

RUNNING HEAD: PREPARING THE MODERN WORKFORCE

**PREPARING THE MODERN WORKFORCE: COMPUTER COMPETACY**

**DEFINED FOR 2000 AND BEYOND**

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## ABSTRACT

The modern work force of first-world countries is undergoing significant change (Reich, 1992) so that even what is considered a marketable end-product is changing as information becomes more a product than a raw material. Computers, the fastest growing industrial production technology (Gilster, 1997; McGee, 2000; Rhinesmith, 1996) not only inundate the work environment but are infiltrating the home environment as well. Therefore, the traditional preparation of the work force should to be augmented to address the need for greater computer skills. However, what exactly are these skills?

This paper will present why computer-based technology skills are necessary in every first-world country. It will also present the five most requested skills across vocational lines. The author's research uncovered relatively few descriptions of what specific computational skills are required for employment in the current and future economy. The skills that were mentioned in the research were often industry specific. However, the following five skills of keyboarding, word processing, spreadsheet skills, database skills, and Internet skills have emerged through comparison of available information as being common to all industries researched for this report. The author contends that these skills are necessary for full interaction with the democracy, economy, and to maximize employability.

## FIVE NECESSARY COMPUTER-BASED TECHNOLOGY SKILLS: PREPARING TO ENTER THE MODERN WORK FORCE

Many organizations today have baseline requirements, which potential employees must meet in order to be considered for employment. These skills range from simply being able to read to advanced analytical skills. Often the set of skills required depends on the focus of the industry doing the hiring (Autor, Levy, & Murnane, 2001). However, many industries now require skills that are not necessarily associated with an organizations purpose, yet are considered indispensable to organizational and individual productivity. This skill set is centered on managing, manipulating, and communicating data. In short these skills are the ability to use computer-based technology either for the benefit of the employer or the employee. In spite of this importance there is relatively little information is available on the exact skills that business and organizations require. This paper will discuss why a basic technology skill set is necessary in the information age. Using what the research will yield, it will also propose what specific skills compose a baseline for personal and economic survival and growth. This paper intends to answer the question: What are the computer-based technology skill areas needed by all individuals in first-world countries to compete economically and domestically for survival in the global economy?

### Definitions

What is meant by technology? Merriam-Webster (1986) indicates clearly that technology is a body of knowledge.

The body of knowledge available to a society that is of use in fashioning implements, practicing manual arts and skills, and extracting or collecting materials (Webster, 1986).

The author has further limited the definition of technology by referring to the specific area of computer-based technology. Others use terms such as “Information Literacy (Blake & Tjoumas, 1990; Potter, Lohr, Klein, & Sorensen, 2000), or Digital Literacy (Gilster, 1997), but these terms seem too narrow in connotation and too broad in denotation.

The term skill pertains to “Proficiency, facility, or dexterity that is acquired or developed through training or experience”(Webster-Online, 1986). Skill was chosen over literacy because it allows a more pragmatic dissection of what specific behaviors are needed. Literacy depicts a more encompassing perspective and suggests mastery over a subject rather than the acquisition of a set of broad use tools. Therefore a “computer-based technology skill set” will indicate a set of knowledge or behavior tools related to technologies involving the use of computers.

These skills, while needed all over the world (Reich, 1992), are not necessarily considered a valuable survival skill in agriculturally oriented economies. Technology in these economies tends to be less sophisticated in design (Blake & Tjoumas, 1990). This view is not to say that those in agriculture would not use or benefit from computer based technology skills; it does however, indicate that countries whose economy centers around subsistence farm yield realize relatively few chances for application of high-tech skills and few possess the monetary means for mass distribution of computer equipment. In referring to these countries the researcher is specifically speaking of the countries, which are considered “Third World Countries” which, according to the CIA fact book, are the “economically underdeveloped countries of Asia, Africa, Oceania, and Latin America”(Central Intelligence Agency-Online, 2001). The author makes this point to refine the focus of this paper to a discussion of the labor force skills of economically developed countries, which are often referred to as “First World” countries such as the countries that compose the European Union, the U.S. and parts of the Middle East.

