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ABSTRACT

These seven papers offer a menu of alternative approaches to apprenticeships and suggests the advantages and disadvantages of each. "Apprenticeship Learning: Principles for Connecting Schools and Work Places" (James Rosenbaum) indicates how fundamental changes in the global economy virtually require improved education of all youth and why teachers and employers are increasingly concerned about preparing youth for work. Some youth apprenticeship models are described and used to infer the essential principles of effective apprenticeships. "School-Based Work Experience" (David Stern) identifies a continuum of work experiences and highlights characteristics of school-based programs that build on work experience. It discusses key components of co-op programs and career academies. "Learning at Work" (Stephen and Mary Hamilton) provides a theoretical basis for learning by doing work. It identifies components that underpin work-based learning and describes practices that make classrooms and workplaces more effective learning environments. "Apprenticeship as a Paradigm for Learning" (Sue Berryman) presents a model supported by the research on experience-based education, discusses characteristics of ideal learning environments, describes traditional and cognitive apprenticeships, and discusses some implementation issues. "Guidelines for Effective School-Employer Linkages for Apprenticeship" (Rosenbaum) examines pitfalls of school-employer relationships and considers examples from Germany and Japan that could make more effective linkages between schools and businesses in the United States. "Certification of Work Competencies" (Berryman, Rosenbaum) explores credentialling systems that could pose standards for attainment, help students get recognition for their accomplishments, and connect students to high-quality entry-level occupations. "Conclusions and Implications for Policy and Practice" (Rosenbaum) offers practical approaches to implementing findings and models. A "Commentary" (Richard Kazis) and author biographies are appended. (Contains 184 references.) (YLB)

Youth Apprenticeship in America:

Guidelines for Building an Effective System

Youth and America's Future: The William T. Grant Foundation Commission on Work, Family and Citizenship

"Too many of our young people are not moving from school to good jobs with a good future. Apprenticeship is an idea which has worked in other countries. We ought to try it here."

Governor Bill Clinton

"We will bring business, labor, and education leaders together to develop a national apprenticeship-style system that offers non-college bound students training in valuable skills, with the promise of good jobs when they graduate."

President-elect Bill Clinton, *Putting People First*

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YOUTH APPRENTICESHIP IN AMERICA: GUIDELINES FOR BUILDING AN EFFECTIVE SYSTEM

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PREFACE

YOUTH APPRENTICESHIP. TWO WORDS SUFFICIENT TO ENRAGE OR to energize! That the Bush Administration, President-elect Clinton, numerous Members of the Congress, and leaders in at least a dozen states think there is something fundamentally different and important about the concept is ample reason to occasion a collection of papers such as **Youth Apprenticeship in America: Guidelines for Building an Effective System.** Indeed, Mr. Clinton's oft-repeated pledge to bring together business, labor and education leaders "to develop a national apprenticeship system that offers non-college-bound students training in valuable skills, with the promise of good jobs when they graduate" lends this work both significance and urgency.

Assembled in this report are the sober reflections of seasoned academics who have explored both the alluring promises and the daunting problems of creating an effective school to employment transition system. What primarily motivates these authors—all contributors to leading-edge research on the subject and, in several cases, also personally involved in trying to implement youth apprenticeship on the ground—is not primarily concern over America's declining economic competitiveness or skill levels. Rather, all the authors are educators, pursuing the mission of helping young people and learners of all ages to acquire the knowledge, skills and values which will equip them for effective functioning in a world of unbelievably rapid and painful change. The authors are all "big-picture" analysts, attempting to relate a century of research in cognitive science, youth development and changes in employment and international trade to the enduring needs of our society for citizens who not only learn to earn but who also participate effectively as parents, neighbors and citizens in an often sorely-stressed democracy.

Those who will attempt to turn President-elect Clinton's vision of a National Youth Apprenticeship System into reality would be well advised to consider the wisdom—and the informed cautions—expressed by the authors in the pages which follow. While all the writers are agreed that the principles of youth apprenticeship represent authentic and powerful tools for effective learning, they differ sharply on critical matters of program design, location of learning and, indeed, whether a wholly new system of learning is required or whether we are better advised to adapt existing structures and programs to the pressing needs of our contemporary society and economy. In any case, all the authors concur that building an effective youth apprenticeship *system* requires not just new programs, but also major changes in the ways the education and employment systems relate to each other. The authors also indicate that simple cookbook approaches will not suffice—effective apprenticeships require thoughtful application of essential principles. Without clear understanding of these principles, educators, employers, and policy makers run the risk of merely renaming co-op programs without gaining the full potential of youth apprenticeships.

While policy makers and aides may be the most immediate users of this volume, educators—particularly those who teach future teachers and instructors, regardless of the setting—should devise substantial benefit from the authors' rich review of learning theory. Certainly, few readers will recognize much resemblance between their own prior educational experiences and the kinds of methods, contexts and contents suggested by recent research in learning.

Youth Apprenticeship in America: Guidelines for Building an Effective System is one of the final products of **Youth and America's Future: The William T. Grant Foundation Commission on Work, Family and Citizenship.** Since late 1986, the Commission, under the chairmanship of Harold Howe II, has sought to "explore the strengths of America's young men and women, their families, and the programs and community institutions that serve them. We adopt this approach not to diminish the importance of the problems that exist, but to learn the lessons of success."

Over 40 reports during the intervening six years have pointed the way to what is known about the pathways to success for America's youth and young families. Our concern has been not merely with "the forgotten half"—those young people who do not complete high school or undertake some measure of postsecondary education — but with *all* the nation's youth. In that regard, **Youth Apprenticeship in America: Guidelines for Building an Effective System** contains wisdom and counsel not just for the 75 percent of our fellow Americans who are unlikely to complete a four-year college degree but for all learners, no matter what institutional context they may choose for their further learning and self-development.

Thanks are due to the authors who made space in their very busy lives for this important public service, and particularly to Professor James Rosenbaum who, as general editor of this report, assembled his colleagues to complete the task at hand in a timely manner.

Samuel Halperin

William T. Grant Foundation
Commission on Youth and America's Future

I

APPRENTICESHIP LEARNING: PRINCIPLES FOR CONNECTING SCHOOLS AND WORKPLACES.

James E. Rosenbaum, ***Northwestern University***

EDUCATION REFORM IS ENTERING A NEW ERA. WHILE POLICY-makers have long known that schools poorly serve low-income children, there is a new realization that schools are ill-serving at least *half* our nation's population and the entire nation's productivity. Well-documented in the William T. Grant Foundation Commission report, *The Forgotten Half* (1988) is "an unmistakable pattern of under investment in the nation's youth, particularly those who do not choose college, and [who] make the transition directly from school to work." Yet, while "recognizing that on-the-job training and apprenticeship programs in Germany and Japan. . .have been powerful forces in their economic prosperity" (p. 99), the U.S. remains the only major industrial nation that lacks a formal system for helping youth make the transition from school to employment.

The Forgotten Half recommended "cooperative work strategies, experiential learning, and instruction that requires thinking skills" and an "expanded apprenticeship program based on experience from the U.S. and abroad" (pp. 131,101) and sparked a surge of interest in apprenticeships generally modeled after the German system. Youth apprenticeship programs have been created and are being planned in many states and communities (*William T. Grant Foundation Commission, States and Communities on the Move*, 1991). Legislation to support youth apprenticeship has been introduced in Congress by members of both major political parties. However, now that a consensus is developing that youth apprenticeship is worth trying, we need to take a closer look at what is presently working in the U.S., what is applicable from the models in other countries, and what should inform any serious effort to install new apprenticeship programs or incorporate goals into existing operations.

While Americans are pragmatic and find apprenticeship attractive for that reason, we can ill afford to repeat a familiar cycle of overblown hopes, hastily assembled programs, disappointing results, and ultimate abandonment of the effort. Rather, we must subject youth apprenticeship to careful scrutiny. Simply naming a program an "apprenticeship" does not guarantee that schools provide adequate academic skills to meet job demands, or that workplaces provide adequate skill training. Instead, if we are to accomplish the intended goals, we need to identify basic principles that are based on careful observation and evaluation of experiential education theory and practice. Such principles would help us develop guidelines for the planning and operation of apprenticeships and help us understand what conditions promote and what conditions impede the implementation and effectiveness of apprenticeships.

Moreover, enthusiasm about apprenticeship may prevent consideration of approaches that may achieve similar goals. Examining currently existing programs—ranging from school-related work experience to vocational high schools—serves as a stepping stone toward youth apprenticeship aims. Presently, about 8% of U.S. high school juniors and seniors (430,000 students) are in high school co-operative education programs, while only .06% (3,500 students) are in youth apprenticeship programs. (U.S. General Accounting Office, 1991). Because co-op programs can often be expanded or replicated more easily than new apprenticeship programs can be started, this may be a preferable option in some communities; in others, these programs may provide a solid foundation on which youth apprenticeship can be constructed. Infusing apprenticeship principles into existing education programs could

strengthen co-op programs, tech-prep programs, career magnets, career academies, and related programs and help the large number of youth who are now poorly served, improving the motivation and capability of large numbers of students and future employees.

WORKPLACE CHANGES DEMAND REFORMS[1]

In the past, the traditional systems of education and employment worked because products, production systems, and technologies rarely changed. With infrequent changes, the costs of planning and developing specialized equipment and processes for routine tasks can be recouped over the long period. A stable environment minimizes the number of non-routine problems that low-skilled, untrained workers are required to handle.

Firms in the United States rose to international prominence in the 20th century based on the mass production of standardized products (Piore and Sabel, 1984), but the benefits of this system have been bought at a cost. The system relies on inexpensive front-line production workers who need little training. Increasingly, it also requires more supervisors, managers, and support personnel when workers encounter unexpected difficulties and changes in procedures. Up to now, employers traded off low-skill levels for more detailed planning, close supervision, and managerial effort. But over the past decade, the production process has been gradually changing in ways that greatly increase the need for a more skilled workforce.

Three major changes have increased the costs of this system and work together to require changes in the way we prepare and train workers: increased competition from international markets; shortened product life cycles; and rapid innovations in production process, technology, and organizational procedures. These changes—along with just-in-time methods, statistical quality control, and teamwork methods—affect the technology or production process and increase the costs of the managerial effort needed to use low-skilled, routinized processes. Of course, managers can continue to compensate for a low-skilled workforce, but they have to make a much larger investment in designing work aids and helping unskilled workers handle a growing volume of unique problems.

Rather than the former low-skill, high-control system, the new economic environment encourages a flexible production system that depends on the positive contribution of the workforce. This alternative to mass production usually involves the integration of previously separated functional roles (such as design, engineering, marketing, quality control, and production), flatter organizational hierarchies, decentralization of responsibility, and greater employee involvement at all levels (Zuboff, 1988; Hayes et al, 1988; Dertouzos et al, 1989). Workers accustomed to narrowly defined jobs and skill requirements are asked to handle more varied responsibilities that necessitate broader skills. Echelons are eliminated and the decision-making, problem-solving, quality control, and goal-interpreting functions—once vested in layers of supervisors, middle managers, and technical specialists—are increasingly delegated to the shop floor, resulting in blurred differences between the conventional categories of higher and lower skill jobs. These alternative protocols produce a model that is more responsive, flexible, and conducive to continuous innovation, but it depends on substantially reduced supervision and workers with broader and, in many cases, higher levels of skill. Between 1975 and 1990, higher skill occupations have grown at almost two and one half times the rate of lower skill jobs. Higher skill occupations accounted for only 38 percent of total employment in 1990, but they grew by 65 percent in this fifteen-year period and represented 56 percent of the total net job growth in the economy. Meanwhile, less skilled occupations represented 44 percent of the total net job growth (Bailey, 1989; Berryman and Bailey, 1992).[2]

The Bureau of Labor Statistics projects that the trend toward higher skills—which characterized the last 15 years—will continue. Over the period 1990–2005, higher skill occupations are expected to grow nearly twice as fast as the lower skilled occupations. While less than the torrid growth rate of 2.5 times of the period from 1975–90, it builds on a larger base and means that higher skill occupations will provide an increasing share of the new jobs in the economy into the 21st century.

It is too early to tell whether the demand for higher workplace skills will remain restricted to certain industries or to companies with particular characteristics. As Bailey (1992) observes, market and competitive pressures vary by sector, and standardization and mass production continue to be possible and profitable in many sectors, such as food processing.

However, even jobs that have demanded few traditionally academic skills have become more complex in the current era. For instance, warehouse jobs, that once required only a strong back, now require the ability to work with computers to locate goods and to keep inventory. Similarly, jobs involving sales, transportation, and distribution are more complex in an era of "just-in-time delivery" regulated by computers and electronic scanners.

These changes force us to reconceptualize good work-bound education to encompass not only job skills but also advanced generic skills. The modern workplace requires both foundation skills (reading, writing, mathematics, listening, and speaking) and complex reasoning skills (skills for defining and solving problems, critical thinking, knowledge acquisition, and evaluating problem solutions; e.g., Stasz et al., 1990). According to the U.S.

Department of Labor Secretary's Commission on Achieving Necessary Skills (SCANS), generic workplace competencies involve the abilities to work with resources, people, information, systems, and technology. For example, "systems understanding" is needed because, under flexible organization of production, shop floor work teams are expected to handle non-routine production problems, often making decisions that involve suppliers and customers.

The changing workplace has real consequences for the preparation that all young people need to meet the altered demands. According to many reports, youth are ill-prepared for employment in current jobs, and they are even less prepared for the occupations that will open up over the next decade (Dertouzos, et al, 1989; Kirsch and Jungeblut, 1986). "While many low skill occupations will continue to employ many people [over the next decade], their skill requirements are expected to increase. . . . Skills increasingly needed to perform many jobs include the ability to connect practice and theory; identify problems; and then analyze, test, and trouble shoot" (U.S. General Accounting Office, 1990, p. 9).

Seeming to go against the grain, however, the U.S. institutional and legal environment continues to be unsupportive of organizational innovation. More decentralized work processes require stronger, more trusting, and longer-term relationships between employers and employees while corporate patterns in the 1980s of "out-sourcing," down-sizing, mergers, acquisitions, and bankruptcies have made employment far less secure in U.S. companies.

Yet, even considering that corporate policies are not adjusting as rapidly as they may need to, these substantial changes put pressure on employers to hire more highly trained employees. Given the low achievement levels of many workers, employers will have great difficulties satisfying this demand. Consequently, they have a vested interest in supporting broad education and employment readiness reforms.

WHO BENEFITS FROM REFORMS?

