

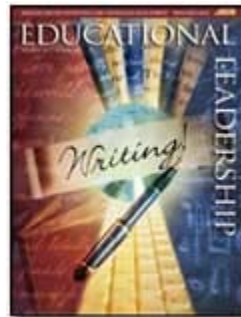
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Education and the Changing Job Market

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An education centered on complex thinking and communicating is a graduate's passport to prosperity.



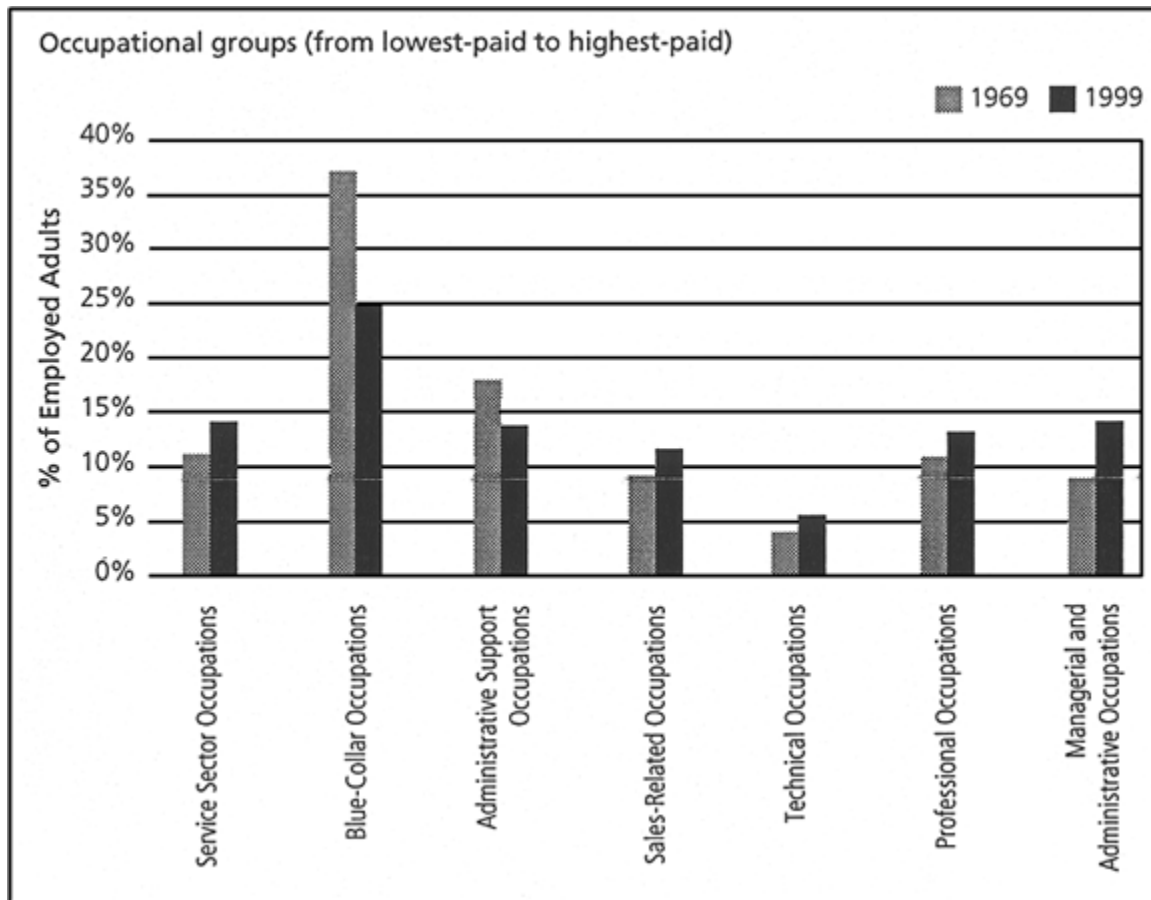
U.S. educators may question whether it makes economic sense to educate all students to meet demanding academic standards. After all, newspapers are full of reports about the computerization of once-secure U.S.-based jobs and outsourcing to countries that pay lower wages. And the U.S. Bureau of Labor Statistics predicts that the fastest-growing occupation in the United States over the next decade will be food preparers and servers. If more and more jobs are going to be claimed by computers or workers in other countries, and if the fastest-growing U.S. occupation is one for which workers require few skills, don't current education reform initiatives clash with the economic realities to come?