## WHY IS A BASIC TECHNOLOGY SKILL SET NECESSARY?

Autor, Levy & Murnane declare “Computerization is associated with declining relative industry demand for routine manual and cognitive tasks and increased relative demand for non-routine cognitive tasks.” (Autor, Levy, & Murnane, 2001, p. 1). Autor, et al, further contend:

Much quantitative and case-study evidence documents a strong association between the adoption of computers and computer-based technologies and the increased use of college-educated and non-production labor within detailed industries, within firms, and across plants within industries. These patterns implicating computerization as a potential source of a demand shift favoring better-educated labor appear consistently in studies from the U.S., the OECD, Canada and other developed and developing countries.(Autor et al., 2001, p. 2)

This trend should be considered alarming to anyone who is unable or reticent to address a personal void in his or her computer-based technology skills. This trend is indicative of a nation whose needs are changing and an economy that is developing a new, more technological, focus.

Researchers also argue that the introduction of computer technologies is changing the organization itself. Coroli and Van Reenan (1999)

“...use several sources of panel data on British and French establishments. Three findings emerge: (i) [sic] organizational change tends to reduce the demand for unskilled workers in both countries; (ii) [sic] OC is retarded by increases in regional skill price differentials [sic] (a measure of the relative supply of skill); (iii) [sic] OC leads to greater productivity increases in establishments with larger initial skill endowments”(Caroli & Reenan, 1999, p. 14).

While they do not say this is cause and effect relationship between OC and technology they do point out that in their research they “find evidence of complementarity [sic] between technical change and skills”(1999, p.14).

First world, or industrialized countries such as Britain, France, and the U.S., are the heaviest users of computer-based technology (Toigo, 1991). These three countries is where computer-based technology is becoming omnipresent and ubiquitous in the lives of citizens. The

U.S. government released a report in 2000 that supports Autor's contention and shows the tremendous growth in that country's computational power over the last several years.

During the past seven years, computers, high-speed communication systems, and computer software have become more powerful and more useful to people at home and work. Nearly half of all American households now use the Internet, with more than 700 new households being connected every hour. More than half of U.S. classrooms are connected to the Internet today, compared to less than three percent in 1993. IT allows Americans to shop, do homework, and get health care advice online, and it has enabled businesses of all sizes to join the international economy. Since 1995, more than a third of all U.S. economic growth has resulted from IT enterprises. Today, more than 13 million Americans hold IT-related jobs, and the rate of growth is six times as fast as overall job growth. (The Whitehouse, Office of the Press Secretary, 2000, Online)

It can be extrapolated from this quote that computer-based technologies will continue to influence the lives of all citizens as economies and the rights of the citizenry to freely access information become more closely linked with the spread of computer use in their private and public lives.

However, many citizens of industrialized countries who, for some reason, are not using computer-based technology in their daily lives (United States. Congress. House. Committee on Small Business. Subcommittee on Empowerment., 1999) and are not learning about them (Center for Educational Research and Innovation., National Center on Adult Literacy., & Organisation for Economic Co-Operation and Development., 2000). The reasons range from age to economics, or simply fear of technology in general (United States. National Telecommunications and Information Administration., 1998). A gulf exists between those who have skills with computers and those who do not for whatever reason.

This divide, often referred to as the "digital divide," is crucial within the culture of the United States and other developed countries (Reich, 1992). Skill with computer-based technology determines what income potential a person has; it determines how they will live. In short, because computational machines are so integral to our productive lives today (McGee,

2000), the level of skill people have in this area will define their future. The digital divide is leaving many people disenfranchised. While computer use continues to grow the beneficial effects of community building and access to the vast amount of knowledge accessible to those who use the Internet seems to be dividing the U.S. along race and income lines.

