

Comparative Benchmarking of IT and Knowledge Worker Skills
(Final Draft)

Charles Lanigan MA, Member
IT Cluster Workforce Education Board, Catalyst Connection of Western Pennsylvania
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Purpose:

This document compares desired skills and competencies for those who work with information technology or in the IT industry to those defined for *knowledge workers*. My purpose is to correlate skills and competencies traditionally associated with the IT industry with those skills and proficiencies that workers in the 21st century and beyond will require to function successfully in what has been called the *knowledge economy* – an economy in which competence and success are measured less and less by the physical goods one produces, than by the information one can bring to bear and share, often through the use of technology, to address human needs, promote innovation and solve (or avoid) problems.¹

The information and conclusions presented here are based on research by organizations that include:

- Greater Philadelphia First (GPF)
- Education Center, Inc. and the Information Technology Association of America (IT Pathway Pipeline Model)
- Regional Workforce Development Initiative of Western Pennsylvania
- European Organization for Economic Co-operation and Development (OECD)

GPF and the Education Center, Inc., in particular, produced two benchmarking studies I used as the basis for comparison. I have also drawn on my graduate school research at the University of Pittsburgh and industry experience.

¹ European Organization for Economic Co-operation and Development (OECD), Committee for Scientific and Technological Policy, *The Knowledge-based Economy: A Set of Facts and Figures*, 1999

Background:

The IT Cluster Workforce Education Board at Catalyst Connection of Southwestern Pennsylvania has focused on IT and computer-related skills that students entering the workplace and existing employees must possess to provide an effective workforce in our region. Definitions of these skills usually center around students' and workers' understanding of information technology and their ability use specific computing applications such as spreadsheets and word-processing to accomplish tasks.

However, businesses leaders, policymakers and academicians in our region and around the world also talk about the need to develop workers who have the skills and competencies to function successfully and competitively in a new global knowledge economy. Peter Drucker coined the phrase *knowledge worker* over thirty years ago to describe workers who add value by interpreting and synthesizing information to create new ways to define and solve problems.²

Whether you agree that knowledge worker accurately describes a distinct class of worker with unique qualifications and skills, there are two facts to be acknowledged: 1.) Businesses and organizations inherit the fruits of our educational system in the workers that they hire, and 2.) The workplace is changing. I don't mean necessarily that the jobs that are available or even the physical working environment have changed with the advent of information technology – though of course these have. I mean that the fundamental tasks workers must perform have shifted from what Shoshanna Zuboff in her book *In the Age of the Smart Machine: The Future of Work and Power* calls *acting on materials* and *with people* to (echoing Drucker) primarily *interacting with, interpreting and communicating information*.³

The needs that employers define for their current and future workforce inform some of the pedagogical goals that schools set for their teachers and curriculum. However, groups such as Greater Philadelphia First have identified discrepancies between the "academic exit standard" defining the skills and competencies with which students leave the educational system and the "business entry standard" of these that businesses say that employees entering the workforce at all levels must have to be effective.

It would be relatively easy if the public and private sector could address the discrepancy simply by installing more computers in schools and teaching students and existing workers how to master

² Drucker, Peter, *The Age of Social Transformation*, The Atlantic Monthly, 1994

³ Zuboff, Shoshanna, *In the Age of the Smart Machine: The Future of Work and Power*, Basic Books, 1988

the tools of information technology. Groups in southwestern Pennsylvania have made laudable progress in ensuring that employees entering the workforce have the technical skills they need related to information technology.

However, today's students and workers will encounter a landscape of shifting technology throughout their personal and professional lives. The current hot programming language or operating system is tomorrow's obsolescence. Application-specific computing skills and knowledge that add value today may not in the future. Businesses say they need employees who can adapt, and rhetoric about the *learning organization* and the *agile organization* abounds.

So what, exactly, are the skills and competencies that workers require to function successfully in the knowledge economy? Beyond knowing their way around the latest operating system and the plethora of word-processing, spreadsheet and database applications, what do we need our employees to be able to do and to know in this region and others?

IT Skills

Is an IT worker someone who designs, develops or supports information technology applications? Is it anyone who uses IT and computing applications to perform tasks? Given the pervasiveness of information technology in our daily lives -- from facilitating diagnostics on our automobile to allowing us communicate instantly with our relatives by E-mail to accessing recipes on the Internet, the latter definition might include anyone.