While widespread workplace changes seem to demand dramatic reforms, what circumstances promote reform—and who leads the way? Clearly, the poor education of much of "the forgotten half" is increasingly problematic for teachers and employers—although in many ways they are tied to education and job-training practices that have existed for a long time. Teachers and employers would not only benefit from such reforms—benefits ranging from job satisfaction to increased productivity—but should spearhead the effort toward change. (A more complete discussion of how employers and teachers can work together follows in Chapter 5.)

Some argue that teachers are complacent about current arrangements and do not care about educating the non-college bound. Indeed, this is a rationale for school voucher systems which are said to give teachers incentives to improve their teaching. Without arguing the benefits of voucher systems, the premise that teachers have no incentive to change is surely wrong. Teachers get blamed when students do not learn and they report feelings of professional inadequacy from these experiences. More urgently, teachers must cope with the poor discipline and apathy that result from students who see no reason to cooperate with classroom activities. Every day, teachers face absenteeism, class cutting, apathy, tardiness, disruptive behavior, verbal abuse, and occasionally physical violence. Most teachers are eager to find ways to motivate their students, but they often lack authority to accomplish this (see Chapter 5). They also need considerable training in experience-based education strategies in order to change the way they teach and the way their students actively engage in their own learning.

The inadequate preparation of the forgotten half also creates multiple problems for employers. Along with the far-reaching workplace changes described above, the youth cohort is projected to shrink by 25 percent from 1980 through the late 1990s. Combining this demographic change with the low skills of youth leads to a potentially serious problem for employers. This skills shortage has begun to affect business decisions. In recent years, employers report that in making relocation decisions, they have had to consider whether a proposed new site has a sufficiently educated workforce to handle their employment needs.

However, the issue is no longer whether employers are interested in helping educate their employees, or whether they will pay the costs. Employers are already spending sizable sums of money on education and training. Employers are increasingly involved in working with schools, as indicated by the many thousands of school-business partnerships that have been started. In particular, employers in several communities have made efforts to start youth apprenticeship programs, but they are often uncertain about *how* to set up such programs.

For example, a group of business executives who wanted to start an apprenticeship program knew exactly what needed to be done politically. The group persuaded the state governor to waive some state education regulations, persuaded the school boards and teachers to try the reform, and encouraged their current employees to support the reform in their workplaces. However, after overcoming these obstacles, the group had not considered alternative approaches to apprenticeships or possible problems they might encounter. "Let's do what the Germans are doing" seemed to be their guiding idea. They seemed to believe that apprenticeships would simply emerge once the bureaucratic and political obstacles were

removed, but they failed to consider practical concerns: which jobs students should have or how supervisors could help them learn.

This report offers teachers and employers a menu of alternative approaches to apprenticeships and suggests the advantages and disadvantages of each. Incorporating the principles of apprenticeship allows practitioners to ensure that their programs include the features necessary for successful outcomes, to anticipate some of the pitfalls and constraints they will face in applying European and Japanese apprenticeship models to the U.S., and to consider how their efforts can be integrated with current programs. Based on the demands of the changing workplace and the desire of teachers and employers to accommodate change, apprenticeship programs have strong merit for the preparation of workers. However, before adopting programs from other countries lock, stock, and barrel, a careful analysis of findings related to youth apprenticeship here and abroad is in order. From these findings, a set of core principles can be developed to guide experience-based education.

YOUTH APPRENTICESHIP FINDINGS

While the German model suggests promising directions for reform, simply transplanting that model to the U.S. is not feasible. German apprenticeship is a comprehensive institution based on a traditional and nearly universal approach to teaching that gives youth challenging real-life tasks under supervision of adult experts and requires mastery before youth can advance to adult work roles. The match with the U.S. is imperfect and complex because, in the American system, schooling has displaced formal apprenticeship. Apprenticeship in the skilled trades in the U.S. rarely serves youth under age 20 and uses worksites only as learning sites for specialized skills for a small number of young adults who have been out of high school for several years.

In contrast, German youth spend 1–2 days a week in school and the rest of the week at a job supervised by master workers. Apprenticeships last 2–4 years. By successfully completing and passing the official examinations, youth are certified as competent at an occupational skill. While some apprentices remain with the same employers, even those who leave still have a valued credential that helps them obtain employment, and practically all get jobs in their area of training (Hamilton, 1990). Unlike the American system, where youth spend their first 3–7 years after high school in aimless job turnover among dead-end jobs, German youth typically enter jobs entailing responsibility and training a few days after they finish their secondary schooling.

While most visions of American youth apprenticeships combine school with work experiences, few models specify what school curricula and teaching methods to use, what kinds of jobs to include, which individuals should oversee the instruction, what instructional roles they should perform, or how to prepare supervisors to fill those roles. Also unclear is how to get employers to provide enough employment positions and to invest enough time and effort in these programs. Most visions of apprenticeships call for school lessons to contribute to work experience, but do not explain how that should differ from what schools are now doing in vocational education programs. There are even disagreements about simple matters like the duration of such programs. Most apprenticeship advocates feel that co-op programs are too short because they last only 1–2 years. Yet, one version of a "Youth Apprenticeship Act" recently considered by the U.S. Congress, proposes 1–2 year apprenticeship programs.

Nor has there been much thought about how to incorporate apprenticeships into existing American arrangements. Apprenticeships are often started from the ground up, without any connections to existing vocational, co-op, tech-prep, or career magnet programs, and sometimes without thinking about how they relate to existing school curricula or work supervision. This approach to creating special programs ignores the possibility that existing programs influence the success of the new apprenticeship program. At the very least, ignoring these relationships creates missed opportunities for improving the effectiveness of the new program. Moreover, in some cases, the existing context provides a good foundation on which apprentice-type reforms can be built. Thousands of co-op programs that already exist across the U.S. represent the result of extensive efforts to connect schools with local employers. This is a valuable asset for working toward apprenticeship goals. If we can develop clear ideas about ways to improve co-op programs so they could incorporate the desirable elements of apprenticeships, then co-op programs could give reforms a running start toward their goals and allow them to accomplish far more with less effort and sacrifice.

In sum, Americans are eagerly touting apprenticeships without being entirely certain about what they mean, what the essential elements are that make them work, what the flaws are in present systems, or what the merits of other approaches are. While everyone likes the positive outcomes of German apprenticeships, we do not yet know what adjustments, commitments, or sacrifices are required in order to accomplish these outcomes in the U.S.

What we do know, however, can be summed up in these statements:

1. *Some kinds of apprenticeships yield better outcomes than others.* Not all apprenticeships are equally good, and some may not yield the desired outcomes. Employers

rarely have clear ideas about how to train youth, and some employer training programs rely on the same lecture format that good apprenticeship programs seek to avoid. What key features make apprenticeships and other school-work programs successful? This report will help employers and teachers know how to promote effective learning, how to interact with each other, and how to use these programs to motivate students.

2. *Apprenticeship requires strong commitment from employers and a capability to provide instruction.* As Stephen and Mary Agnes Hamilton describe in Chapter 3, employers must be willing to make a substantial investment and long-term commitment to training young people and must be able to assign adult workers as coaches and mentors and support them in their new roles. Conversely, teachers must understand the needs of the workplace and be willing to change their instructional methods to help work-bound students better prepare for the higher skills needed for apprenticeship and future employment. Chapter 5 discusses guidelines for establishing these linkages. By upgrading present programs to incorporate principles of apprenticeship learning, schools can increase their effectiveness. Such efforts can show strong benefits quickly and require less effort than starting new youth apprenticeship programs.

3. *Some practices that are easier to implement than work-based apprenticeships may accomplish many of the desired outcomes.* When schools and employers meet the conditions for apprenticeships, they may derive great benefits. Various other practices (some of which may already be partially in place) in schools and workplaces may achieve some of the same aims, and they may better fit the contemporary context of the U.S. Other programs, like co-op or academies, can proceed with less effort from employers and can involve larger numbers of students.

Of course, co-op programs (discussed at length in Chapter 2) do not often produce the same results or have the same benefits as full-blown apprenticeship programs. Co-op programs generally involve fewer hours a week over a shorter period of time (typically 1–2 years), so they are unable to have as great effects in skill development or socialization as full apprenticeships. Academies usually have strong academic effects, but they tend to have a shorter work-experience component than apprenticeships. Apprenticeship teaches a specifically defined set skills related to a particular occupation or occupational cluster over a period of 3–4 years, and it culminates in the award of portable credentials signifying mastery. Upgraded co-op or academy programs can move in this direction, but they are not of sufficient specialization or duration to accomplish the same outcomes. We do not wish to oversell these alternatives, nor do we wish to detract from other current efforts to create youth apprenticeship demonstrations (Jobs for the Future, 1991; Office of Work-Based Learning).

However, all these approaches have similar goals, and they all differ from traditional programs in stressing experience-based education. Moreover, in many cases, they offer a good foundation upon which reforms can build to accomplish the desired aims if we can craft from these findings a set of principles that guide program reform or development.

PRINCIPLES OF APPRENTICESHIP

A set of principles that characterize successful youth apprenticeship programs can be a valuable blueprint for starting new programs as well as reshaping existing programs. This report identifies the basic features of apprenticeships, the underlying principles that make them effective, and the way these principles can guide development of new programs or be incorporated into practices that now exist in the U.S. While apprenticeship is sometimes loosely considered as any system combining school and work, we propose five core principles essential for effective school-work programs, including apprenticeships:

- Programs should use work-based learning methods that build on school learning and are connected to schools.
- School-based programs should build upon work experiences.
- Experience-based teaching in classrooms should develop cognitive as well as practical skills.
- School-work linkages should reward school learning and effort with good jobs.
- Credentialling procedures should identify clear standards and certify attainment.

In subsequent chapters, we identify the rationale for these principles, examples that illustrate them, and procedures for accomplishing them.

These apprenticeship principles provide a conceptual framework for designing schools, classrooms, and work practices and the linkages and credentialling procedures for connecting them. Rather than a single type of institutional procedure in workplaces, apprenticeship learning can occur in any setting and take diverse forms, even in earlier schooling in K–12 classrooms. Recognizing the varied settings in which apprenticeship learning can take place permits us to utilize its benefits more fully in various existing programs, including those called apprenticeships and some that are not.

ORGANIZATION OF THE REPORT

The chapters of this report explain and offer examples of the core principles. This chapter indicated how funda-

mental changes in the global economy virtually require improved education of all youth and why teachers and employers are increasingly concerned about preparing youth for work. Having described some youth apprenticeship models, we used those to infer the essential principles of effective apprenticeships.

Chapter 2 identifies a continuum of work experiences and highlights characteristics of school-based programs that build on work experience. It discusses the key components of co-op programs and academies.

Chapter 3 provides a theoretical basis for learning by doing work. It identifies components that underpin work-based learning and describes practices that make classrooms and workplaces more effective learning environments.

Chapter 4 presents a paradigm of learning that is supported by the research on experience-based education, including apprenticeship programs. Used in some K–12 environments, this learning paradigm could be more widely replicated as an important precursor to those programs we presently identify as apprenticeships or school-based work experience. In addition, this chapter presents characteristics of ideal learning environments, describes some traditional and cognitive apprenticeships, and discusses some implementation issues.

Chapter 5 examines the pitfalls of school-employer relationships and considers examples from Germany and Japan that could make more effective linkages between American schools and businesses. This chapter supports a key principle: the promise of good jobs is a powerful incentive for stronger school performance.

Chapter 6 explores credentialling systems that could pose standards for attainment, help students get recognition for their accomplishments, and connect students to high-quality entry level occupations.

Chapter 7 summarizes our conclusions and offers some practical approaches to implementing these findings and models.

Creating the strong institutional commitments between schools and employers required for apprenticeships will take much time and effort. Our aim is to provide the most current theoretical and practical information and to consider options available to schools, communities, and employers ready to tackle the complicated process of creating and investing in youth apprenticeships. Meanwhile, communities that are not fully ready to build those institutional connections may use this report to begin making reforms inside schools or reforms with less extensive commitments between schools and employers. Such efforts, while not full-blown apprenticeships, may have immediate benefits and point the way to more comprehensive reforms at a later date.

Notes

1. The following section was written by Sue Berryman and relies on material from Berryman and Bailey (1992).

2. Bailey (1989) defines higher skill occupations (executive, administrative, and managerial; professional specialty; technician and related support; and sales and marketing) as ones whose average educational levels, measured by the share of the workers in the occupation with at least some college, are above the average for the economy as a whole. Lower skill occupations are the residual, consisting of administrative support; service; precision production, craft, and repair; agriculture, forestry, and fishery; and operator, fabricator, and laborer occupations.

II

SCHOOL-BASED WORK EXPERIENCE

David Stern, ***University of California-Berkeley***

MOST HIGH SCHOOL STUDENTS IN THE U.S. HOLD A PAID JOB AT some time during the school year. Questions have been raised about the benefits of working in the kinds of jobs that are usually available to high school students. Most notably, Greenberger and Steinberg (1986) have described students' jobs as largely repetitive and unchallenging, offering students little contact with adult coworkers. In their sample from Orange County, California, Greenberger and Steinberg discovered that students who work report more stress, use more drugs, and become more cynical about work itself.

Educators worry that working may interfere with school. A National Teacher of the Year went so far as to decry the trend toward more students working as "a cancer that's eating up excellence, and it's ruining our children." (Mihalik, 1989). Greenberger and Steinberg found that students who work longer hours spent slightly less time on homework and received slightly lower grades. Similarly, Mortimer and Finch (1986) found that boys who spent more time working while in high school had lower grades, lower estimates of their academic abilities, lower educational and occupational aspirations, and had completed less additional schooling in the first five years after high school. D'Amico (1984) also found some negative correlations of work experience with study time and high school completion, though only for students who worked more than 20 hours a week.*

Such evidence does not prove that working undermines commitment to school; it is quite possible that the students who work, or who work longer hours, do so because they are already disenchanted with school, but there is nevertheless ground for concern. (A more complete review of research on the effects of students' work experience is in Stern et al, 1990.)

*See research notes by Ivan Charner and Bryna Shore Fraser at the conclusion of this chapter and references on page 88.

Accordingly, some states and school districts have recently tightened restrictions on students' working hours (Graves, 1992). But legal restrictions on students' work are not likely to have much effect because the public agencies charged with enforcing them do not have sufficient resources to monitor more than a small fraction of the workplaces where students are employed.

Instead of spending additional resources in an attempt to limit students' work hours, a more productive policy would commit those resources to enhancing the educational value of students' work experience both in and out of school settings. If more students had experience-based classroom work or could use their jobs explicitly to apply and extend what they are learning in school, they might see a stronger connection between school and work. If students' jobs demonstrated the relevance of knowledge and skill acquired in school, then work might reinforce commitment to school rather than undermining it. How to build this kind of connection between school and students' jobs, identified as a core principle of apprenticeship programs, is the main focus of this chapter.