Although computers are becoming increasingly prevalent, Internet users are divided by race and income level, according to a recent Commerce Department study. Rather than reflecting society as a whole, the Internet is largely used by whites with incomes of \$75,000 and above. Households with annual incomes of \$75,000 and above are more than 20 times more likely to have Internet access than homes at the lowest income levels. Meanwhile, households that identify themselves as black and Hispanic are just 40 percent as likely as white households to have Internet access. Though all households are gaining Internet access at a growing rate, the divide between white households and black and Hispanic households has increased more than 6 percent since last year. Among families earning between \$15,000 and \$35,000 annually, more than a third of white families owned computers, while just one in five black families did. (as quoted in Washington Post , 1999, Online)

Using computer-based technology is integral to becoming fully involved with the productive economy of a first-world country. As indicated earlier, computers contribute to the knowledge, the productivity, and the international marketability (Reich, 1992) of a modern country's citizenry. The acquisition of computer-based technology skills will potentially diminish racial lines and empower individuals to cross the divide and provide their input to help shape a modern economy. The larger the digital divide is allowed to become, the greater the number of voiceless citizens within the democracy and the fewer valuable skills that will present and available within the national workforce.

#### EXACTLY WHAT COMPUTER-BASED TECHNOLOGY SKILLS ARE NECESSARY?

If computer-based technology skills are indispensable as survival tools in today's world, then just what are the actual skills needed? A variety of industries require a baseline computer skill set (Blake & Tjoumas, 1990). Little information is available regarding specific skills

regarding technology. The term “computer literate” or “computer skills” is often substituted for a specific skill list. In other cases many of the skills required depend specifically on the task at hand (Autor, National Bureau of Economic Research., Levy, & Murnane, 2000). However, from the few industry-based resources found there exists a small skill set that seems to be common across most industries. What follows are some examples.

JC Penny representatives were recently asked to provide what they thought were basic skills for “an entry-level position” in one of their stores (JC Penny, 2001). They indicated computer skills near the top of the list. Specifically they listed:

- Basic typing skills and a comfort level with computer keyboards and standard computer workstations so that new skills and programs can be easily learned
- Proficiency with point-of-sale registers and calculators. Understanding of data-entry techniques
- Familiarity with word-processing and spreadsheet software is also helpful (2001, Online)

After surveying Indiana businesses to discover “what specific workplace skills employees need for entry-level, mid-level and management jobs”(ICPAC, 2001, Online), the Indiana Career And Postsecondary Advancement Center (ICPAC) discovered keyboarding, word processing and spreadsheet skills among those skills needed at entry-level (2001).

While industry is the ultimate benefactor of a workforce armed with basic computer-based technology skills, education most clearly defines what those skills are to be. Schools and Universities have long been, and are now, the vanguard in the movement to provide marketable and personal survival skills to the citizens of developed countries. First, however, the educators themselves must demonstrate those skills. A self-assessment rubric was distributed through the UW-Whitewater Multimedia Development Center in 1997 and later updated in 2000. This rubric (*as shown in Appendix B, Figure B-1*), authored by Dr. Roger Yin (2001), addresses skill sets in the areas of Productivity Software, Electronic Communication, Electronic Research, Presentation

Technology, and Electronic Authoring. He also breaks the skill down by level of proficiency. However, he does not indicate at what level proficiency is thought to be achieved or at what level a UW-Whitewater faculty member should attain. Such recommendations are most likely out of Yin's purview. Like the ICPAC and JC Penny surveys, collectively, Yin's rubric emphasizes word processing and spreadsheet skills. In addition he emphasizes Internet and multimedia skills at all levels. Noticeably absent was any mention of keyboarding skills. His choice of skills to emphasize, no doubt, is a result of the academic environment in which these skills were being prescribed, however; again some of the basic skills needed by other businesses were part of the rubric.