The IT Pathway Pipeline Model developed by the Education Development Center, Inc., classifies IT skills as follows:⁴

- IT Use for Living
- IT Use for Learning
- IT Use for All Work
- IT Use for Professional Users
- IT Use for Industry Professionals

The authors state that "*The Information Technology World is fast paced and constantly changing. We can think about the IT world in terms of the different ways people interact with IT as they live and work.*"

⁴ Education Development Center, Inc., Techforce Initiative, *IT Pathway Pipeline Model: Rethinking Information Technology Learning in Schools*, January 2000

The IT Cluster Workforce Education board at Catalyst Connection has benchmarked skills and competencies for IT workers based on the IT Pathway Pipeline Model by level of education. These benchmarks are also based on standards identified in studies by Lyceum Group for the Three Rivers Workforce Investment Board and the Regional Workforce Development Initiative of Western Pennsylvania. The IT Pathway Pipelines Model presents benchmarks identifying desired IT skills and knowledge that students attain at different grade levels – ultimately toward enabling them to master the use of computers and information technology in life and in the workplace.

The IT skill and knowledge benchmark categories in the IT Pathway Pipeline model comprise the following:

- Technology and Society
- Information Literacy
- PC Principles and Operation
- World Wide Web
- Word Process and Desktop Publishing
- Graphics and Multimedia
- Keyboarding Skills
- E-mail
- Software and Systems Integration
- Databases
- Spreadsheets
- Operating Systems
- Programming
- Hardware Installation and Configuration
- Networks
- Self-Management, Teamwork and Communication (characterized by the model as *soft skills*).

The IT Pathway Pipeline model assumes that the student achieves increasing skill and knowledge in each category as he or she moves through the educational system. Thus, under the category *Technology and Society* a fourth grader should understand what a computer is and its appropriate use as a tool for living and learning – including concepts such as intellectual property and copyright. A student graduating high school and entering the workforce should understand the social implications of information technology and its use in business.

Information Literacy involves appreciating the power that information and information technology carry in our society, gathering and evaluating it critically, and presenting information

in various forms for clarity and impact (e.g., as text, graphics, sound).

PC Principles and Operations include terminology, concepts and technical skills involved in using specific applications and parts of a computer to accomplish tasks.

I will not repeat the criteria for each category. Mastery progresses from technical literacy and knowledge of facts to using computing applications and understanding how IT applies in the workplace, to knowing how to use specific IT skills and knowledge in a job (perhaps toward a career in the IT industry). The authors suggest that the model can be used as a tool for consumers (students and their parents), as well as educators and employers in identifying criteria for IT worker competencies and assessing the ability of prospective employees to perform successfully in the workplace. The Lyceum Group in Pittsburgh and other local organizations have sought to bridge the gap between educational preparation and the workplace with similar models and tools such as the ICDL (the International Computer Driver's License).

Knowledge Worker Skills

In 1999 Greater Philadelphia First (GPF) commissioned a team to identify and define the skills and competencies that "knowledge-based" companies in the region required in their workers in order to compete successfully.

The team consisted of representatives from businesses and universities in and around Philadelphia. The introduction to their report states their purpose:

In this information and technologically driven economy, knowledge-based businesses grow under the effect of their own innovation. No longer tied to a physical location, business can and will locate where the talent is available. We are now at the point where our most important regional asset is not land or other raw materials but the creativity and innovation of our workforce. Brains and enterprise are the new creators of wealth and prosperity. The ability of a region to retain and attract a professional workforce will become an even more critical element of economic competitive advantage. The bottom line is that our region's knowledge-based companies need talent to remain competitive.⁵

⁵ The Business/Academic Partnership to Develop the Information Technology Workforce in Greater Philadelphia, *What Do Today's Information Technology Graduates Need to Know to Meet the Needs of Knowledge-Based Companies?*, October 4, 1999

Lanigan, *Comparative Benchmarking of IT and Knowledge Worker Skills*

Based on input from employers, the GPF report found a gap between educational preparation and workplace demands. The team sought to address this by presenting benchmarks they developed jointly. These benchmarks identify “behavioral and organizational competencies for students graduating with a baccalaureate degree in IT relevant major” (defined within the report as computer and information science, computer engineering, management information systems, and software engineering.)