THE RANGE OF SETTINGS WHERE STUDENTS WORK

Paid jobs outside of school are not the only settings in which it is possible to demonstrate the practical relevance of school-taught skills and knowledge. In other settings, students perform useful work—producing goods or services for sale or use to people other than themselves. To indicate the range of possibilities, this section describes the various settings where students work.

These settings can be placed on a continuum. On one end are jobs that are completely unconnected to school (non-school, unsupervised work) and on the other are work-like experiences that are completely contained

within the school (school-supervised, school-based work). The following section maps the variety of situations in which students work.

Naturally occurring, paid, unsupervised jobs. This is the most common kind of work experience for students. "Naturally occurring" means that the jobs exist because private or public employers want certain work to be done, not because they are trying to create employment opportunities for young people or anyone else. "Unsupervised" means that students find these jobs without help from the school or other public agency and that the school or other public agency has no involvement other than issuing work permits for students younger than age 18. Lewis et al (1983), analyzing part of the NLS Youth sample, found that 89 percent of all paid jobs held during the school year by male high school students, and 84 percent of those held by females, were of this naturally occurring, unsupervised kind.

Unpaid work in families and family enterprises. This is the most frequent kind of work in a preindustrial economy, where most work is in agriculture and crafts, and much production is controlled by families (Stern et al, 1975). Some products may be sold for money, but individual family members do not receive a regular wage or salary. Vestiges of this system survive in rural regions of industrialized countries, where children's work at home may produce something for sale or use by the family, but the children are not paid a regular wage. "Mom-and-pop" retail or other enterprises may also employ children on the same basis. Even in affluent urban and suburban neighborhoods, children are still called upon to clean their rooms and perform other household chores that have real economic value (someone hired to do it would have to be paid), but for which the children do not necessarily receive any money.

Synthetic, paid jobs. Various public programs have created jobs for school-age youth. These have been synthetic jobs, invented for the express purpose of providing employment. One large federal program of this kind was the Neighborhood Youth Corps, which has continued under CETA and JTPA as the Summer Youth Employment Program. Synthetic jobs during the school year were offered to young people under parts of CETA and then YEDPA (YETP, YACC and YCCIP; see Taggart, 1981). In the 1980s, as federal money for this purpose became more scarce, several states and localities started "conservation corps" or "service corps" programs that offered synthetic jobs to young people. One purpose of all these programs has been to put money into young people's pockets. Other objectives include getting useful work done and developing participants' knowledge, skills and prosocial values. Schools have, for the most part, been involved only peripherally, if at all, in these programs.

Naturally occurring, paid jobs that are supervised by a school or other training agency. One traditional program in this category is cooperative education, or "co-op." This takes various forms in secondary and post-secondary schools, as described below. One distinct form of co-op is connected with vocational education in a particular occupation. In this type of program, the instructor also acts as a work experience coordinator, arranging and supervising placements in jobs where students can practice and extend what they learn in the vocational class. The teacher-coordinator collaborates with the student's supervisor at the work site in writing a training plan for the student and evaluating the student's performance. Students receive school credit for their work experience. This is the traditional practice in cooperative vocational education. Later in this chapter I present some evidence on how co-op students perceive their jobs.

Schools also sponsor other versions of work experience programs for students in naturally occurring jobs. There is a "diversified" form of cooperative vocational education, in which students from different occupational specialties are all supervised by the same teacher-coordinator. Many students also participate in work-study or work-release programs, where their jobs do not necessarily relate to anything else they are doing in school. In work-study or work-release programs, school supervision is less intense than in the traditional model of cooperative vocational education: there may not be a written training plan, the work experience coordinator may not teach any of the students in their regular classes, and the job site supervisor may have no say in evaluating students. Still, students may receive course credit for their work or for some kind of related instruction.

Another kind of school-supervised work experience in naturally occurring jobs has been created by federal employment training efforts under MDTA, CETA, YEDPA, and JTPA. (For analysis of these programs, see Taggart, 1981; Hahn and Lerman, 1985.) Some of these have subsidized employers to make naturally occurring jobs available to students who belong to groups with high rates of unemployment. A notable program of this kind was YIEPP (Youth Incentive Entitlement Pilot Project), which made jobs available to students only on condition that they stayed in high school until graduation. (For analysis and evaluation of YIEPP, see Farkas et al., 1984.)

Unpaid experience in real work settings. Schools have been extensively involved in finding unpaid roles for students in naturally occurring work settings. A major federal initiative in the 1970s was Career Education, one form of which was Experience-Based Career Education (EBCE). This program placed students in a succession of unpaid, participant-observer positions with various employers. Related classes were designed to help stu-

dents extract the educational benefit of these experiences. EBCE is discussed in the next section.

Like paid work experience, unpaid work experience may be related or unrelated to subjects a student is taking in school. Some vocational programs use unpaid job placements—much like paid co-op jobs—to give students a chance to practice what they are learning in school. Meanwhile, other school districts, including Atlanta and Detroit, have required high school students to spend time performing service to the community. In practice, this often means an unpaid job placement in a public or nonprofit agency. The purpose is for students to learn to accept their responsibility as citizens, and the work is not necessarily intended to connect directly with a student's regular classes.

Apprenticeship. Like cooperative education, apprenticeship combines paid work with classroom instruction. But apprenticeships are sponsored by employers or labor/management groups, seldom by schools. They also last longer than most cooperative education experiences, and they result in formal certification as a skilled worker.

As organized in the U.S., apprenticeship serves few high school students or recent graduates. Less than two percent of U.S. high school graduates enter apprenticeships (Glover, 1988), compared with approximately 70 percent in Germany (Raddatz, 1989). The average age of apprentices in the U.S. is 27, significantly higher than the German average. At least 75% of all U.S. apprentices are preparing to be skilled craftworkers either in the unionized construction industry or in large-scale manufacturing (Glover, 1988).

Currently there is much interest in making some kind of apprenticeship available to more young people (Hamilton, 1990; William T. Grant Foundation Commission, 1991). The Council of Chief State School Officers has made grants of $50,000 to each of five states (California, Maine, Minnesota, West Virginia, and Wisconsin) for implementation of youth apprenticeship programs. Arkansas, Oregon, and Pennsylvania have started pilot programs on their own. The Council of Great Lakes Governors is coordinating efforts in eight midwestern states. Jobs for the Future, a nonprofit group in Cambridge, Massachusetts, is conducting demonstrations and providing technical support for new apprenticeship-like programs. The U.S. Department of Labor, through its Office of Work-Based Learning, is also supporting demonstrations.

Jobs for the Future (1991) has defined youth apprenticeship as combining, at a minimum, three basic elements:

1. Work experience and guided learning opportunities provided for participants by employers within an industry or occupational cluster;
2. A structured linkage between secondary and post-secondary components of the program, leading to high school diploma, post-secondary credential, and certification of occupational skills; and
3. Close integration of academic and vocational learning and of school and workplace experiences through planning and ongoing collaboration between schools, employers, relevant unions, and other key institutions and through innovations in curriculum and instructional strategies in the classroom and at work.

These elements are further elaborated in a list of 48 specific features of youth apprenticeship programs, among which some of the most important are:

- Program duration of at least two years, including at least one year of secondary and one year of post-secondary education.
- Part-time employment during the school year with employer committed to providing guided learning experiences at the workplace.
- Structured summer component integrating school-based learning and paid work experience.
- Employers provide each participant with a structured mentoring relationship with an employee of the firm or organization.
- Schools impart academic and work-related skills and knowledge (such as problem-posing, problem-solving, and critical thinking) general enough to be transferable to a broad range of work and life situations.
- Post-secondary institutions offer pre-admission or special consideration to participants who successfully complete the first two years of the program and earn their high school diploma.
- Award of credential of occupational skills achievement recognized at least within the state.
- Ability to continue post-secondary learning in a four-year college program.

Unpaid experience in synthetic jobs designed to develop productive capabilities. Many schools sponsor enterprises in which students learn by producing goods or services that have immediate value or use to people other than themselves. In high schools, these activities are often part of vocational classes. Typical activities of such vocational enterprises are running a restaurant, building a house, or operating a child care center. In Maryland, the Montgomery County Schools have created two nonprofit foundations. One engages students in building and selling a house (or two) every year. The other operates two auto dealerships in which students recondition and sell damaged cars. There is evidence from two student-run restaurants in California that school-based enterprises can provide work of higher quality, offering more opportunities for learning than the jobs students find on their own outside of school (Stern, 1984).

In addition to enterprises attached to vocational programs, many extracurricular or co-curricular activities involve students in doing something that is both productive and educational. Junior Achievement, school newspapers and yearbooks, performing arts, spectator sports, and service societies all fit in this category. One set of extracurricular clubs that emphasizes productive activities is the vocational student organization. Clubs of this type include: the Future Farmers of America (FFA), with approximately 400,000 members; Vocational and Industrial Clubs of America (VICA), with 270,000 members; Future Business Leaders of America (FBLA), claiming 225,000 members; Distributive Education Clubs of America (DECA), with about 170,000 members; and several others. DECA has run Learn and Earn Projects, in which local chapters organize and operate small retail enterprises, and compete for national awards. FFA sponsors a program called Building Our American Communities, which engages students in such activities as renovating historical structures and establishing a farm museum.

Within agricultural education, there is a tradition of assigning students to conduct productive activities at home (Rosenfeld, 1984). The purpose was to help establish students in farming by building up a set of ongoing farm enterprises. This approach applies to fewer students now, but it is still used.

Simulations not producing goods or services. Finally, at the end of the continuum opposite from paid, unsupervised, naturally occurring jobs are simulations of work that take place in school, are not paid, and are evaluated only as learning experiences. For example, students may engage in a model office, store, or shop, in which they perform some of the same tasks required by naturally occurring jobs, but there are no customers or clients who use or buy the resulting output. Simulations have the obvious disadvantage of not being real transactions, but they have other advantages, including the possibility of designing tasks to maximize what students learn. For a description of some work simulations in schools, see Jamieson et al (1988). Despite the educational potential of simulations, we will not discuss these because our focus is the educational use of work that does produce goods or services for sale to, or use by, people other than the students themselves.

EXPERIENCE-BASED CAREER EDUCATION: UNPAID, SCHOOL-SUPERVISED EXPLORATION

Experienced-based Career Education (EBCE) was a good example of an educational program that was based on unpaid experience in naturally occurring jobs. In 1971, the U.S. Office of Education awarded contracts to four regional education laboratories to develop EBCE models. EBCE programs were an attempt to provide students with learning opportunities that were individualized, action-oriented, and located in community settings. In addition, they were intended to promote cooperation between public education and manpower agencies and to broaden occupational opportunities for youth.

EBCE programs emphasized student self-development and career awareness developed in conjunction with enhancement of basic skills (reading, writing, oral communication, and communication skills) and life skills (interpersonal relations, problem solving, and decision making). Individualized learning plans constituted the major vehicle for focusing and realizing student achievement. They usually encompassed both specific experiences with employers and learning objectives in academic areas.

As conceived, these models entail students, staff, and community playing active, complementary roles. The Far West Model placed its main emphasis on the development and execution of the students' individualized plans. Research For Better Schools and Appalachia Educational Lab emphasized in-school career experiences and academic instruction coupled with community-based exploration. School credit was usually assigned as a result of a student product review, as a rating of student interest and effort, or as a mixture of Carnegie units for coursework and on-site experience completed. Most projects were staffed by a resource analyst who determined resources needed for students and identified learning activities at the site, teacher coordinators or learning managers who defined career interests and monitored progress, a director, and support staff.

Evaluations of 17 programs were published through the Education Resources Information Clearinghouse. These were conducted by a variety of agencies including the Educational Testing Service and Appalachia Educational Lab (Owens, 1982). Results of these evaluations found EBCE programs increased students' confidence in approaching career decision making. Attitudes towards career counseling services and various aspects of the learning environment were also found to be enhanced. Students' achievement in math and reading stayed even with comparison groups, and there was some evidence that oral communication was improved. Improved communication was thought to be the result of increased opportunities to deal with a variety of adults—in large part through talking to them, rather than reading or writing. Students demonstrated increased responsibility and the development of realistic job expectations.

EBCE programs developed a considerable inventory of curriculum materials. These might still be used in other programs to link schooling with experience at work sites.

COOPERATIVE EDUCATION (CO-OP): SCHOOL-SUPERVISED EXPERIENCE IN PAID JOBS

Since co-op programs no longer receive any special categorical funding, neither the federal government nor most of the states keep an accurate count of how many students are participating in co-op. The U.S. General Accounting Office surveyed state directors of vocational education, who estimated that approximately 430,000 high school students nationwide were enrolled in co-op programs during the 1989–90 school year. Most co-op students are juniors and seniors, of whom about eight percent are estimated to participate. Jobs most commonly held by co-op students are in retail sales, secretarial work, auto repair, and construction. (U.S. General Accounting Office, 1991)

Differences between co-op and non-co-op work experience.

Recent research has compared high school students in cooperative vocational education (Stone et al, 1990) and cooperative education students in two-year colleges (Stern et al, forthcoming) with other students at the same schools who were also employed but not in school-supervised jobs. Results in both high school and two-year college indicate that students in cooperative education are more likely than the other employed students to:

- Say their jobs make use of what they have learned in school.
- Say what they learn on the job is useful in school.
- See their current jobs as closely related to their desired careers.
- Say their jobs provide abundant opportunities for learning.
- Feel their jobs are intrinsically interesting and worthwhile.

In short, compared to other working students, co-op students more clearly see their jobs as part of their education.

Differences in perceptions of work between high school co-op students and their schoolmates in non-school-supervised jobs persist even when other student characteristics are statistically controlled. Controlling for grade level, gender, parents' education, reported grade point average, and expectations for further education, co-op students report more:

- Use of reading and writing on the job
- Use of other school-taught knowledge and skill
- Opportunities to learn new things
- Interest and motivation to do the job
- Use in school of what they learn at work

In fact, participation in co-op was a more consistently significant predictor of these reported job characteristics than any of the other variables (Stern et al, 1991).

Elements of co-op program structure

Rather than undermining commitment to school, cooperative education provides a structure in which work and school become mutually reinforcing. Elements of that structure have evolved through practice over several decades (National Child Labor Committee, 1984; Leske and Persico, 1984; U.S. General Accounting Office, 1991). Among these elements are:

(1) A written *training agreement* between the school and each employer sets forth the expectations for each party. The employer will provide a job with opportunities to learn. The school will monitor students' performance.

(2) A written *training plan* for each student is at the heart of the co-op program. It specifies what the student is expected to learn on the job. Learning objectives may be linked to vocational or academic courses. The plan also specifies who will judge whether the student has achieved the stated objectives. It is usually signed by the student, the job supervisor, the co-op coordinator, and sometimes by a parent.