The Wisconsin Department of Public Instruction (2000) has developed an Information and Technology Literacy Standards Matrix that separates computer skills into performance indicators then divides by the academic disciplines of Language Arts, Math, Science and Social Studies. These skills are further dispersed from grade kindergarten through grade 12 (Potter et al., 2000). The skills that are listed as required by the 12<sup>th</sup> grade are considerable and probably more than many mass production-oriented employers would require. However, this skill repertoire represents the many areas that a diverse job market will need. While many of these skills may seem too in-depth for simple survival skills or low-income repetitive performance level positions, they nevertheless "identify and define the knowledge and skills essential for all...students to access, evaluate, and use information and technology" (2000 p. 1).

To review, this author's contention is that a set of baseline of computer-based technology skills is not only necessary for survival but also necessary to give the individual the ability to make choices about their future. Based on this contention the basic skills this matrix portends are essential (*as shown in Appendix A, figure A-1*). However, the skill categories are altered in a

manner in which the particular skills relate to technological actions on information. This alteration is done solely to provide a relationship between the skills and the functions these skills may serve within an organization. Because the world is steeped in an “information-based economy” (Toigo, 1991) it seems only logical that these specific skills be categorized by how they relate to the “digital literacy of information management”(Gilster, 1997). Some skills may overlap into more than one column. The skills that do, may be considered more basic than those appearing only once.

The ICPAC and JC Penny surveys indicated a need for keyboarding, word processing, spreadsheet, and database skills. These skills are the ones that tend to overlap the most in this Matrix and the Yin rubric, which would seem to make them basic. However, does that make them more essential? These four skills are represented in the Wisconsin Standards Matrix along with the addition of Internet, multimedia and graphical manipulation skills. By separating the skills into information manipulation-oriented categories, it becomes evident that many of the skills are useful in many or all aspects of information manipulation. Which then, of these six skill sets are more essential and can they be ranked?

A skill such as Internet skill, “is necessary knowledge,” according to Gilster, (1997)

“because the Internet has grown from a scientists tool to a worldwide publishing and research medium open to anyone with a computer and a modem. ...The Internet is the fastest growing medium in history-like it or not, it will affect you and those around you at home and on the job, from the merging of you television set’s images with network data to the emergence of communities of users whose activities will change the shape of commerce and education”(p. 1).

Gilster believes Internet skills are essential in today’s world. However, statistically it has been shown that multimedia skills are not currently as much in demand (Groneman, 2000) as are the skills of keyboarding, word processing, spreadsheet, and database.

Keyboarding is the base of the five skill sets as the keyboard is the primary device used to input information, manage information, and conduct text-based communication. Because of the advent of the graphical user interface, the mouse device has become a popular, if not indispensable, system navigation tool; however, the keyboard is still the primary interface for information management and text-based communication. Because of this fact, keyboarding skills are the base on which all other skills depend. Keyboarding skills pertain directly to people's ability to interact with the environment of the information age.

After the information has been put into the system through keyboarding the next three skills allow individuals to manipulate the information. Word-processing software specifically addresses the ability to communicate information in either paper-based or electronic formats. Because word-processing primarily supports text-based activities, a separate tool is needed for numerical data. This is the spreadsheet software. Spreadsheet software allows numerical information to be compartmentalized and organized. This organization makes it possible for spreadsheet software to perform complex calculations, which further refines numerical information and makes it more manageable. Similarly, database software organizes and performs calculations on a wide variety of data. In the information age, data is being collected constantly in efforts to identify patterns of behavior or simplify arduous tasks. Database skills suggest that people understand how data is collected (i.e. through a cash register) and what it can be used for (i.e. to pinpoint sales opportunities). Word processing, spreadsheet, and database skills directly link to organizing and interpreting data to better manage the tremendous amount of information that individuals encounter both at work and at home.

The Internet is the linking of computers on a global scale to share or acquire managed information. If keyboarding skills is the base of the house on which the other four computational

skill sets rest, than Internet skills would be the roof, which is supported by the other four skills. Internet skills include all the skills previously discussed. The big difference is that people are no longer depending on one computer resource on which to practice these skills. The Internet user may manage information on many computers as well as synchronously or asynchronously communicate with other computer users. This fact makes being able to use the Internet synonymous with having the skills necessary to fully access all pertinent information. Without these skills individuals would be limited to a single computer resource and only the information stored within. As the world develops an Internet-based global community, people need to have Internet skills to participate.

