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The New Division of Labor: How Computers are Creating the Next Job Market

Q&A with Richard Murnane and Frank Levy

Harvard Graduate School of Education
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by Greer Bautz

Thompson Professor Richard Murnane (© 2004 Andrew Brilliant / Brilliant Pictures, Inc.)

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With time, today's economic recovery will return the economy to full employment. But what kind of jobs will we have? In The New Division of Labor: How Computers Are Creating the Next Job Market *(Princeton University Press and Russell Sage Foundation, June 2004), economists Richard Murnane and Frank Levy examine how computers are reshaping the job market and the human skills rewarded in the marketplace. Combining numerous workplace examples and 30 years of economic trends, the authors illustrate how computers create and enhance jobs, even as they eliminate some jobs and move other jobs overseas. The result is a hollowing-out of the U.S. occupational structure with most job growth in higher-end, high-skilled occupations.* (See Figure A.)

Using examples from IBM's Basic Blue Management Training, Cisco Networking Academies, and a Boston public school, Murnane and Levy show how U.S. firms and schools are learning to teach what they call expert thinking *and* complex communication*, the two modes of thinking required to thrive in a computerized workplace.*

Q: How does *The New Division of Labor* relate to the current jobs debate?

A: We are coming out of a slow economic recovery, much like the

"jobless recovery" of 1992-94. As in that recovery, we will eventually return to full employment. But it will be full employment with a different set of jobs—the jobs lost to computerization and to other countries are not coming back. This is the essence of the book—how computers are driving long-term change in the U.S. job market and in the skills the job market now demands, and how the right kind of education creates the essential skills for success in future job markets.

Q: What skills are valued in the computerized workplace?

A: We argue that the jobs growing in number share two general skills that computers cannot replicate. One is *expert thinking* the ability to solve new problems that cannot be solved by rules. (If the problem could be solved by rules, a computer could do it.) New problems run the gamut from doing research to fixing a new problem in a car (not covered in the manual) to creating a new dish in a restaurant.

The jobs growing in number share two general skills that computers cannot replicate—*expert thinking* and *complex communication.*

The second general skill is *complex communication*, the ability not only to transmit information, but to convey a *particular interpretation* of information to others in jobs like teaching, selling, and negotiation. If a student gets a calculus lesson from the web, the student will literally have the information. But there is no guarantee that the student will understand the information she is receiving. It takes a good teacher to present the information in a way that allows the student to translate the information into knowledge she can apply.

Complex communication is equally important in sales. Customers who know exactly what they want can order from a web site without human intervention. But a customer who requires convincing needs subtle human contact. A good salesperson is constantly modifying her argument as she reads the customer's facial expression, and listens to the customer's questions and the tone of voice the customer uses. That kind of selling is very hard to express in rules and so it remains a human endeavor.

Q: *The New Division of Labor* argues that many of the jobs now moving overseas would have eventually been replaced by computers. Can you give some examples?

A: In the case of call centers, moderately complex scripts are being read by workers in India but simpler scripts, such as requesting a check from a Charles Schwab account, are now handled by speech-recognition software. Among professional jobs, software coding, a job based on standard procedures, is slowly moving offshore. Executing trades on the floor of the New York Stock Exchange, another professional job based on standard procedures, is moving from human traders to computerized networks. In the case of manufacturing, technology has

been replacing blue-collar jobs for many years. In the 1990s, U.S. manufacturing output increased by 35 percent but U.S. manufacturing *employment* actually decreased slightly.

Q: What do computers do that creates this overlap with jobs sent overseas?

A: Begin with the fact that every job in the economy requires the processing of information. Words on a page, numbers in a report, the look on a customer's face, the taste of a sauce, the sound of a stumbling automobile engine—people in their daily work process all this information as they decide what to do next.