(3) The co-op *coordinator* may be the teacher in a related class (e.g., business or marketing) with responsibility for supervising students only in that field. Alternatively, in a diversified co-op program the coordinator supervises students from several fields. The coordinator may also have special training and certification as a co-op specialist. The coordinator's responsibilities include:

- Finding suitable job placements. Some programs provide summer salary for coordinators to come back early for this purpose. In well established programs, employers initiate placements by calling the school and requesting a co-op student. It is considered desirable for the coordinator to visit the worksite before placing a student there in order to ensure that the employer understands the responsibility entailed in hiring a co-op student. The training agreement embodies this understanding.
- Identifying suitable students for each placement. It is considered advisable to refer more than one student for the employer to interview. This gives students practice in job interviews and gives the employer some choice.
- Negotiating training plans for all students.
- Monitoring students on the job. Coordinators must have released time during the day for this

purpose. By visiting the job site, the coordinator can ensure that both the student and the job supervisor are satisfied with the way things are going. If there are problems, the coordinator can try to mediate or, if that fails, can remove the student from the job. At the end of the student's placement, the coordinator is responsible, usually in collaboration with the job supervisor, for evaluating students' performance according to their training plans.

- Offering related instruction. If the co-op program is offered in conjunction with a regular class, the coordinator would normally be the teacher in that class, which would naturally deal with issues from students' jobs. In a diversified program, there may be a special class for co-op students, which would deal with more generic issues about work.

It is evident from this description that co-op programs require resources. Some of these are provided by the school: for example, released time for co-op coordinators to visit job sites, or summer salary to develop job placements. Other resources must come from the employer: in particular, the time spent by job supervisors to provide guidance and instruction to students.

CAREER ACADEMIES: INTEGRATED CURRICULUM AND EXPERIENCE

Since co-op programs in high schools are often connected to vocational classes, they sometimes suffer from the reputation of high school vocational education as a second-class program (U.S. General Accounting Office, 1991). Vocational education in U.S. high schools has had an image problem since the early part of this century when it became established as a separate track, set apart from the college preparatory program. Over the objections of John Dewey and others, the 1917 Smith-Hughes Act (which first provided federal money for vocational education) defined vocational programs as preparation for occupations not ordinarily requiring a bachelor's or advanced degree. Accordingly, students aspiring to the more highly paid and prestigious jobs for which college degrees are required have avoided vocational education (although in some schools with strong vocational programs, vocational classes may attract stronger students than the general track). The unintended result has been to institutionalize a dichotomy between theory and practice, rigor versus relevance. College-bound students have been deprived of opportunities to apply academic subjects in practical contexts while many vocational students have been denied sufficient academic preparation for upward mobility in the workplace.

For these and other reasons, Congress in 1990 made a 90-degree turn on vocational education, maintaining it as a separate categorical program, but now requiring that federal money be spent on programs that integrate academic and vocational education. This might be done in various ways: using new curricula that teach academic subjects through practical applications, beefing up the academic content of vocational classes, offering tech-prep programs that coordinate the last two years of high school with two years of college in a technical field, or organizing the entire high school curriculum around a career theme (Grubb et al, 1990).

This last approach is exemplified by career "academies." These started in Philadelphia in the late 1960s, spread to California and New York in the early 1980s, and now exist in most states (Stern et al, 1992).

A career academy is a school-within-a-school, where a team of teachers offers a career-related academic curriculum to students in grades 10–12 or sometimes grades 9–12. Evaluations have found these programs effective in retaining potential dropouts and at the same time preparing students for college. They keep the college option open by offering a complete curriculum that includes college prerequisites while they organize the curriculum around a theme such as health careers, electronics, finance, or computer-related occupations. Each of these themes encompasses a set of jobs ranging from those that require no post-secondary schooling to those that require advanced degrees. Students graduating from a career academy can seek full-time work related to their high school program or they can go to college for further study, which may or may not be related to the same theme.

In addition to offering an integrated academic/vocational curriculum, most career academies also give students the opportunity for paid employment in their field of study. This usually starts during the summer after junior year and may continue part-time through senior year. In the context of a career academy, work experience can be especially powerful in demonstrating the practical use of school learning—not only what is learned in vocational classes, but also in academic subjects.

STUDENTS' PERCEIVED CONNECTION BETWEEN SCHOOL AND WORK IN CO-OP PROGRAMS AND CAREER ACADEMIES

Evidence on the relatedness of school and work comes from four career academies in Oakland, California. In the summer of 1991 questionnaires were given to academy students who had been placed in summer jobs (Rubin et

Table 1. Relatedness of work experience to school, as reported by Oakland Academy and other high school students in school-supervised work experience (SSWE) and non-school-supervised work experience (NSWE) jobs.

	OAKLAND (n=72)	SSWE (n=362)	NSWE (n=600)
"My job gives me a chance to practice what I learned in school." (% "very true")	38	24	6
"What I have learned in school helps me do better on my job." (% "strongly agree")	39	12	3
"My job provides information about things I am studying in school." (% "strongly agree")	28	10	3
"School makes me realize how important it is to learn to do things well on my job." (% "strongly agree")	49	13	7
"My job has made me realize how important it is to learn and do well in school." (% "strongly agree")	48	23*	16*
"Do you use reading on this job?" (% "yes")	86	59	36
"Do you use math on this job?" (% "yes")	45	70	58
"Do you use writing on this job?" (% "yes")	86	73	48

*Question read, "My job has taught me the importance of getting a good education."

al, 1992). Thirty-two questionnaires were completed by students from the Health Academy, 29 from the Media Academy, seven from the Business Academy, and four from Pre-Engineering. Table 1 shows some of the responses. (This table and surrounding discussion are from Stern et al, 1992.) For purposes of comparison, Table 1 also shows responses from high school students in other parts of the country in the fall of 1988 and 1989 (Stone et al, 1990). The comparison study included students who were employed in school-supervised work experience (SSWE) programs (mainly cooperative vocational education) and students at the same schools who were employed in non-school-supervised work experience (NSWE).

Table 1 shows that Oakland Academy students report a stronger perception that their jobs are related to what they do in school compared to other students. The only exception is in use of math on the job. Among the students from other parts of the country, SSWE participants report a stronger relationship between school and work than their schoolmates who were employed in NSWE. On five of the seven questions where Oakland Academy students' percentages are highest, the difference between the Oakland students and SSWE students elsewhere is bigger than the difference between SSWE and NSWE students. Compared to other working students, Oakland Academy students report that they make more use on the job of what they learn in school, except math. More of the Academy students also report that their job informs and motivates their work in school.

These differences occur in spite of the fact that other questions—which asked about involvement of teachers or other school staff members in visiting the job, writing a training plan, and evaluating students performance on the job—indicated less direct school supervision of students' work experience in the Oakland Academies than in the SSWE programs elsewhere. Apparently, Oakland Academy students see a strong connection between school and their summer work experience, even though their summer jobs were not closely monitored by school staff.

The focused Academy curriculum, complemented by direct contacts with employers in the field before they actually apply for a paid job, evidently prepares Oakland Academy students to see their summer jobs as a direct extension and application of what they do in high school. For these students there is no longer such a sharp boundary between school and work.

SCHOOL-BASED ENTERPRISE: AN ALTERNATIVE TO OUTSIDE JOBS

Cooperative education and career academies demonstrate that experience in paid, naturally occurring jobs can be linked to students' schoolwork. However, in some communities it may be difficult or impossible to find enough high-quality job placements and, in all communi-

ties, the availability of placements fluctuates with the business cycle. School-based enterprises (SBEs), unpaid experience in synthetic jobs designed to develop productive capabilities, are an alternative source of work experience for students, which are controlled by the school itself. Because the school does control them, SBEs can be designed to provide more opportunities for learning than most outside jobs. Job rotation, cross-training, teamwork, and learning from mistakes are easier to arrange in SBEs than in profit-seeking firms. The price of these advantages is that SBEs usually do not pay wages.

Most existing SBEs have been attached to the high school's vocational program. Students in construction trades build houses, food service students run restaurants, child care students operate centers, marketing students manage school stores, students in automotive classes repair cars, and so on. Although the SBE provides a real context for learning, the scope of learning is circumscribed by the limited purpose of the vocational course.

It is possible to broaden the scope of SBEs by attaching them to integrated academic/vocational programs such as career academies. The Foxfire project has already demonstrated how a productive application—publishing books and magazines—can make an English class into something much more powerful for students (Wigginton, 1986). Foxfire has engaged students in documenting and preserving the folklore and culture of their rural region. Students have published their stories and pictures in a magazine and books for the mass market. Offshoots of this move toward experience-based education provide a powerful idea of the possibilities. One can only imagine what students might achieve if a school enterprise were sponsored not just by a single academic or vocational class, but by an integrated academic/vocational program. For example, a career academy or other integrated program in electronics could sponsor an enterprise where students repaired VCRs and personal computers. A house-building SBE could be part of a program where math, history, literature, and other academic subjects were all related to analyzing the built environment. A program where all the courses were related to health careers and health issues could run a screening clinic that performed simple tests such as blood pressure and vision screening. A child care center could be a useful adjunct to a program that organized a whole curriculum around human development. Such configurations not only would blend academic and vocational coursework, but also would combine theory with problem-solving in the context of actual production.

The possible advantages of work experience related to the content of schoolwork should not limited to students who are not planning to attend college right after high school. All students, including those who are college-bound, can benefit intellectually from applying theoretical subject matter to problem-solving in a practical context (Brown et al, 1989; Resnick 1987a, 1987b; Raizen, 1989; Lave and Wenger, 1991). There may also be a practical benefit for college-bound students: since most of them will hold paid jobs while in college, work experience during high school can help them materially if it enables them to earn a higher hourly wage. Furthermore, keeping high school work experience programs open to all students, including the college-bound, avoids the risk of such programs being viewed as second-rate. First-rate work experience, whether through paid or unpaid placements in jobs outside the school or in school-based enterprises, should be an option for all students.

Publisher's Note—*Regarding Professor David Stern's concerns about students' after-school paid employment, I append these comments by Ivan Charner and Bryna Shore Fraser of the National Institute on Work and Learning, Academy for Educational Development:*

It is a recurrent cause for concern that most American young people work in naturally occurring jobs that they find on their own while in high school (56 percent in 11th grade and 66 percent in 12th grade). Many continue in these jobs after high school, generally in retail, food service, clerical and unskilled manual work.

In our 1987 comprehensive review of what was known and not known about the impact of teenagers working, we concluded that,

> With regard to the effect of working on grades, the findings are mixed. There seems to be a curvilinear relationship between hours worked and grades, with 20 hours the "magical" cut-off for when a negative effect emerges. (Charner and Fraser, 1987:53)

Four studies conducted since that earlier review (Barton, 1989; Lillydahl, 1990; Yasuda, 1990; Steinberg and Dornbush, 1991) confirm this earlier conclusion, with the possible exception of a lower cut-off. The consensus suggests that for up to about 15 hours worked there appears to be a *positive* relation between number of hours worked and grade point averge, while above 15 hours the relationship is negative.

With regard to other areas of impact, our 1987 review found general agreement that working while in high school:

- generally promotes desirable work habits and world of work knowledge;
- has little impact on days tardy or absent, or number of extra curricular activities;
- has some impact on time spent on homework and watching television for those who work more than 20 hours per week;
- has little effect on educational plans. Students who work more than 20 hours per week, however, had lower educational aspirations;

- is positively associated with employment and income after completion of high school in the short range;
- is not related to delinquent behavior, with findings inconclusive and contradictory;
- generally is approved of by parents and friends;
- generally does not affect relationships with parents and siblings, albeit they do spend less time with their families;

Despite the findings cited above, studies of youth employment suggest that while young people gain some skills from the jobs they hold while in high school and after graduation, these jobs are generally not tied to academic learning or to school programs, nor are they linked to any career path. Many of these working students lack a sense of career direction and see work as successive short-term jobs, not in terms of careers. These naturally occurring jobs that could have enormous potential for education-work experience—with advantages to both students and employers—are largely being wasted, because there is little connection to what goes on in school.

Until more complete, longitudinal data are available, the debate over the effects of young people working while in school will continue. What is clear is that, whatever the effects, educators and employers must create mechanisms for jointly promoting the long-term economic benefits of education while encouraging productive, developmentally appropriate work by young people. Further, we agree with Stern's view about enhancing the educational value of students' work experience, with the added statement: If students' classroom work utilized and extended the knowledge and skills developed in jobs, then education and work might reinforce one another to the great benefit of the student.

LEARNING AT WORK

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THE PROMISE OF WORK-BASED LEARNING

The educational demands of employers in contemporary high performance work organizations—characterized in the previous chapter as cognitive work environments—are remarkably consistent with the traditional goals of liberal education. Both emphasize a general education that depends upon basic literacy and mathematical competence and also include skills in written and oral communication, problem solving ability, teamwork, and the capacity to continue learning. Mortimer Adler captured the convergence neatly with his aphorism, "The best education for the best is the best education for all" (1982).

Emphasis on the universality of educational goals and standards builds on the healthy assumption behind *A Nation at Risk* (1983) that nearly all young people are capable of achieving high standards. It also disposes of the traditional distinction between education and vocational training. If employers really do need workers without four-year college degrees who can work cooperatively, solve problems, and continue learning throughout their careers, then the best vocational training is a liberal education!

However, both Adler and the National Commission on Excellence in Education leaped from that happy conclusion to a non sequitur, namely, the assumption that everyone, whether headed for corporate management, laboratory research, warehouse materials handling, or shop floor production, should acquire their education in the *same* manner. Identical ends are not necessarily achieved by identical means. While some students thrive on school-based instruction, many more find it boring and meaningless because so much of what happens in schools violates the criteria learning environments described in the next chapter. *The only way for every young person to achieve the best possible education is to provide multiple educational paths.*

High quality apprenticeships epitomize work-based learning. Ironically, many definitions of apprenticeship neglect its pedagogical characteristics. In late January 1992, the Federal Committee on Apprenticeship released a statement on "The Meaning of Apprenticeship: When and How to Use the Term." It contains eight "essential components," each prefaced by "apprenticeship is a training strategy." The points address the combination of supervised on-the-job training with related instruction, sponsorship by employers or labor/management groups, legal requirements, certification upon completion, sponsor investment, apprentices' wages, supervision by masters, and a contractual relationship.

All of these components are important (though the statement could be misread to say that only programs *currently* recognized in law and regulation are legitimate), but none indicates in any detail the nature of teaching and learning, beyond its embeddedness in work. While some U.S. apprenticeships entail both classroom and workplace curricula, others emphasize hours at work and in class much more than either what is to be learned or how it should be taught. In contrast, European countries that rely heavily on apprenticeship have developed quite elaborate specifications, in part because apprenticeship is part of the educational system.