The central message from our research is that there is no such conflict. Those with strong skills do not have to worry about mass unemployment or underemployment. On the contrary: The great danger is the continuing decline in earnings opportunities for people who lack the skills to do work requiring *expert thinking* and *complex communication*. The jobs lost to computerization and to other countries are not coming back. What we should focus on is raising student achievement in math, science, and reading because complex, technical skills will be necessary for the new century's jobs.

How Is the Job Mix Changing?

The occupational structure in the United States is "hollowing out"—that is, we are losing jobs in the middle while gaining jobs at the top and bottom ends of the wage scale. In Figure 1, the nation's occupations are grouped into seven categories, arrayed from lowest-paying on the left to highest-paying on the right. The job categories that declined in importance between 1969 and 1999 are blue-collar occupations (for example, assembly line workers) and administrative support occupations (for example, file clerks). The lowest-paid category, service sector occupations (for example, janitors, waiters, and security guards) grew moderately and is continuing to do so. However, the higher-paid job categories—technical occupations (for example, nurse practitioners), professional occupations (for example, teachers), and managerial and administrative occupations—have experienced the greatest growth.

Figure 1. The U.S. Adult Occupation Distribution: 1969–1999



Source: Author's calculations based on the March 2000 Current Population Surveys conducted by the U.S. Census Bureau.

Moreover, these trends have continued during the past four years as the nation has recovered from recession. Between June 2000 and June 2004, the combined total of U.S. jobs in the technical, professional, and managerial categories increased by 1.9 million, and the number of jobs in the service sector category—a category that includes food preparers and servers—increased by 2 million. However, this trend was balanced by declines of 2.2 million in the blue-collar occupations category and 900,000 in the administrative support occupations category.

The categories in which jobs are declining have historically provided work to the majority of U.S. high school graduates who do not go on to college. Therefore, young people who leave high school today must be able to succeed in the postsecondary education or training program that they will need to access the growing number of relatively high-wage jobs. Youth who graduate ill-equipped to handle further training will find themselves competing for service sector jobs, and—although the number of such jobs is increasing—most do not provide financial security.

Why Has the Job Distribution Changed?

Advances in computerization play a key role in the changing job distribution in the United States. Every job requires workers to process information. Numbers in a report, the look on a customer's face, the taste of a sauce, the sound of a faltering automobile engine—people process all this information in their daily work to help them decide what to do next. Computers excel at rules-based tasks—those in which information can be processed through a series of logical rules or simple pattern recognition. For instance, the task of issuing a boarding pass to an airline passenger follows simple steps and logic-based rules:

- Identify the passenger by reading the account number on his or 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 the available seats and prompt the customer to choose one; if yes—complete the transaction.

Because computers can process this information by applying rules, self-service kiosks rather than desk agents now issue many boarding passes. The same holds true for thousands of administrative support jobs.

Moreover, when the greater portion of a job can be described in rules, or *codified*, people or machines far from the customer seeking the service can do that job with minimal risk of misunderstanding. Many call-center jobs are considered codified because everything the operator needs to know can be written in scripts. These are the kinds of jobs that companies are sending outside the United States.

To choose a manufacturing example, Boeing designs aircraft modules using computer-assisted design software that generates a set of instructions—rules—for computer-controlled machine tools. The machine tools making the parts may be located in China, Japan, or Italy; thus, fewer U.S. workers now make aircraft modules.

Will Computers Create Mass Unemployment?

