literacy of Business Management majors at institutions has revealed that we are not achieving our goals. After taking an initial course that teaches computer competency in the Office suite applications, students seem able to perform adequately and feel confident in their skills. But, later at the junior level students seem to have decreased in their ability to perform required assignments in an MIS course, especially with database or spreadsheets. Finally, at the senior level students surveyed are less confident of their computer skills than they were when they began their studies.

This situation is not unique to any one institution, as shown in comparisons to students at another institution.

In a literature review that focused on skills and abilities believed to lead to success for business graduates, Tanyel et al (1999) found the use of technology, working knowledge of computers, computer knowledge, computer competency, and computer skills were listed as necessary competencies. As mentioned earlier, these authors also caution that constant assessment of the needs of important stakeholders is critical. Following this admonition, additional research was conducted to assess local employers' satisfaction level with our business school graduates in the area of computer competency. The results of this localized measurement were also discouraging. It is likely that many business graduates are not performing up to the expectations of employers in the areas of spreadsheets or database skills.

A much more difficult problem awaits us as efforts are made to examine solutions for strengthening the computer literacy component of the Business Management curriculum. As Chung & Keith (1994) stated, "We believe that certain intellectual/conceptual aspects of computer literacy cannot be learned effectively in one introductory course; rather, they must be accomplished through subsequent courses which both reiterate the basic knowledge and at the same introduce more sophisticated applications of computer technology in specific discipline areas." Chung & Keith (1994) also concluded that a more complex application of computer literacy, like the ability to analyze challenges and opportunities, to communicate possible solutions, and the ability to motivate and coordinate fellow workers are skills that are often not listed in job descriptions developed by human resource offices. However, these are the very skills that many companies are seeking in today's job market.

There will be no easy fix to this dilemma of helping students to obtain and retain their computer skills. The solution will depend on the support and cooperation of faculty who teach courses in the Business Management program. Future research in this area will examine what kinds of course assignments are currently being given to Business Management majors that require the use of computer applications and where improvements can be made. A computer literate faculty is also necessary to model skills, techniques, and behaviors to deliver a computer literate graduate. Wolfe (1996) states that

the most important factor in establishing computer competency in students is the faculty. "The major problem, therefore, to be addressed is how to provide computer literate faculty and having achieved this goal, how to get that particular faculty to incorporate the computer as a tool in the curriculum."

Wolfe (1996) provides this guidance: "Colleges and universities must develop a large body of faculty who are tool users and then capitalize on the few creative ones who can become adapters by providing them with proper incentives." Measurements of computer literacy should also become more advanced as faculty increase their skills and their expectations for students.

The challenge of computer literacy and retention cannot reside solely on the department or faculty who teach courses on computer literacy (MIS or other IT courses that service Business Management programs). The vision must come from the administration of the Business School and the institution to require and facilitate a computer literate business faculty and to empower them so they are excited about incorporating computer applications into the areas of problem-solving at every level of the curriculum. Students need the advantage of functioning at a high level of computer competency; then like other movements to incorporate writing and ethics across the curriculum, the Business School vision statement should include faculty training in IT skills, making hardware and software resources available, and providing incentives for faculty who will then be able to model the behaviors and skills most in demand for business graduates.

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### Appendix A
#### Business Computer Proficiency Requirements

Students must demonstrate proficiency in each of the six segments by achieving a minimum score of 80 percent as evaluated by a hands-on production test. Scores cannot be averaged for an overall test or course grade of 80 percent.

**A.    Windows & General Information**

Working with Files
- Creating folders
- Renaming/ Deleting/ Restoring
- Moving/ Copying
- My Computer & Windows Explorer
- Finding Files/ View Options
- Start Menu & Shortcuts
- Ctrl + Ctrl & shift + Click

General Concepts
- Basic parts of a computer
- Information processing cycle (input, processing, storage, etc.)
- File names & extensions

Windows
- Minimize, Maximize, Restore
- Left & Right Mouse
- Getting help (F1)

Ethics & Other Issues
- Proprietary, shareware, public domain
- Site licenses
- Computer Viruses
- Copyright issues

Other
- Control Panels

Changing properties
Drag & Drop

B.  **Word Processing**
General Skills
Page setup options
Spelling, thesaurus, grammar
Changing toolbars
View and save options
Working with windows
Print preview

Formatting
Bold, underline, italics, typefaces
Line and paragraph
Indenting options
Justification
Page breaks
Widow and orphans
Date & time options

Specialized skills
Bullets & numbering
Inserting & sizing graphics
Setting & modifying all tab types
Headers & Footers
Tables & columns (sections)

Commands to Know
Cursor movement commands
Selecting text(cursor in text & in margin)

C.  **Spreadsheets**
General Skills
Same as in word processing
Inserting and naming worksheets
Paste special
Edit -> Clear options
Math operators (^, *, /, +, -)
Absolute, relative, & mixed cell addressing
Types of entries
Naming ranges
Moving & selecting
References to other sheets or files

Formatting
Numeric formats
Auto formats
Conditional formatting
Line drawing & shading
Column & row size
Title lock/ Freeze pane

Graphics
Creating & modifying charts

Specialized Skills
Sorting

Data filters & subtotals
Dynamic links
Pivot Tables

Functions
SUM, MIN, MAX, COUNT, AVERAGE, PMT

D.  **Database**
General Skills
Same that apply from earlier sections
Switching views (design & datasheet)
Creating object with wizards & from scratch

General Concepts
Fields, records, tables, databases
Queries and forms
Relational files
Field types

Specialized Skills
Simple and complex queries
Designing and modifying reports
Expression builder (forms)
Typing reports to queries & tables

E.  **Presentations**
Items Covered
Creating and Sorting slides
Custom animation options
Basic organization & content
Types of slides
Drawing tools

F.  **Internet & E-mail**
Basic Skills
Logging on
Browser operation
Sending a messag
Typing an address
Using a search engine
Connecting to a library search bank

General Concepts
E-mail addresses
WWW
HTML, URL
Hyperlinks

Specialized Skills
Sending attachments
Creating groups
Searching for specific information
Inserting URL