This section will make a case for the value of work-based learning, using apprenticeship as the exemplar. The sub-headings take the form of four propositions, that is, statements that are empirically testable. Each proposition encapsulates part of the argument on behalf of workplaces as learning environments for youth.

1. *Work is best learned by doing.*

Workplaces have several advantages over conventional schools as environments for learning, especially for high

school-age youth. If part of the purpose of secondary schooling is to prepare young people for employment, then some of that education should occur at work.

One reason for this assertion is that young people regard work as real, and they take it seriously. Researchers who have examined adolescent work experience are frequently surprised at how committed young workers are to jobs that are manifestly unchallenging, and how much satisfaction they express at holding those jobs (Greenberger and Steinberg, 1984). It appears that, even in routine jobs, teenagers believe they make a difference. If they are late, their co-workers will suffer. If they make a mistake, their customers and their employers will be let down. In contrast, at school what one does or fails to do affects only oneself.

At school, students are told to learn because they "will need it someday." At work, learning has an immediate application and immediate payoff. Furthermore, instead of abstractions, workers learn knowledge and skills that are directly related to equipment, procedures, and products. A context that is defined as real and important supports more effective, more powerful learning, as the following [Berryman] chapter indicates.

A third advantage to learning at work is that it occurs among adults. Although high schools are created and operated by adults, they are populated overwhelmingly by adolescents. Being among adults not only makes work and learning more serious, it also enables young people to develop mentoring relationships. Having an adult mentor, along with taking on challenging responsibilities, can contribute significantly to adolescents' overall development toward adulthood.

2. *Some of work-related learning should occur before employment begins.*

Lest workplaces be portrayed as ideal places for learning how to work, it should be noted that classrooms are the best places for some learning. Memorizing the multiplication tables and touch typing are two examples of important skills with clear utility at work that are eminently suitable for classroom instruction or computer-aided instruction, but not for on-the-job training. Moreover, classroom-based discussions are excellent locations for critical reflection on work experience.

Families and communities also teach valuable lessons. Diligence, punctuality, teamwork, and many other norms and behaviors that are critical to success in work are typically acquired from parents and from daily experience with friends and neighbors. Thus, the argument here is not that school be abandoned for work or that employers assume all responsibilities for educating and socializing the young, but that work be acknowledged as an important contributor to the education of adolescents and changes be made in both schools and workplaces to optimize that contribution.

3. *Some work is mis-educative.*

John Dewey (1938), who defined education as growth, pointed out that some experiences mis-educate by stunting or constraining possibilities for future learning. His definition of a learning experience was one that leads to further learning or growth: "Every experience is a moving force. Its value can be judged only on the ground of what it moves toward and into" (p. 38). This perspective calls attention to the limited learning possibilities in many workplaces. In some cases, it is true that, "school is bad; work is worse" (Behn, Carnoy, Carter, Crain, & Levin, 1974).

When work is routine closely supervised, and undemanding, then it is unlikely to be educational. Least promising as learning opportunities are the kinds of youth jobs typified by fast food restaurants, which Greenberger and Steinberg (1986) found did not contribute much to adolescent development, contrary to the claims of advocates (notably Coleman, 1974), whose visions of the workplace are outdated. Such jobs neither demand nor teach academic skills. In many cases, co-workers and even customers are predominantly other adolescents rather than adults. Greenberger and Steinberg found that some effects of working were perverse, such as increased use of drugs and tobacco and greater willingness to lie and steal.

However, despite the limitations of youth jobs, young workers can learn from undemanding jobs the importance of punctuality and reliability, and how to deal with customers, co-workers, and supervisors (Charner & Fraser, 1984). The problem is not that such jobs have nothing to teach but that what they offer can be learned so quickly and require few job skills or academic knowledge.

Technical knowledge and skills may be taught rather superficially in fast food restaurants and similar workplaces. In order to adapt to remarkably high turnover rates, they routinize every procedure so that employees can perform them with no more than a few minutes' training. The opposite end of the spectrum is found in high-quality apprentice training, where the goal is for the learner to understand the principles underlying his or her task performance so that they may readily be adapted to many different situations.

4. *Some workplaces are more educational than others.*

What makes a workplace a good place for learning? One answer is that the learning that goes on there is usable elsewhere. Sylvia Scribner (1984) concluded her research on the cognitive skills of dairy workers with a proposition: "Skilled practical thinking is goal-directed and varies adaptively with the changing properties and changing conditions in the task environment" (p. 39). Such "adaptive thinking" is certainly as appropriate a goal for teaching in the workplace as it is for school instruction, which should not be presumed to be broadly applicable. A num-

ber of studies indicate that school learning is, in fact, narrowly specialized and difficult to generalize in out-of-school settings (Lave, 1988; Bossok & Holyoak, 1989; Leshowitz, 1989; Ceci, 1990).

The nature of the work tasks to be performed is another criterion. They must be sufficiently different from what the learner has done before to be challenging. Vygotsky (1978) expressed this point in terms of "the zone of proximal development," that is, the arena in which a person can perform certain tasks only with assistance. Development is demonstrated when the person becomes able to perform the same tasks independently. Bronfenbrenner (1979) has elaborated this notion by hypothesizing that development is facilitated by "progressively more complex patterns of reciprocal activity" with others (p. 60) and by an optimal "balance of challenge and support," (p. 288).

This proposition, like the one before it, rejects a simple-minded choice between work and school and implies instead a painful synthesis of the two. American adolescents have already "voted with their feet" in favor of work, some to the detriment of their schooling. However, much of the work they are able to do is minimally educative.

Starting with these general criteria, we undertook a series of exploratory studies to begin to answer the question of what makes a workplace a good learning environment. The question has practical as well as theoretical significance because, with our colleagues, we are developing a demonstration youth apprenticeship project. The apprenticeships we design simultaneously allow us to test the ideas that have emerged to date and to discover new criteria. The following analysis reflects both those exploratory studies and the first fruits of the demonstration.

WORKPLACES AS LEARNING ENVIRONMENTS

The preceding section laid the groundwork for identifying the characteristics of workplaces that make them good places for learning. The following features appear to be critical:

1. **Appropriate and comprehensive content** must include both the technical and the social aspects of job performance.
2. **Challenge** and **support** should be optimally balanced so that the learner is constantly pushed to exceed previous limits but never overwhelmed.
3. **Motivation** and **affirmation** should be built into the learning process. Apprentices need to have incentives for continuing their learning and assurance that they have the capacity to succeed.
4. **Sequencing** of task assignments should be planned to enable each to build on previous ones.
5. **Transfer** or **generalization** should be explicitly built into instruction. Both in school and out, instructors are frequently mistaken when they assume that knowledge and skills acquired in one situation will automatically be applied in another. Apprentices should be taught to make such transfers.
6. **Reflection** is the difference between an experience and a learning experience. Apprentices need opportunities for thoughtful consideration of what they have experienced, what it means to them, and where they might go next.

REFLECTION IS CENTRAL

Reflection deserves extended attention; it is central to apprenticeship but also designates a promising strategy for treating any work experience as the focus for school-based learning activities. According to Dewey:

> To reflect is to look back over what has been done so as to extract the net meanings which are the capital stock for intelligent dealing with further experiences. It is the heart of intellectual organization and of the disciplined mind. (1938, p.87)

For Dewey the importance of reflection is derived from an examination of purpose and of the progressive organization of subject matter. The process of reflection helps the learner to make connections between previous learning and new learning experiences on the job. (Conrad and Hedin, 1981, found the presence of opportunities for reflection to be associated with more effective experiential learning programs.) Reflection is the activity that encourages a learner to process what has been learned. It may include adopting a critical perspective on previously unquestioned arrangements, at which point it becomes what Freire (1970) called "conscientization" and recalls his noble goal of "education as the practice of freedom."

The best account of this approach applied to work experience is provided in the book, *Learning Work: A Critical Pedagogy of Work Education* (Simon, Dippo, & Shenke, 1991). The authors distinguish compellingly between learning how to do work and learning about work (p. 13). Accepting that young people are likely to learn *how* to work by working, they describe numerous classroom activities designed to help them learn *about* work. Central to this purpose is treating the classroom as "a site for the interrogating of competing claims to truth" (pp. 17–18).

The central purpose of learning about work for the authors and the difference between their treatment and conventional ones is captured in their statement, "Experience should never be celebrated uncritically. School is a place within which to explore the problematic character

of experience" (p. 9). The first issue recommended for attention in the classroom is the nature and acquisition of "working knowledge." What does it mean to be skilled? What does it take to get a job done? How does a new worker make the transition from neophyte to competent worker? In this way, aspects of work experience that might otherwise be taken for granted are rendered problematic. Young workers who have discussed these issues and considered them from multiple perspectives are better able to understand their roles and opportunities as workers.

The authors view the workplace as encompassing technical relations, social relations, and the exchange of work for pay. Through the activities described, this conception is communicated to students, and they are encouraged to notice and question these relations in their own workplaces. Charged issues such as safety and health, unions, and how much people earn are surfaced, not for the purpose of "irresponsibly sowing the seeds of disorder in relations between employers and employees," but to "enable people to act with a sense of hope and possibility in their lives" (p. 9).

A school class, seminar, or discussion group based on these ideas would not give students technical skills for work, but it would help them reflect thoughtfully on their present and future work, and likely help them develop habits of thought that would serve them well in all aspects of life. It would also contribute powerfully to the goals of democratic education.

THE TEACHER'S ROLE

Many different individuals participate in teaching apprentices; therefore, we refer to what they do rather than who they are. We call direct teaching of apprentices "coaching" and "mentoring."

Coaching. Coaching refers to teaching apprentices about their work tasks and job responsibilities. Coaching includes the following instructional behaviors:

1. *Demonstrating task performance by doing the task while the apprentice observes.* While performing the task, the coach directs the apprentice's attention to important features of the task and checks the apprentice's understanding by asking questions and encouraging questions from the apprentice. (These questioning strategies also apply to the remaining functions.)
2. *Explaining* ***how*** *to perform a task correctly.* Explanation may accompany demonstration or be provided separately. It sets out performance criteria, points out what problems are likely to occur and identifies possible problem-solving strategies.
3. *Explaining* ***why*** *a task is performed a certain way.* To understand a task, the apprentice needs to know more than the specific steps taken to accomplish the task; she or he also needs to understand the context. Therefore, a coach must explain why the task is performed according to certain specifications, provide information about the business management or scientific principles underlying the procedure, and explain how the task relates to other tasks and to the overall productivity of the company.
4. *Monitoring and critiquing the apprentice's attempts at the task.* While monitoring the apprentice's performance, the coach gives clear and immediate feedback on initial attempts. Although monitoring and critiquing are continual, the interval between instances increases as the apprentice gains competence, and the coach encourages the apprentice to monitor his or her own performance and to seek help when difficulties arise.
5. *Modeling problem solving by thinking aloud and demonstrating problem-solving strategies.* Modeling is not restricted to demonstrating task performance. (See number 1 above.) It also includes explaining what questions the apprentice can ask him or herself when problems arise, identifying the kinds and sources of information the apprentice might need to find a solution, and pointing out important information or cues that the coach is relying on to guide problem-solving.

Mentoring. In contrast to coaching, which focuses on instrumental instruction about how to do job tasks, mentoring emphasizes teaching about social and personal aspects of work. The distinction between mentoring and coaching reflects recent analyses of workplace mentors. Business executives seeking mentors are advised not to choose an immediate supervisor. A mentor should be an advocate; a supervisor must sometimes make decisions that have a negative effect on a subordinate. Further, one function of a mentor is to provide a perspective that a supervisor does not have—to help a protege figure out how to resolve conflicts with a supervisor, even to help circumvent a supervisor in the organizational hierarchy. Hence, we distinguish mentoring, as functions related to the social and personal sides of work, from coaching, which addresses the technical domain. Following are the primary mentoring functions:

1. *Initiating the apprentice to the workplace culture.* Apprenticeship brings adolescents into an adult social system, a new culture with its own rules, conventions, and norms. Explanations about the culture of the workplace facilitate adjustment to the work setting for the apprentice. Initiating the apprentice to the workplace culture also includes describing both its manifest organizational structure and the informal social system that operates within the organizational structure.

2. *Advising the apprentice on career directions and opportunities.* Career advice takes many forms, such as discussing education and training requirements for entrance into a particular field, helping apprentices identify other career resources (e.g., professional associations that have information about job opportunities and certification requirements), introducing apprentices to other professionals and staff in the firm who can share their experiences and generally expanding the apprentices' conceptions of career domains. A mentor does not perform the same functions as a professional counselor, with diagnostic tools and systematic information about options, but rather in the armchair manner of a kindly relative or friend.
3. *Helping resolve problems.* A good mentor helps resolve problems that involve the apprentice. Problems may arise on all levels (e.g., from an apprentice not knowing how to ask for help to an apprentice not coming to work because of a conflict that has come up at school) and may involve multiple systems (e.g., the firm, the school, and the apprentice's family).

Workplaces can be thought of as "socio-technical systems." Being a productive worker requires an understanding of social relations, not just the technical side of a job. Workers must be attuned to unwritten norms and traditions as well as written rules and procedures. Gaining this kind of insight is especially challenging for an apprentice who is culturally different from most workers. A worker from a similar cultural background is more likely to be able to "read" the work situation and understand how to interpret and participate in social relations. One with a relative or close friend in the workplace may already know many of its customs. Furthermore, someone who is like the other workers is very likely to be mentored "naturally," as one or more experienced hands take him or her under their wing to "show them the ropes."

Without a formal process to assure that every apprentice receives mentoring, those who are unlike other workers in gender, race, or ethnicity, may fail to adapt, not because of active prejudice against them but simply because no one thought to explain how things work.

THE LEARNER'S ROLE

Just as in school, providing instruction in the workplace is not sufficient to produce learning. The learner must also act. The coaching and mentoring functions listed above entail complementary functions on the learner's part. Dewey's principle of interaction makes this point. Interaction designates the two-way influence between a person's internal state and the external conditions in which she or he exists: "An experience is always what it is because of a transaction taking place between an individual and what, at the time, constitutes his environment" (Dewey, 1938, p. 43). In other words, the nature and impact of an experience cannot be determined solely on the basis of its "objective" qualities because it depends equally on the "subjective" state of the person having the experience. One implication of this principle is that no two people have literally the same experience at the same time. Although they are both involved in the same event, each one experiences it somewhat differently depending upon individual traits and previous experiences that color his or her interpretation of and reaction to the event.

Educationally, this means that learning cannot be assured by arranging the external circumstances: such as subject matter, setting, and teaching methods. The same situation may provide a learning experience for one person but nothing new for another because each brings something different to the situation. Hence, the learner's contribution is also essential.