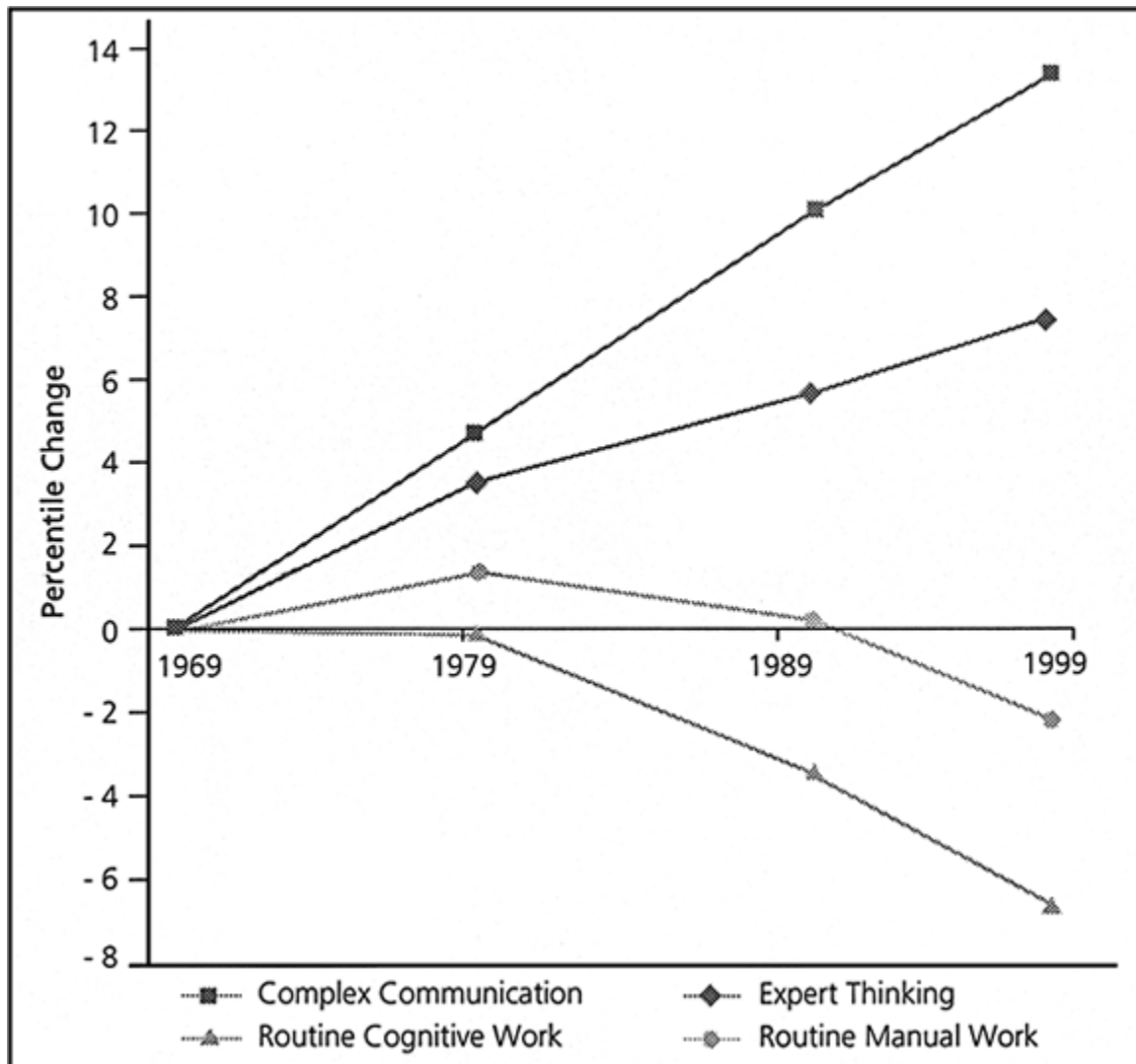
If there were only a fixed amount of work in the economy, the growing capability of computers would translate into mass unemployment. But advances in computerization create new tasks each year. For example, computerization made possible complex mutual funds involving derivatives. Valuing these complex new funds, which involves both complex communication and non-routine problem solving, is a task that only humans can do.