However, ranking the skill sets in order of importance would depend on the circumstances of the individual using the skills and where they were being employed. As previously mentioned, setting does have an impact on what skills are used the most (Autor et al., 2001) so, for an individual to be prepared for the variety of potential situations that will meet ones life in a modern country all the skill sets share an equal importance.

## SUMMARY AND CONCLUSION

Identifying the five most important computer-based technology skill sets is important. These skill sets combine to form a shelter that will withstand the storms that are brewing as a result of the modern world's dependence of information. Each skill alone, while still useful, will not provide the necessary protection individuals need to survive today. These skill sets translate into the tools individuals will use to secure their home, bring in an income, and interact within a democracy and/or global economy that is increasingly focused on information. They are the bridge that crosses the digital divide.

The individual skills within each skill set may vary depending on the reason that information is being manipulated or sought. There does not seem to be a doubt, however, that these five skills are indispensable for all school age and adult individuals, regardless of economic demeanor, for survival in the modern economy of first-world countries.

### Implications For Further Research

More information needs to be attained to assure that all necessary skill sets have been unearthed. It is also necessary to determine, as was attempted in the Yin rubric (2001), whether there are levels that can be determined and what those levels would look like. The question becomes: Should the levels be based on the geographical region one inhabits, or should they be oriented toward intended job task?

The times are certainly changing at a fast pace. This quickened pace has wrought the computer-based skill deficit that is being faced by the U. S. and many other countries (Rhinesmith, 1996). At such a pace, how can these skills be kept up to date. Will the five skills recommended here be out of date soon? If so, how soon and how should educators and business tell? How much of the world needs to enter into the use of a new technology before it changes the necessary skill set of graduating students and incoming labor?

Finally, what are the barriers to acquiring these skills? Why are these skills not touted and taught as vigorously as the three R's? Is the reason related to culture, economics, and/or globalization? More than likely all three are influencing the acquisition of these necessary skills. However, one thing is certain, these skills are as necessary to surviving and thriving in today's world. And they are becoming more so everyday.

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Yin, L. R. (2000) Technology Skill Matrix

<b>Information Acquisition</b>	<b>Information Analysis</b>	<b>Information Management</b>	<b>Information Communication</b>
-demonstrate proper keyboarding mechanics and touch type accurately (suggested range 30-35 wpm)	-demonstrate proper keyboarding mechanics and touch type accurately (suggested range 30-35 wpm)	-demonstrate proper keyboarding mechanics and touch type accurately (suggested range 30-35 wpm)	-demonstrate proper keyboarding mechanics and touch type accurately (suggested range 30-35 wpm)
	-use an integrated program or application suite.	-use an integrated program or application suite.	-use an integrated program or application suite.
			-use draw, paint, graphics, or presentation software to visually communicates ideas or concepts
			-manipulate graphics objects in a word processing program.
-gather and organize statistical or survey data using e-mail, listservs, or on-line news or discussion groups.	-gather and organize statistical or survey data using e-mail, listservs, or on-line news or discussion groups.	-gather and organize statistical or survey data using e-mail, listservs, or on-line news or discussion groups.	
-choose the most appropriate search engines and directories to locate specific resources on the Internet or other on-line resources.	-choose the most appropriate search engines and directories to locate specific resources on the Internet or other on-line resources.		
	-analyze data from a database and present conclusions in a document or report.	-analyze data from a database and present conclusions in a document or report.	-analyze data from a database and present conclusions in a document or report.
	-construct a spreadsheet, enter data into cells, use mathematical functions to manipulate/process data, generate a chart or graph, and interpret the results.	-construct a spreadsheet, enter data into cells, use mathematical functions to manipulate/process data, generate a chart or graph, and interpret the results.	
	-use a computer and graphical organizer software to generate modifiable flow charts, project timelines, organizational charts, or calendars	-use a computer and graphical organizer software to generate modifiable flow charts, project timelines, organizational charts, or calendars	-use a computer and graphical organizer software to generate modifiable flow charts, project timelines, organizational charts, or calendars
		-develop a document or file for inclusion into a website or web-page	-develop a document or file for inclusion into a website or web-page
			-use desktop publishing software to produce page layouts in different formats (e.g. brochure, tri fold, newsletter)