In our observations of apprentices, we have observed many repetitions of a cycle that embodies Vygotsky's (1978) idea of the zone of proximal development: apprentices begin by *observing* a coach perform a task; then begin to *assist* with the task; and finally are able to *perform* the task themselves. Sometimes the cycle applies to a complex and difficult task that takes months to master. Other times it is completed for a simple task in a period of minutes or hours. Hence, learning a complex task can comprehend a long series of cycles within cycles. Following are the learner's responsibilities:

1. *Attending to coaching and mentoring.* The first duty of a learner is to pay attention to instructions. It is especially critical to learning at work, where failure to pay attention may be disruptive and even dangerous.
2. *Trying out or practicing what has been taught and trying to improve performance.* Learning does not occur solely via observation of the mentor; it requires performance of the learned behavior by the learner combined with observation and evaluation of that performance, both by the coach and by the learner.
3. *Processing learning to apply, comprehend, and transform it.* Processing learning entails cognitive activity on the learner's part. New learning must be related in a way that makes sense in connection with knowledge, skills, and dispositions already present. Processing is manifested by the act of questioning and is an interactive process with the coach or other learners. Even low-level questions such as requesting clarification indicate the learner's effort to make sense of instruction. Innovation is another indicator that processing is occurring. Innovation includes altering what has been taught, trying a dif-

ferent approach, and applying a lesson in a novel context. Innovation demonstrates that more than rote learning has been acquired.

4. *Producing, or getting work done.* A critical distinction between learning on the job and learning in a classroom, even a corporate classroom, is that while on the job a learner is also expected to perform real work. Students, of course, accomplish tasks, but they are exercises assigned purely for the student's benefit. A student who fails to do the exercise or does it badly is the only one to suffer, if a poor grade causes suffering. A trainee or apprentice is simultaneously a worker and a learner. If real work is not done well, the customer, co-workers, and the firm suffer. The demand for performance explains much of the power of learning on the job; it provides both the opportunity to apply what is learned and motivation to learn.
5. *Initiating learning.* Another sharp contrast between conventional school-based learning and work-based learning is the importance in the latter of learners taking responsibility for their own learning. Schools encourage passive learning, soaking up what the teacher sets out. One of the first lessons an apprentice must learn is how to learn, and that requires seeking out people who can teach and opportunities to learn. Simply waiting for instruction as in a school classroom will seriously constrain learning.

REINVENTING APPRENTICESHIP

The pedagogical principles stated above are guiding the youth apprenticeship project we direct, but they fall far short of comprehending all the issues that must addressed, issues that are also crucial to the prospects of youth apprenticeship as an institution supporting the transition from secondary school to career. We discuss a few of those issues briefly in order to indicate the nature and magnitude of the undertaking:

Legal uncertainties are a hindrance. Current youth apprenticeship initiatives can be characterized as either "top-down" or "bottom-up." Our own belongs to the latter category because we have started without benefit of a state or national framework. Wisconsin has taken the opposite approach by amending their apprenticeship statute to give youth apprenticeship a defined legal status. The two approaches are complementary. We suffer from having to work out as we go along key issues such as how school credit will be awarded for work experience and what the legal status of apprentices is with regard to child labor laws and compensation. To the extent that legislation and regulations can deal with such issues at the state and national levels, more schools and employers will participate and development costs will be reduced.

Institutional relations and responsibilities are challenging. Youth apprenticeship works best as an institution that is shared by the educational system, families, employers, and labor, with facilitative support from government. Our country lacks the quasi-public organizations that are central to apprenticeship in Europe. Nor do our traditions make it easy to foster such collaboration or identify potential institutional sponsors. Creating a national institute for youth apprenticeship and bodies for setting and assessing performance standards would be steps in the right direction.

A structure is needed. Among its elements are occupational credentials, which specify education and training objectives. Credentials must be flexibly defined and measured in order to match a dynamic labor market and to satisfy American values. Objectives derived from occupational credentials should guide the development of a curriculum for both the school-based and the work-based components of youth apprenticeship. Assessment systems are part of the structure, too. Although formal credentials can block career mobility by erecting barriers to career entry; they also facilitate career planning, serving as milestones indicating progress and passports authorizing entry. Credentials, therefore, mark career pathways which guide and motivate young people (Hamilton, in press). In the United States, high status occupations offer well-marked career pathways, but middle level occupations do not. Young people who are not aiming toward careers that require extensive higher education lack knowledge about how to achieve their goals, knowledge that a system of credentials provides. With a little help, an aspiring physician can set a course through secondary school, college, and medical school. How many guidance counselors can tell a fourteen-year-old how to become an electronics technician?

Youth apprenticeship is neither cheap nor easy. From a public policy perspective, one of the most attractive features of youth apprenticeship is that it enlists employers in the process of educating and socializing youth, thereby directing resources far beyond government's capacity toward a critical public need. However, facilitating that process requires resources, and employers will not invest in educating and training young people unless they expect their investment to pay off in the form of a highly skilled workforce and resulting productivity. European countries that already rely on youth apprenticeship can calculate the costs and benefits with some confidence. The calculations are different and less certain for us.

Enlisting employers is the greatest challenge. Precisely for these reasons, the biggest question looming over the nascent movement toward an American-style youth apprenticeship system is how many employers will agree to participate and how much they will invest to see that it is done well. Firms that do not hire teenagers and do

not train their adult employees undergo a kind of culture shock when they introduce youth apprentices Adult supervisors (coaches) need to know they will be recognized for their skillful teaching rather than penalized for reduced productivity when they take time to work with apprentices. Adult co-workers cannot see youth apprentices as threats to their job security. In difficult economic times, when many employers are laying off experienced workers, these conditions may be impossible to create. Yet, if employers wait for the economy to turn around, they will be impatient for skilled workers to emerge from four-year training programs. Tax incentives may be appropriate vehicles to stimulate employer involvement, but they should be examined very carefully in the light of past experience and their impact on tax collections must be calculated as real costs. If employers are offered incentives for training, a portion must be explicitly tied to youth or they will, quite logically, be used for training adult workers.

Young people are ready. We have easily generated many times more applicants than can be accommodated in our small program. High school students find the prospect of youth apprenticeship extremely attractive. When the program is described to them by current apprentices, they sign up in droves.

Our experience to date leaves us guardedly optimistic that youth apprenticeship can be implemented in the United States. However, one year does not make a program. Judgment must be reserved until at least one cohort has passed through a four-year program. Moreover, the key question is not whether a youth apprenticeship *program* can be created since one of our country's great strengths is its capacity to invent new programs. The looming question is whether we can create a youth apprenticeship *system*.

A system has a place for everyone who needs one; we have a school *system* but a Head Start *program*. A system's components are related to each other coherently so that achievement in one component opens doors in another. Knowledge of the system provides a road map for personal goal setting and planning. A system is larger and more enduring than a program, which may disappear because its founder leaves or a budget is reduced.

Americans are not particularly adept at building such systems, and the systematic nature of European apprenticeship is what will be hardest to import and adapt. As difficult as it is to create new programs that work, it is much more difficult to leap from programs to a system. One source of optimism that this chasm might be bridged is precisely that our research and development project, and other bottom-up demonstration projects, are complemented by state-level initiatives to build systems from the top down, propounding legislation and standards before youth apprentices are actually in place. If people involved in all these efforts can learn from each other and work toward a common core from opposite starting points, then a functioning system may result. No one should presume that it will happen quickly or easily.

IV

APPRENTICESHIP AS A PARADIGM FOR LEARNING

Sue E. Berryman, *The World Bank*

THIS REPORT AROSE OUT OF A CONCERN ABOUT, AND PROPOSES A solution for, the education of "the forgotten half." This chapter argues that this solution—apprenticeship—is a learning paradigm broadly applicable to the education and training of *all* individuals, whether college-bound or not. It also argues that the optimal location for apprenticeship learning—the workplace, school, or some mixed arrangement—remains an open question, even for the non-college-bound. Specifically, this chapter develops four arguments:

1. The learning paradigm that prevails in K–12 education routinely and profoundly violates what millennia of experience and a century of formal thought and research tell us about effective learning, whether for the college-bound or the non-college-bound.
2. Apprenticeship, understood as a way of setting up the learning situation, is an alternative paradigm that promises to generate more effective learning for all students.
3. Traditional apprenticeship—usually organized around visually observable practices that need to be learned—has to be modified to make visible for modeling and discussion the non-visible cognitive components of modern work. It also needs to be modified to help individuals accommodate the non-routine and changeable nature of modern work.
4. Apprenticeship as a paradigm for learning needs to be distinguished from the location for apprenticeship. "Work-based apprenticeship" blurs the two issues. Apprenticeship normally occurs in the workplace, but as a paradigm of learning, it can and should occur in schools. The optimal location for apprenticeship as an organization of learning is an open question for the United States.

THE PREVAILING K–12 PARADIGM OF LEARNING

Although this discussion is couched in K–12 terms, it is important to recognize that K–12 practices tend to permeate all levels and sectors of American education and training, from elementary school to corporate training. Americans share the common experience of elementary and secondary schooling, and this shared experience seems to frame our ideas and models of what learning environments should look like, whether called a college classroom, an adult literacy class, or a corporate training classroom. Thus, despite the rhetoric about their differences, the nation's educational and training systems do not differ significantly in their teaching and learning strategies, and the limited success they share seems to arise partly from shared problems in how they structure learning.

For example, studies of advanced technical training—such as radiology, electronic trouble-shooting, and the law—show a mismatch between the theoretical principles, processes, and skills learned in formal school and the structure of knowledge needed and contexts of use in professional practice (Resnick, 1987). Even corporations as advanced in their training practices as Motorola are having to unlearn traditional, less effective practices, such as job training separated in time and place from the work problems to be solved.

The basis for this and the next section of this chapter is a powerful knowledge base known as "cognitive science."[1] At the heart of this research is the presumption that intelligence and expertise are built out of interaction with the environment, not in isolation from it. It thus challenges our traditional distinctions between:

- Head and hand

- Academic and vocational education
- Knowing and doing
- Abstract and applied
- Education and training
- School-based and work-based learning

We characterize the standard K–12 paradigm of learning by talking about four flawed practices that combine to give us the learning situations that we see in too many American classrooms: passive learning; fragmented learning; fact-based/right-answer learning; and noncontextual learning.

Passive Learning

Although schools treat the learner as a passive vessel, research shows that students need to be actively engaged with what is to be learned.

In a typical schoolroom, Congressional hearing, or corporate training session, the teacher—or "expert"—faces the learners, in the role of Knowledge Source. The learner is the passive receiver of wisdom, a glass into which water is poured. This instructional arrangement comes out of an implicit assumption that the basic purpose of education is transmitting the society's culture from one generation to the next. The concept of transmission implies a one-way flow from the adult members of the society to the society's young (Lave, 1988)—or from the expert to the novice. In fact, schooling is often talked about as the transmission of "canonical" knowledge, "canon" referring to religious regulation or dogma. Education as canonical transmission thus becomes the conveying of what experts know to be true, rather than as a process of inquiry, discovery, and wonder.

This view of education leads naturally to the student as receiver of The Word, to a lecture mode of teaching, and to the teacher as the controller of the process. These arrangements have several unhappy consequences.

Under a passive learning regime, learners do not interact with problems and content and thus do not get the experiential feedback so key to learning.

Students need chances to engage in choice, judgment, control processes, problem formulation; they need chances to make mistakes. The saying, "experience is the best teacher," is borne out by the research—you learn when you do. Not sufficient for effective learning, doing is nonetheless necessary.

However, if schools present what is to be learned as a delineated body of knowledge, students come to regard the subject being studied—mathematics, for example—as something received, not discovered, and as an entity to be ingested, rather than as a form of activity, argumentation, and social discourse.

Passive learning places control over learning in the teacher's, not the learner's, hands.

Passive learning creates learners dependent on teachers for guidance and feedback, thus undercutting the development of confidence in one's own sense-making and problem-solving abilities and discouraging displays of initiative. As Lave (1988) observes, people experience themselves as both subjects and objects in the world. In the supermarket, for example, they are subjects, seeing themselves as controlling "... their activities, interacting with the setting, generating problems in relation [to] the setting, and controlling problem-solving processes ... In contrast, school ... create[s] contexts in which children ... experience themselves as objects, with no control over problems or choice about problem-solving processes" (pp. 69–70).

As important as the effects on confidence, passive learning also undercuts the development of certain higher-order cognitive skills known as "cognitive self-management" or "executive thinking" skills. These are simply the skills we use to govern our problem-solving attempts. They include goal setting, strategic planning, checking for accurate plan execution, monitoring our progress, and evaluating and revising our plans.

We now know that those whom we recognize as knowing how to learn are people with cognitive self-management skills. However, as Pea (1989) observes, passive learning is disastrous for developing these skills. Such skills seem to get developed when the learning situation is structured to shift control from the teacher to the student, the teacher gradually removing the support that students need initially as they begin to show the ability to work autonomously.

Passive learning creates motivational and "crowd control" problems.

Jordan (1987) describes a Mexican public health training program designed to improve the practice of Mayan midwives. Her analysis spotlights behaviors that American teachers constantly complain about in their students.

The teaching is organized as straight didactic or instructive material in a mini-lecture format. When these lectures begin, the midwives shift into what Jordan calls their "waiting-it-out" behavior: "...they sit impassively, gaze far away, feet dangling, obviously tuned out. This is behavior that one might also observe in other waiting situations, such as when a bus is late or during sermons in church" (p. 3).

We see the same behaviors in American third graders. Hass (n.d.) found students deeply engaged in team problem-solving during their drill and practice time, but investing little attention or involvement in the teacher's instruction sessions. During three weeks of observation, the children had not adopted any of the specific strategies

demonstrated by the teacher during general instruction time.

As teachers know so well, motivational problems end up as crowd control problems, illustrated by the behaviors of different groups of school children at a Metropolitan Museum display of Ice Age art and artifacts (Farnham-Diggory, 1990). Most of the school groups were moved from one exhibit to the next, pausing before each to hear a guide's or teacher's lecture. Since the children were bunched in front of an exhibit, they could not all hear the lecture, and, even when they could, they lacked understanding of the time frames involved or the archaeological significance of bits of bone. Teachers had not set up the museum visit to prepare students for and involve them in what they were going to see. Groups were therefore restless, and crowd control became the teacher's primary concern.

One junior high school class behaved very differently, exhibiting a quiet intensity as they moved through the exhibit. They had packets of work sheets with questions about issues and problems that they were expected to use the exhibit to solve. Some questions were factual, but most required inference and thought. The students had to figure out for themselves where and what the evidence would be concerning particular questions.

Fragmented Learning

Although schools fragment knowledge into pieces, research shows that fragmentation destroys the learner's ability to make sense out of what is being learned.