Computers excel at tasks in which the information processing can be described as a series of logical rules ("rules-based") or in the recognition of simple patterns. An example of a rules-based task is the job of issuing a boarding pass to an airline passenger:

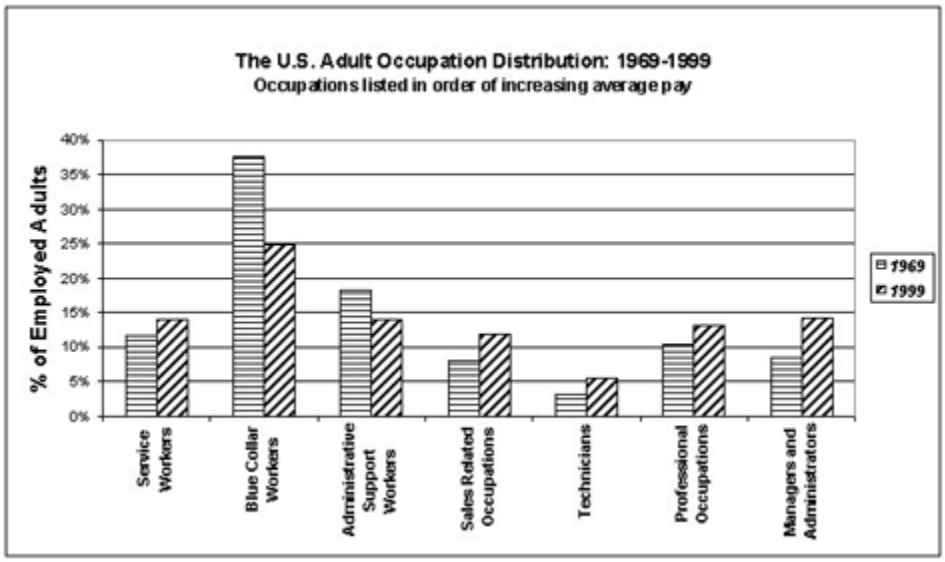
- Identify the passenger by reading the account number on her credit card
- Does the number on the credit card match a reservation in the database (yes/no)?
- If no, reject the request
- If yes, does the passenger have a seat assignment in the database (yes/no)?
- If no, show her the available seats and prompt the customer to choose one.
- If yes, complete the transaction

Because the information can be handled by rules, boarding passes increasingly are issued by self-service kiosks rather than by desk agents. When most of a job can be described in rules—"codified"—it can be moved offshore with minimal risk of misunderstanding. In manufacturing, an example is Boeing's design of aircraft modules using CATIA, computer-assisted design software. CATIA's output is a set of instructions—"rules"—for computer-controlled machine tools. Some of these machine tools are located in China and Japan and Italy because Boeing knows the parts will fit when they are returned for final assembly.

A call center job is codified when everything the operator needs to know can be written in scripts on a computer screen. These are the kinds of jobs that are being sent offshore. Basic software coding is codified because students everywhere study from the same textbooks and work with the same platforms from Microsoft, Oracle, SAP, etc.

Q: So, specifically, how are computers changing the occupational outlook?

A: The occupational distribution is being hollowed out, as demonstrated in this figure: (Click figure to display larger version.)



The biggest relative losses are occurring in the lower-middle of the distribution-assembly line work, clerical work-jobs typically held by high-school graduates.

Lower-paid service jobs like janitors require extensive optical recognition that is very hard to program—e.g., making sense of what you see when you enter a new room. Sales occupations continue to grow because the act of selling involves complex human interaction. But the greatest job growth will continue to be concentrated in higher-skilled technical, professional and managerial occupations—work where the required problem solving and human interaction cannot be described in rules. Not all of those higher-skilled occupations will be immune from competition but that is where the major job growth has been and will continue to be.

Q: You say that job growth will be concentrated in highly skilled occupations. The Bureau of Labor Statistics (BLS) predicts that many of the fastest-growing occupations will require little education—for example, food-service workers. Why do their predictions differ from yours?

It is clear that job growth is concentrated in higher-skilled occupations.