Figure A-1

<b>Information Acquisition</b>	<b>Information Analysis</b>	<b>Information Management</b>	<b>Information Communication</b>
			-participate in an on-line discussion group or listserv appropriate to content area
			-develop a document or file for inclusion into a website or web-page
			-proofread and edit a document using the spell, thesaurus, and grammar checking functions of a word processor.
		-demonstrate how to import and export text and graphic, and sound files between applications.	-demonstrate how to import and export text and graphic, and sound files between applications.
			-use desktop conferencing tools such as chat programs for synchronous discussions
			-produce a multimedia program using text, graphics, moving images and sound

*Figure A-1, (cont'd)*

	Productivity Software	Electronic Communication	Electronic Research	Presentation Technology	Electronic Authoring
Level 1	<p><b>Are you able to...</b></p> <p>Understand and navigate within an operating system like Windows 95/98/2000 or Macintosh?</p> <p>Use a word processor like MS Word to create and edit text documents?</p>	<p>Understand and use an E-mail software application to read and send electronic mail?</p>	<p>Search the on-line catalog of the library?</p> <p>Perform searches with keywords?</p> <p>Use a Web Browser like Netscape Navigator to search the Web?</p>	<p>Create an electronic slide presentation with step-by-step guidance from slide creation wizards available in MS PowerPoint or Astound?</p>	<p>Use a word processor like MS Word to author content and save as HTML/Webpages?</p> <p>Use a WYSIWYG Web editor like Composer or Dreamweaver to author Web content?</p>
Level 2	<p>Use a graphics software like Photoshop to create, scan, and edit graphics and images?</p> <p>Insert non-text (e.g. charts, and images) components onto a document?</p>	<p>Understand and use a LISTSERV or a Newsgroup to read and send messages?</p>	<p>Search the Web with search engines like Yahoo?</p> <p>Perform search with keywords and operators like +, "", ( ), etc.?</p>	<p>Create an electronic slide presentation from templates with PowerPoint or Astound?</p>	<p>Use an integrated Web development system like WebCT or Blackboard to create course documents?</p>
Level 3	<p>Understand and perform "cut and paste" in and between application?</p> <p>Use a spreadsheet program like MS Excel to track student attendance and keep their grades?</p>	<p>Understand, create, and use an on-line discussion forum or a chat room to read and post messages?</p> <p>Understand and use and FTP software to transfer files?</p>	<p>Search the Web with the understanding of the Web conventions like .com, .net, .edu?</p> <p>Perform search with time, holding and other restrictions?</p>	<p>Create an electronic slide presentation from scratch with text and bullets?</p> <p>Operate a data projector to play the slide show?</p>	<p>Generate HTML codes for Webpages with an HTML or Text editor?</p>
Level 4	<p>Use a word processor to design newsletters and brochures?</p> <p>Use a spreadsheet's formula and statistical analyses to process data like final grades?</p> <p>Use graphics software for preparing image files for Web publishing?</p>	<p>Understand, create and use audio or videoconferencing to communicate in synchronous mode?</p>	<p>Identify search outcomes that are factual, truthful, and accurate?</p> <p>Cite the on-line resources in a proper format?</p>	<p>Create an electronic slide presentation from scratch with interactive and multimedia elements?</p> <p>Troubleshoot computer video and/or data projector problems?</p>	<p>Create interactive modules with Director, Toolbook or Authorware?</p> <p>Create interactive modules with programming languages like JavaScript, Java, or C++?</p>