American education reflects a behaviorist theory of learning, a view that conceives of learning as the strengthening of bonds between stimuli and the learner's responses to those stimuli. Based on his animal experiments, the brilliant psychologist Edward Thorndike (1898) developed a new theory of learning. As Cremin (1961) observed, the theory presumed that learning was the connection of a specific response to a specific stimulus through a physiological bond in the neural system. The stimulus [S] then regularly called forth the response [R]. The bond between S and R was created by being continually rewarded; an undesired bond was extinguished through punishment or failure.

This psychological theory had several effects. It led to the breakdown of complex tasks and ideas into components, subtasks, and items ("stimuli") that could be separately trained. It encouraged repetitive training ("stamping in"). And it led to a focus on the "right answer" ("successful response") and to the counting of the number of correct responses to items and subtasks, a perspective that ended up in psychometrically elegant tests considered the scientific way to measure achievement.

The result was fractionation, or splitting into pieces: having to learn disconnected subroutines, items, and subskills, without an understanding of the larger context into which they fit and which give them meaning. Farnham-Diggory (1990) notes that fractionated instruction maximizes forgetting, inattention, and passivity. Since children and adults seem to acquire knowledge from active participation in complex and meaningful environments, "school programs could hardly have been better designed to prevent a child's natural learning system from operating" (p. 146).

The phrase "a child's natural learning system" goes to the heart of why the usual school programs do not meet their own learning objectives well. Human beings—even the small child—are quintessentially sense-making, problem-solving animals. "Why" is a hallmark of children's talk. Fractionated and decontextualized instruction fails to mobilize this powerful property of human beings in the service of learning.

The point about "subtasks" is not that learners do not have to do simple operations. Studies of traditional apprenticeships in tailoring show that novices start with simple tasks. However, they conduct simple tasks in the context of being able to observe the masters' execution of complex tailoring, which involves the integration of different subskills. Observation lets learners develop a conceptual model or cognitive map of what it means to be an expert tailor. This model gives learners an advanced "organizer" for their initial attempts to execute a complex skill; it provides an interpretive structure for making sense of the feedback and corrections from the master; it provides a guide to which the learner can refer during times of relatively independent practice (Collins et al, 1989).

Right-Answer/Fact-Based Learning

Schools focus on getting the right answer, at the cost of developing the processes that generate answers.

Both the transmission and behaviorist views of learning place a premium on getting the right answer. A transmission view stresses the ability of the learner to "reproduce" The Word; a behaviorist view, the ability of the learner to generate the correct response. The end result is the same: students and teachers focus on the "right answer," jeopardizing the development of real understanding. This focus plays out in several ways.

Students resort to superficial accomplishment.

Students learn to sound and test "right" within the school system. They figure out what answers the teacher or the test seems to want, but often at the cost of no real learning. These surface achievements have been called "veneer of accomplishment" (Lave et al, 1988).

Again, Jordan's (1987) analysis of a Mayan midwives' training program illuminates basic truths about the learning and testing of American students. She found that midwives who had been through the training course saw the

official health care system as powerful, in that it commanded resources and authority. They came to distinguish "good" from "not good" things to say. Specifically, they learned new ways of legitimizing themselves, new ways of presenting themselves as being in league with this powerful system, but with little impact on their daily practice. Although they could converse appropriately with supervisory medical personnel, their new knowledge was not incorporated into their behavioral repertoire. It was ". . . verbally, but not behaviorally fixed . . ."

The same behaviors show up with Hass' American third graders. He observed that in mathematics lessons the students got much practice in problem-solving methods that they had brought into the classroom with them—methods that were not being taught and that were not supposed to be used. The children used these methods to produce right answers, which the teacher took as evidence of their having grasped the formal procedures that she was teaching them. *In fact, all that had happened was the appearance of learning.*

Lave et al (1988) cite Resnick's (1986) observations that school learners have reasonably correct calculational rules and, in the classroom, learn rules for manipulating the syntax of symbolic notation systems. However, they fail to learn the meaning of symbols and the principles by which they represent quantity. Thus, wrong answers can look right and may not betray the students' lack of mathematical understanding. (The attack on multiple-choice tests is targeted at the veneer problem, in that these tests fit and reinforce an emphasis on fragmented knowledge and superficially correct answers.)

Teachers fail to understand the assumptions that students bring to what is being learned.

This is part of the veneer problem. We end up with appearances of learning because, in their search for right answers, teachers often fail to check behind the answers to understand what assumptions students have brought into the learning situation.

The evidence shows that learners carry into the learning situation conceptions and constructs that they have acquired elsewhere—Hass' students are an example. In other words, the teaching challenge is not to write on a clean slate. It is to confirm, disconfirm, modify, replace, and add to what is already written there.

As Raizen (1989) points out, traditional curricula are based on a conceptual analysis of the subject matter that ignores what is already in the learner's head, with the result that students make mistakes that arise from undetected ideas that they brought to the lesson. Or they can play back memorized canonical knowledge and conceptions but return to their own ideas when confronted with unfamiliar questions or non-routine problems. One study found that students in college physics courses designed for physics majors solved "book" problems in Newtonian mechanics by rote application of formulae, but—even after instruction—reverted to naive pre-Newtonian explanations of common physical situations (Raizen, 1989).

Teachers do not focus on how to use student mistakes to help them learn.

In their search for right answers, teachers tend to ignore student errors as "failures" rather than as opportunities to strengthen students' understanding.

In their observations of urban and suburban Chicago, Taipei (Taiwan), Beijing (China), and Sendai (Japan) first and fifth-grade mathematics classes, Stigler and Stevenson (1991; also Stevenson and Stigler, 1992) found a marked difference in how American, versus Asian, teachers treated student mistakes. American teachers place little emphasis on the constructive use of errors as a teaching technique, a practice that Stigler and Stevenson attribute to the strong influence of behaviorism in American education. Behaviorism requires teaching conditions that help learners to avoid errors and to make only correct responses which can be reinforced through praise.

For example, a teacher in a Japanese fifth grade class was introducing the problem of adding fractions with unequal denominators. The problem was simple: adding 1/2 and 1/3. The teacher called on one of the students to give his answer and explain his solution. The student answered two-fifths. Pointing first to the numerators and then to the denominators, he explained that one plus one was two and three plus two was five, giving him two-fifths. Without comment the teacher asked a second student his solution. This student said that two point one plus three point one added up to five point two. When changed into a fraction, he got two-fifths. The teacher, unperturbed, asked a third student for her solution, and she answered five-sixths. She showed how she had found the common denominator, changed the fractions so that each had this denominator, and then added them.

Instead of emphasizing the correct solution and ignoring the incorrect ones, the teacher next capitalized on the errors that the first two students had made to help them and the other students confront two common misconceptions about fractions. She helped the first student test the sensibleness of his solution by asking which was larger, two-fifths or one-half? When it was acknowledged that one-half was larger, she asked whether it didn't seem strange that adding something to one half gave you an amount less than one-half? In working with the second boy, she helped him to see that he had confused decimals with fractions, but that, *given that error*, he had arrived at a sensible solution.

Since the instructional focus is on the right answer, it is not on how to think about problems or on different ways to solve them.

Perhaps the most serious consequence of a "right answer" emphasis is just that: it excludes a focus on how

to approach the problem to be solved or on different ways to solve the same problem. It emphasizes facts, which are important, but by themselves constitute an impoverished understanding of a domain. A fact-focus does not develop students' abilities to think about the domain in different ways. Cognitive analyses of a range of jobs show that being able to generate different solutions to problems that are formally the same is a hallmark of expert performance (Scribner, 1988).

Again, Asian teachers differ markedly from Chicago teachers. They seem to focus more on concepts, conceptual understanding and, at least in mathematics, on the notational system needed to represent concepts and their relationships. Stigler and Stevenson (1991) found that, teachers ask questions for different reasons in the United States and in Japan. In the United States, the purpose of a question is to get an answer, but Japanese teachers pose questions to stimulate thought. In fact, they consider questions to be poor if they elicit immediate answers because this indicates that students were not challenged to think.

A common type of lesson in Asian classrooms is one that asks the students to invent and evaluate different ways of solving the same problem without worrying about specifying an answer. A videotape of typical Asian classrooms (Stevenson, 1989) shows a fifth-grade teacher who started her class by showing the students a trapezoid drawn within a rectangle. She divided the class into small groups, asking each group to figure out one or more ways to determine the area of the trapezoid. She stressed that it did not matter which method they used. "You don't need to show us your calculations; just show us your method. It is your method that matters, not simply getting the correct answer." The groups came up with several different and ingenious solutions.

Lessons like these have several effects. First, they give control over problem-solving to the students, both in terms of generating the solutions and evaluating their mathematical validity. The teacher guides the process and insures that mathematical values are respected; but her role, in the words of an American teacher, is that of "guide on the side," not "sage on the stage."

Second, lessons such as these reproduce the actual processes in which mathematicians themselves engage—the processes of mathematical argument, discourse, and proof. By doing mathematics, students come to understand how mathematics got put together over the centuries, see that they can engage in the same processes and, by virtue of participating in mathematical argument, develop a deeper understanding of mathematical concepts. Finally, by being encouraged to generate multiple solutions to the same problem, students can regard the problem from multiple angles, thus developing a fuller understanding of its properties. They come to realize that problems can usually be solved in several ways, freeing them from a constraining hunt for the "one right way."

Non-contextual Learning

Although schools often teach skills and knowledge outside of their contexts of use, the research shows that context enhances learning.

This problem is often talked about as "decontextualized learning," which simply means learning in the absence of context or meaning. The rationale for decontextualized learning is that, if fundamentals are learned independent of specific context, they become available for application to a wide range of specific situations. A behavioral theory of learning also implies stripping away "extraneous" stimuli—i.e., stimuli that can give context and meaning.

Almost three-quarters of a century earlier, John and Evelyn Dewey (1915) wrote about the learning costs of decontextualized education:

> A statement, even of facts, does not reveal the value of the fact, or the sense of its truth—of the fact that it is a fact. Where children are fed only on book knowledge, one "fact" is as good as another; they have no standards of judgment or belief. Take the child studying weights and measures; he reads in his textbook that eight quarts make a peck, but when he does examples he is apt, as every schoolteacher knows, to substitute four for eight. Evidently the statement as he read it in the book did not stand for anything that goes on outside the book, so it is a matter of accident what figure lodges in his brain, or whether any does. But the grocer's boy who has measured out pecks with a quart measure *knows*. He has made pecks; he would laugh at anybody who suggested that four quarts made a peck. What is the difference in these two cases? The schoolboy has a result without the activity of which it is the result. To the grocer's boy the statement has value and truth, for it is the obvious result of an experience—it is a *fact*.

Thus we see that it is a mistake to suppose that practical activities have only or even mainly a utilitarian value in the schoolroom. They are necessary if the pupil is to understand the facts which the teacher wishes him to learn; if his knowledge is to be real, not verbal; if his education is to furnish standards of judgment and comparison.

Context turns out to be critical for understanding and thus for learning. We are back to the issue of meaning-making and sense-making, discussed earlier. The importance of context lies in the meaning that it gives to learning.

Asian teachers rely much more heavily on context than American teachers, both in terms of using concrete objects and real-world problems (Stigler and Stevenson, 1991; Stevenson and Stigler, 1992). Sendai teachers were twice as likely as Chicago teachers, and Taipei teachers five times as likely to use concrete objects to teach fifth-grade mathematics.

American teachers tended to introduce mathematical concepts and rules abstractly, only later (if ever) turning to real-world problems that involved those ideas. For example, they often started the lesson on fractions by defining the term "fraction" formally and naming the elements of fractional notation ("denominator" and "numerator"). Asian teachers, however, tended to introduce new mathematical ideas by first "interpreting and relating a real-world problem to the quantification that is necessary for a mathematical solution" (Stigler and Stevenson, 1991, p. 20). For example, a teacher might start the lesson by asking students to estimate how many liters of colored water a beaker contains, the amount always being some part of a whole liter, such as 1 1/2 or 1 1/3 liters. He then helps them translate their visual appreciation of "parts of" into fractional notations. The terms "fraction," "denominator," and "numerator" are mentioned only at the end of the lesson, these formal words now being connected to real-world experiences. In other words, these teachers understand that concrete experiences are not sufficient for learning—they have to be linked to formal notation and abstract concepts. However, real-world experiences provide the intuitive meaning that lets students "hook into" and "take possession of" abstract ideas.

Confusion surrounds the idea of "teaching in context." It is not about making learning "relevant," as that term came to be used in education in the 1960s. In the 1960s "relevance" came to be defined as teaching subject matter directly applicable to students' lives rather than the traditional academic disciplines. This is not the same as using students' experiences to help them learn the disciplines.

It does not refer to a vocational or applied curriculum. As we just saw, Asian teachers make use of context in the form of concrete objects and real-world problems for teaching a distinctly "academic" subject (mathematics). As the Oxford English Dictionary states, relevance is about that which "connects," "makes coherent," "gives meaning," "makes interpretable."

And that which "makes interpretable" comes out of the experiences of those doing the interpreting. It is for this reason that "context" often gets confused with applied curricula. Context involves experience, which comes out of specific situations, and the presumed objective of vocational curricula is for use in specific situations. These are not the same thing. The fact that well-designed vocational curricula use real-world problems and objects does not mean that "teaching in context" is vocational teaching.

There is only limited research on the outcomes of learning in context, versus out of context. For example, Brazilian street vendor children successfully solved 98 percent of their marketplace transactions, such as calculating total costs and change. When presented with the same transactions in formal word arithmetic problems that provided some descriptive context, the children correctly solved 74 percent of the problems. Their success rate dropped to 37 percent when asked to solve the same types of problems when these were presented as mathematical operations without descriptive context (Carraher et al., 1985.) Sticht (1989) found that marginally literate adults in a job-related reading program gained in job-related reading twice what they gained in general reading that is, they did better when a meaningful context was provided for the text.

TRADITIONAL APPRENTICESHIP AS A PARADIGM OF LEARNING

In their search for learning strategies more effective than those often evidenced in K–12 schools, analysts looked at the "spectacular" learning of young children and at apprenticeship in developing countries. They noted that children's learning situations had certain characteristics (Bransford et al., 1985; Pea, 1989). First, learning took place in context. During their first five years, children were learning in the midst of culturally meaningful, ongoing activities, and receiving immediate feedback on the success of their actions.

Second, learning was often guided. Parents, friends, and peers not only served as models for imitative learning, but helped the children learn by providing structure to and connections between their experiences. These mediators highlighted information in the situation that helped the child carry out a task. They let them take on "part" activities in the conduct of a whole task, such as mixing sugar and flour in the whole process of making a cake.