A: In BLS projections, all food-service workers fall under one occupational title and this results in many job openings in a single occupation. In these same projections, a highly skilled category like engineering is divided into multiple specific occupations: aeronautical engineer, mechanical engineer, and so on, each relatively small. In the figure above, specific occupations are combined into broad groups: food-service workers grouped with other service workers and aeronautical engineers grouped with other professional occupations. Looking at these groups, it is clear that job growth is concentrated in higher-skilled occupations.

Q: Are all blue-collar jobs going to disappear?
A: Not at all. Carpenters, plumbers, and mechanics and other craftsmen can't be off-shored—they have to work at the site of the problem. But more important, their work can't be automated because they constantly encounter new problems for which they have to construct new solutions—they are constantly applying expert thinking skills.
Q: You argue that complex communication and expert thinking are the skills increasingly required for good jobs. Does this mean that our schools should stop teaching the "three Rs" and focus on teaching these skills?
A: No, for two reasons. First, literacy and math are critical skills necessary to acquire the knowledge to be an expert thinker in any field. Second, the skills needed to be good at complex communication and expert thinking can be taught in any subject area: English, history, science, etc., and need not compete for space in the curriculum.
Q: Can computers help improve education? Can they help students to master the skills needed to excel at complex communication and expert thinking?
A: Computers can offer students access to a wide range of information. More importantly, computers can absorb routine parts of learning, leaving classroom time for learning that demands human interaction. For example, in IBM Basic Blue new managers' training, a new manager can learn basic IBM policies by reading web-based text (assuming proper incentives to ensure the text is read). But text alone is not sufficient to learn how to handle a talented but disruptive employee. That kind of learning has to be done in a classroom through role-playing and case studies directed by a skilled instructor.
Q: If a growing proportion of the nation's workforce is using computers, isn't it critical to emphasize computer skills in the nation's schools?
A: The answer depends on how you define computer skills. Young people learn very quickly how to operate computers and use software. Evidence from firms' training programs show that even older people can acquire these skills fairly rapidly. It is when computer skills are defined more broadly to include forming judgments about what kinds of information are relevant to solving a particular problem and how to effectively communicate by e-mail that the real educational issues arise. Notice that these skills really antedate computers.
Q: Aren't computers increasing the range of tasks they can do? Isn't there a real danger of mass unemployment?
A: The number of tasks computers can do grows every year. If there were only a fixed amount of work in the economy, computers' growing capability would translate into mass unemployment. But the amount of work to be done is not fixed. Partly as a result of

Partly as a result of advances in computerization, new tasks are created each year.

advances in computerization, new tasks are created each year. For example, computerization made possible complex mutual funds involving derivatives. Valuing these complex new funds is a task that only humans can do because it involves both complex communication and non-routine problem-solving.

We can draw an analogy by going back to 1880, the last year when half of the work force worked in agriculture. If you had said then that new machinery would allow all the agriculture we need to be produced by 3 percent of the workforce, people would have assumed that the unemployment rate would soar. The unemployment rate hasn't soared because people are doing hundreds of jobs that didn't exist in 1880. The way to think about computers (and computer-supported trade) is that they change the economy's mix of jobs, not the number of jobs. In particular, they create new and higher skill demands for workers.

Q: Your book is about preparing students to cope in a rapidly changing economy. But don't we want our schools to do more than provide job-related skills? What about preparing students to be good citizens in a pluralistic democracy?

A: Of course schools need to do more than prepare students to earn a decent living. However, the stability of our democracy depends on broad-based sharing in the nation's economic benefits. Moreover, complex communication and non-routine problem-solving are important skills for contributing to life in a pluralistic democracy.

About the Authors

Richard Murnane is the Thompson Professor of Education and Society at the Harvard Graduate School of Education, and Frank Levy is the Rose Professor of Urban Economics at the Massachusetts Institute of Technology. *The New Division of Labor* is the pair's second book together. In 1996, they co-authored the widely cited *Teaching the New Basic Skills: Principles for Educating Children to Thrive in a Changing Economy*.

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