Alarm about a possible mass loss of jobs is nothing new. In 1880—the last year in which half of the workforce worked in agriculture—no one could have predicted that the United States would be a net exporter of agricultural products in 2004, with less than 3 percent of the workforce employed in agriculture. If they had foreseen this result, people would have assumed that the unemployment rate would soar. That hasn't happened, because workers in the United States are doing hundreds of jobs that didn't exist in 1880.

Which Human Skills Does the Labor Market Value?

As illustrated in Figure 2, changes in the distribution of U.S. jobs have increased the importance of two types of skills: expert thinking and complex communication.

Figure 2. Trends in Tasks Done by the U.S. Workforce 1969–1998 (1969 = 0)



Source: Adapted from Autor, Levy, & Murnane (2003). Use with permission.

Expert thinking is the ability to solve new problems that cannot be solved by applying rules. Tasks requiring expert thinking run the gamut from fixing an unexpected problem in a car to creating a new dish in a restaurant.

Many jobs considered blue-collar involve expert thinking as well as manual labor; workers continually encounter new problems for which they have to construct new solutions. For example, today's auto repair technicians use computer-based diagnostic tools to test cars—but expert thinking must kick in when the computer diagnostics indicate that all systems are functioning yet the car is not performing adequately.

Complex communication is the ability to not only elicit and transmit information but also convey a particular interpretation of information to others. Jobs in teaching, selling, managing, and negotiation require this set of skills. If a student downloads a calculus lesson from a teaching Web site, the student will have access to the information—but there is no guarantee that the student will understand it. It takes a good teacher to present the information in a way that helps students translate information into usable knowledge.

Complex communication is equally important in sales. Customers who know exactly what they want can order from a Web site without human interaction. But only subtle human contact can convince a reluctant customer to buy. Good salespeople are continually modifying their arguments as they read the customer's facial expression and listen to the customer's questions. Selling is difficult to express in rules, and so it

remains a human endeavor.

Figure 2 also illustrates the declining importance of routine manual work (such as manufacturing products on an assembly line) and routine cognitive work (such as filing and bookkeeping). These are the easiest types of tasks to computerize.

What Should Schools Focus On?

Although it is crucial for schools to help students gain expert thinking and complex communication skills, they should not stop teaching basic skills. People must have literacy and math skills to become expert thinkers in any field. And students can learn the skills needed to be good at complex communication and expert thinking as they study any subject area.

The challenge posed by a changing economy is not to teach *new* subjects, but to teach *all* subjects so that students develop complex understanding and communication skills. Young people will need these complex skills to succeed in additional education or training and in almost any job that pays a decent salary.

The following two student responses to a short oral quiz (Pellegrino, Chudowsky, & Glazer, 2001) demonstrate the role of critical thinking skills in student learning. They show the difference between memorizing a historical fact in isolation and connecting that knowledge to a deeper understanding of history. Only the second student has studied history in a way that fostered the ability to think critically and communicate clearly about historical realities.

Student 1:

Q. What was the date of the defeat of the Spanish Armada?

A. 1588.

Q. How do you know this?

A. It was one of the dates I memorized for the exam.

Q. Why is the event important?

A: I don't know.

Student 2:

Q. What was the date of the defeat of the Spanish Armada?

A. It must have been around 1590.

Q. How do you know this?

A. I know the English began to settle in Virginia just after 1600, although I'm not sure of the exact date. They wouldn't have dared start overseas explorations if Spain still had control of the seas. It would have taken a little while to get expeditions organized, so England must have gained naval supremacy somewhere in the late 1500s.