The competencies fall into four categories, with specific criteria that the team identified listed under each:

Business Perspectives and Processes

- Project Management/Orientation (e.g., planning, organizing, monitoring, quality assurance)
- Business Acumen (e.g. client focus/customer service orientation, problem solving, understanding organizational dynamics, goal/results orientation)

Communication

- Communication Skills (oral, written, listening, presence)
- Meeting Skills
- Public Presentation (podium) Skills
- Interpersonal Skills/Relationship Building

People Skills

- Team Skills (organization skills, collaborative skills, group dynamics skills, adaptability, ability to both lead and follow)
- Interpersonal Skills/Relationship Building (e.g., tact and professional decorum, consulting skills, client awareness)
- Group Creativity (brainstorming, sensitivity to others, strategic thinking skills, alignment to strategic goals and objectives)

Personal Skills and Characteristics

- Professionalism
- Ability to Work in Multiple Contexts at the Same Time

- Time Management
- Stress Management
- Resilience
- Initiative/Follow Up/Motivation

These competencies match those often classified in the IT Pathway Pipeline Model under "soft skills" – meaning those that are difficult to define and quantify or measure (as opposed to "hard" IT skills that consist of mastering specific computing techniques, concepts, applications and programming languages).

The report explains the team's bias as follows:

We chose to emphasize behavioral competencies over technical competencies for several reasons. In the knowledge economy, these skills are an integral part of the success equation— employers value them as much as the purely technical skills, they are universally applicable, and they are less subject to rapid change. The Partnership's intent is for these standards or competencies to provide guidance and a framework for academic and internship program development. Additionally, as an expression of the skills that companies value, students themselves will use the competencies to evaluate college and university programs as they and their parents increasingly understand that a knowledge-based career is key to personal and regional prosperity.⁶

The report quotes employers in the region describing the gap between the academic exit standard and the business entry standard often in terms of these soft skills. The summary and conclusion that follows includes some representative comments.

Summary and Conclusion

The question of whether we should equip workers with IT-related application and programming skills versus so-called soft skills and proficiencies is not an either/or proposition. Employees of all types face a range of demands in the modern workplace from using a variety of existing computing applications, to defining and developing new ones, to looking at ways to apply information technology more effectively. Companies and organizations in the knowledge economy need IT and other workers who have technical skills, talent and understanding at a variety of levels.

⁶ Ibid

The notion that we must teach students and prospective employees to interact primarily with technology is misguided. Contrary to the statement in the IT Pathway Pipeline model, we do not need workers whose primary proficiency is interacting with the technology. We need workers who know how to use the technology appropriately to interact with others, stay informed, increase their own expertise and that of others, and work successfully to achieve business goals. Much of this interaction occurs across disciplines and departments. For every Javascript and C++ programmer, network administrator and web developer, there are a variety of managers, sales and marketing personnel, support staff and (dare I say) users. All must work together to interpret and communicate information, define business goals and priorities, and make and carry out decisions.

The GPF study suggests that students leaving the public school system who are competent or even highly proficient in certain technical skills (such as using word-processing and presentation applications or Javascript programming) sometimes lack other skills necessary to understand business goals and interact collaboratively with non-specialists. Comments from business representatives involved in the study included concern about students' lack of listening skills and need for more client service/customer service orientation. The report concluded in particular that:

...good customer service include listening skills, engaging and developing a rapport with the client, building a partnership in which both sides win, and understanding that technology is a tool to solve business problems, not an end in itself. Technical people need to understand the business drivers of a particular problem and then match technical solutions to the desired outcome....It is very important for students and faculty to be aware that information technology is part of the service sector economy and that its goal and mission is service.

The definition of a knowledge worker and knowledge economy applies beyond the IT industry. Automated manufacturing has become more flexible and sophisticated. Demands on machinists and others who work with physical processes have changed. The ability to solve problems, interpret the meaning of abstract data readouts with regard to manufacturing processes, communicate information and work as a team have become at least as important as individual hands-on (acting-on) operator expertise and craftsmanship. The service industry and medical care, too, depend on workers with an increasingly-sophisticated level of awareness and knowledge of the usefulness (and limits) of information technology. This is especially important with recent legislation regarding managed care and patient privacy issues.

Return-on-investment in the knowledge economy depends not just on information (or other) technology and technical skills of workers. An organization's (and region's) success will increase with its workers' ability to understand the day-to-day and overall goals of their business, combine their skills synergistically, and apply the technology appropriately with others to achieve those goals consistently in a way that makes the whole greater than the sum of its parts.

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Author Information

Charles Lanigan develops workflow and collaborative applications for PNC Bank, where he is currently a knowledge management consultant. He holds a Master's Degree in Instructional Design & Technology from the University of Pittsburgh, with a focus on literacy and problem-solving in information-rich environments. He has taught at the Katz Center for Executive Education, Penn State University Outreach and Carnegie-Mellon University. He serves on the IT Workforce Education board at Catalyst Connection in Pittsburgh, is a member of the Pittsburgh Regional Knowledge-Management Consortium (PRKMC) and a past president of the Pittsburgh chapter of the Society for Technical Communication.

E-mail: waysofknowing@comcast.net
Voicemail and Fax: 810-885-7200