Q. Why is the event important?

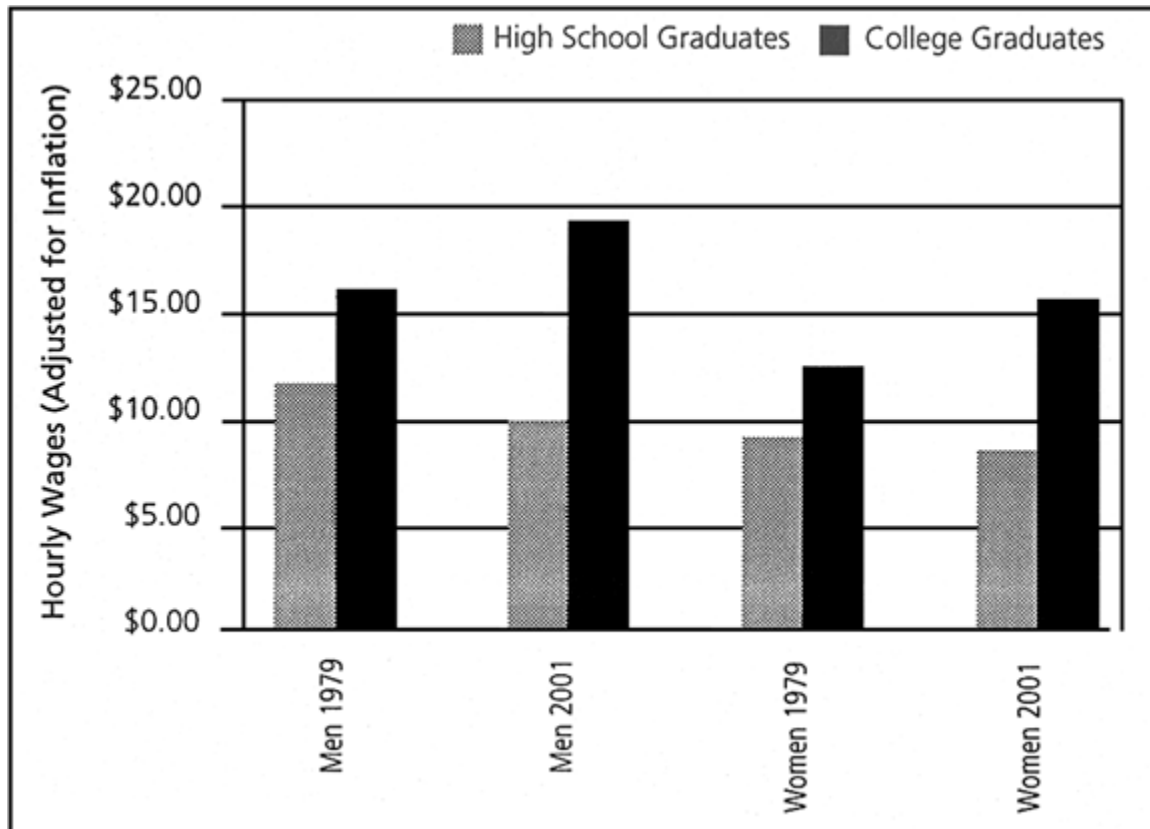
A. It marks a turning point in the relative importance of England and Spain as European powers and colonizers of the New World.

Will Better Education Affect Earnings?

The earnings gap between college-educated workers and high school graduates has increased markedly in recent decades (see fig. 3). Moreover, the earnings of high school graduates have declined. If U.S. schools prepare more students to succeed in postsecondary education, the college-high school earnings

gap will decline. But if a greater percentage of high school graduates do not enroll in and complete college, this gap will continue to grow.

Figure 3. Changes in Earnings Gap Between High School and College Graduates



Source: Author's calculations based on Current Population Surveys conducted by the U.S. Census Bureau.

The dramatic changes taking place in the U.S. economy jeopardize the economic future of students who leave high school without the problem-solving and communication skills essential to success in postsecondary education and in the growing number of high-paying jobs in the economy. To back away from education reforms that help all students master these skills is to give up on the commitment to equal opportunity for all.

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Computers Are Creating the Next Job Market (Princeton University Press, 2004).

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