Third, learning was useful. Learning in context and with adult guidance gave children an understanding of the role of information in problem-solving. Concepts and skills were acquired as tools with a range of purposes. And fourth, the uses of new knowledge were not only shown, but often explicitly stated--in other words, the need for and purpose of the learning were explained.

Another source of effective learning ideas was watching how individuals learned in traditional apprenticeships, including informal on-the-job training in American companies (Lave, in preparation; Jordan, 1987; Scribner and Sachs, 1990).

What does traditional apprenticeship look like? In her studies of Vai and Gola apprentice tailors, Lave noted that the tailoring curriculum arranges opportunities *for* practice, whereas school curricula tend to be a specification *of* practice (Lave et al, 1988). Collins et al (1989) note that Lave found that the apprentices learned tailoring through a combination of observation, coaching, and practice:

> In this sequence of activities, the apprentice repeatedly observes the master executing . . . the process [that they are trying to learn], which usually involves a number of different

but interrelated subskills. The apprentice then attempts to execute the process with guidance and help from the master (coaching). A key aspect of coaching is the provision of scaffolding, which [simply means] the support, in the form of reminders and help, that the apprentice requires to approximate the execution of the entire composite of skills. Once the learner has a grasp of the target skills, the master reduces (or fades) his participation, providing only limited hints, refinements, and feedback to the learner, who practices by successively approximating smooth execution of the whole skill.

Jordan (1987) identifies several characteristics of traditional apprenticeship learning. Those include:

1. Apprenticeship happens as a way of, and in the course of, daily life and may not be recognized as a teaching effort at all. In other words, there is likely to be almost no separation between the activities of daily living and learning of "professional" skills. This aspect of traditional apprenticeship recalls how very young children learn in contemporary families.
2. "Work" is the driving force. In apprenticeship the activities in which masters and students engage are driven by the requirements of the work to be accomplished: pots need to be fired, a shawl needs to be woven, trousers need to be manufactured. The activities to which the apprentice is a witness and, by stages, a contributor, are organized around work to be done, and whatever teaching or learning may happen is coincidental to that overriding concern. As a consequence, the progressive mastering of tasks by the apprentice is appreciated not so much as a step towards a distant, symbolic goal (such as a certificate), but for its immediate use value. Apprentices are not so much "practicing for the real thing" as doing useful and necessary tasks.
3. There is a temporal ordering of skill acquisition. Apprentices start with skills that are relatively easy and where mistakes are least costly. For example, young tailor apprentices first experiment with parts of the production process that are least costly in terms of wasted materials. The apprentice's first assignments are sewing garments from pieces someone else has cut, not constructing it from start to finish. Only when the individual production processes are mastered is the entire production sequence put together. The concept of working from the "sidelines" of a complex task to its center stands in contrast to the ways that knowledge is usually transferred in formal schooling. In a formal classroom there is usually a (chrono)logically ordered sequence of things to be learned. The components are treated as equal in importance to one another, and it is assumed that they have to be acquired in a linear way, in other words, one after the other, rather than in "bundles."
4. Traditional apprenticeship learning focuses on bodily performance and embodied knowledge. When lectures are used to convey knowledge, the focus is on verbal and abstract knowledge. However, apprenticeship learning is the acquisition of bodily skills. It involves the ability to do rather than the ability to talk about something. Indeed, it may be impossible to elicit from people operating in this mode what they know how to do. The master is less likely to talk than to guide the hands, producing truly embodied knowledge. In the apprenticeship mode, acquisition of bodily skills is primary, while the verbalization of general principles is secondary, ill-developed, and not well rehearsed.
5. Standards of performance and evaluation of competence are implicit—in fact, they are embedded in the work environment in which the novice participates. What constitutes expert execution of a task is obvious and observable in the master's performance. Judgements about the learner's competence emerge naturally and continuously in the context of the work being accomplished, rather than occurring as a specially marked event, such as a test. The success or failure of a task that has been performed is obvious and needs no commentary. To a large extent, the person who judges the apprentice's performance is the apprentice himself or herself rather than the expert. The apprentice, having observed the work sequence many times, knows what remains to be learned. Moving on to the acquisition of the next skill may be up to the apprentice and largely under her or his own control, rather than that of the master's. In other words, the apprentice tends to "own the problem" of moving on to learning the next skill.
6. Teachers and teaching are largely invisible. In apprenticeship learning—and during informal on-the-job training in modern American workplaces—it looks as though little teaching is going on. Teaching does not occur as an identifiable activity and whatever instruction the apprentice receives originates, not from a teacher doing teaching, but from a weaver/tailor/stockroom worker doing his or her work that the apprentice observes.

In sum, an apprenticeship situation consists of a community of experts and novices. Apprenticing is a process of being inducted or trained into the community of expert practice, whether the practice is that of tailoring, weaving, or farming. In the case of the very young child, the child is being inducted into the broader community—into the "way" of his or her native culture. Critical to this learning situation is that the "teacher" continuously engages in and is a master at the practice being learned. His or her performances constitute the standards of performance for the apprentice.

COGNITIVE APPRENTICESHIP AS A PARADIGM OF LEARNING

The Need to Modify Traditional Apprenticeship

Traditional apprenticeships, however, are not entirely transferable to a modern society for two reasons. First, practical work such as tailoring or weaving are visually observable to the novice, and embodied knowledge—the knowledge of the hand—is important. However, in many modern practices, whether reading, machine repair, management, mathematics, law, or computer-based machining, cognitive skills complement embodied knowledge in importance. Cognitive components of activity are ordinarily not visible.

Visually observable or "externalized" skills make them available to students and teachers for "observation, comment, refinement, and correction." Externalized skills bear a fairly transparent relationship to concrete products, such as the assembly of pieces into a shirt. This ability to see the relevant skills, procedures, and resulting products helps the student build a conceptual model of the complex target skill—to envision his or her ultimate performance goal. And the relatively transparent relationship, at all stages of production, between process and product facilitates the learner's recognition and diagnosis of errors, upon which the early development of self-correction skills depends. Applying apprenticeship methods to skills that are not particularly visually observable—in other words, to largely cognitive skills—means that ways have to be found to "externalize" processes that are usually carried out internally.

Today, many occupations that previously depended primarily on the skilled hand and the skilled eye now also require facility with symbolic material. For example, in traditional machining, responsibility for part dimensions and tolerances, metal properties, and tool use is literally in the hands of the machinists who have extensive knowledge of part geometry, metallurgy, output requirements, and tool functioning. Computerized numerical control (CNC) machines radically alter these processes of set-up, control, and operation—a decisive transformation that replaces manual set-up and control with set-up by symbolic command. Whereas the machinist working on a traditional machine reads an engineer's blueprint and then manually adjusts dials and levers to set up a particular operation, a machinist on the CNC machine reads the blueprint and then creates commands in a programming language to govern the machine's operations (Martin et al, 1990).

In the textile industry, when textile machines were mechanically-based, workers could visually observe how they operated. Working around them gave operators a sense of how to repair them, and the additional training needed to become a "fixer" was acquired on the job with little or no formal instruction. This situation has now changed. Most machines now have microprocessors and other electronic components. Since important machine components are not visually observable, operating the machines does not provide much of a sense of what it takes to repair and maintain them. Now, to understand, diagnose, and fix the new machines, technicians have to be able to represent their structures and processes symbolically in their heads. To do this they have to be able to follow complicated manuals, diagrams, and updates provided by the manufacturers.

Second, traditional apprenticeship is not entirely transferable to the modern world in that it presumes relative constancy in the activities being learned. Thus, it does not focus on developing the skills and knowledge that seem to be needed when domains are characterized by change and non-routine events. Tailors, midwives, or rug-makers encounter non-routine events, but the incidence of these events would seem to be much lower than in modern work, especially in economic sectors characterized by substantial international or domestic competition.

Greater volatility should increase the importance of two types of skills. One is higher-order cognitive skills, such as problem-defining, problem-solving, and knowing how to learn. The other is facility with the principles that govern a domain and that can be used to handle variations in the situation-specific manifestations of those principles.

Modifying Traditional Apprenticeship to Fit the Modern World

At the same time, traditional apprenticeships show what contextualized, effective learning looks like. Given the images of traditional apprenticeships, cognitive scientists have been able to invent analogies appropriate for learning less visible practices and those subject to change. Collins et al (1989) have proposed what they believe to be key elements of these environments, calling the emergent strategy "cognitive apprenticeship."

Cognitive apprenticeship modifies traditional apprenticeship to teach symbolically-based and therefore less observable activities, such as reading, writing, and mathematics. The term "cognitive" should not be read to mean "academic." The model ignores our usual distinctions between "academic" and "vocational" education, in that its objective is to train the novice into communities of expert practice, whether the practice is what the rest of us might call "academic"—for example, mathematics, or "vocational"—for example, interior design.[2]

Collins et al (1989) argue that the most important difference between traditional schooling and apprenticeship

is that, in schooling, skills and knowledge are abstracted from their uses in the world; in apprenticeship, they are continually used by skilled practitioners and are instrumental to accomplishing meaningful tasks. In other words, "apprenticeship embeds the learning of skills and knowledge in their social and functional context." Thus, their focus is on learning through guided experience, but emphasizing cognitive skills and processes, not just the physical ones that characterize traditional apprenticeship.

Collins et al (1989) identify characteristics of ideal learning environments. Their ideas hold on to the power of traditional apprenticeships, modified for contemporary activity, and eliminate the flawed characteristics of the standard K–12 paradigm of learning. The characteristics of effective learning environments are listed in Table 1.

Table 1. Characteristics of Ideal Learning Environments: Content

Target knowledge for an ideal learning environment includes domain-specific conceptual, factual, and procedural knowledge and three types of strategic knowledge. Schools and traditional apprenticeships usually focus only on the first type of content. However, the last three types are needed to operate effectively in, on, and with domain-particular knowledge.

- *Domain Knowledge:* The conceptual and factual knowledge and procedures associated with a particular subject, e.g., geography, repairing textile machinery, comparative literature, physics, accounting, architecture, radiology, contract law.
- *"Tricks of the Trade":* Called more formally "heuristic strategies," these are problem-solving strategies that experts pick up with experience. They do not always work, but when they do, they are quite helpful.
- *Cognitive Management Strategies:* These cognitively govern the process of carrying out a task and are also known as "executive thinking" skills or "metacognitive" skills. They include goal setting, strategic planning, checking for accurate plan executive, goal-progress monitoring, plan evaluation, and plan revision.
- *Learning Strategies:* These are strategies for learning any of the kinds of content described above. Knowledge about how to learn includes general strategies for exploring a new domain. It also includes strategies for getting more knowledge in an area already somewhat understood and reconfiguring the knowledge already possessed.

Table 2. Characteristics of Ideal Learning Environments: Methods

Teaching methods should be designed to give students the chance to observe, engage in, invent or discover expert strategies in context.

- *Modeling:* For students to model expert performance, the learning situation must include an expert's performing a task so that the students can observe and build a conceptual model of the processes that are required to accomplish it.[4]
- *Coaching:* This means observing students as they carry out a task and offering hints, support, feedback, modeling, reminders, and new tasks to bring their performances closer to expert performance.
- *Scaffolding and Fading:* "scaffolding" refers to the supports that the teacher provides to help the student carry out the task. Supports can take either the form of suggestions or help or actual physical supports, such as the short skis used to teach downhill skiing. "Fading" is the gradual removal of supports until students are on their own. Fading is critical to autonomous and independent functioning.
- *Articulation:* This includes any method to get students to articulate their knowledge, reasoning, or problem solving processes in a domain. It makes visible otherwise invisible cognitive processes. It also makes explicit assumptions that students bring to the learning situation.
- *Reflection:* This is any technique that lets students compare their own problem-solving processes with those of an expert, another student, and, ultimately, an internal cognitive model of expertise.[5]
- *Exploration:* This refers to any device that pushes students into a mode of problem-solving on their own. Forcing them to explore is critical, if they are to learn how to frame questions or problems that are interesting and that they can solve. This part of the model provides the opportunities for experiential feedback so key to learning.

Table 3. Characteristics of Ideal Learning Environments: Sequencing

Learning should be "staged" so that the learner builds the multiple skills required in expert performance and discovers the conditions to which they generalize.

- *Increasing Complexity:* Tasks and task environments are sequenced to require more and more of the skills and concepts necessary for expert performance.
- *Increasing Diversity:* Tasks are constructed so that they require a wider and wider variety of strategies or skills. This strategy helps students learn to distinguish the conditions under which they do (and do not) apply. (This principle is key to students' seeing transfer possibilities and their limits.)
- *Global before Local Skills:* This simply means staging the learning so that students first develop a "feel" for, sense of, a conceptual map of, the overall terrain before attending to its details. (In tailoring appren-

tices learn to put together a garment from precut pieces before learning to cut out the pieces themselves.) Having a mental image of the overall activity helps the student make sense of the sub-activity that he is carrying out. It also acts as a guide for the learner's performance.

Table 4. Characteristics of Ideal Learning Environments: Sociology

The learning environment should reproduce the technological, social, time, and motivational characteristics of the real world situations in which what is being learned will be used.

- *Situated (Contextualized) Learning:* This refers to students' carrying out tasks and solving problems in a way that reflects the nature of such tasks in the world. For example, reading and writing instruction might be situated in the context of an electronic message system that students use to send each other questions and advice.
- *Community of Expert Practice:* This refers to the creation of a learning environment where participants actively communicate about and engage in the skills evidenced by experts. In other words, the learning situation needs to include experts and learners; experts performing tasks; and learners being drawn into the community of expert practice by watching experts, working with experts to solve problems and carry out tasks, and coming to assume autonomous control over problems and tasks.
- *Intrinsically Motivated Learning:* This refers to the incentives that govern the learning situation. Intrinsic motivation arises when students are engaged with interesting or at least coherent goals, rather than for some extrinsic reason, such as pleasing the teacher.
- *Co-operative Learning:* This refers to having students work together to solve problems and carry out tasks. Learning through cooperative problem-solving is both a powerful intrinsic motivator and a way to extend learning resources. For example, in contemporary computer clubs nonexperts were able to use each other as "scaffolding" for increasing their command of computers. They pooled their fragments of knowledge about computers to bootstrap themselves toward expertise (Levin, 1982).
- *Competitive Learning:* This refers to giving students the same task to carry out and then comparing their performances to focus their attention on strengths and weaknesses. Learning in today's classrooms is competitively and usually destructively structured. For competition to be constructive, comparisons should be made, not on the products of student problem-solving, but on the processes that generate the products. The learning objectives for students should be defined, not as making no errors, but as learning to spot errors and using an understanding of them to improve. Combining co-operative and competitive learning can mitigate the destructive aspects of competition: for example, students might work together in teams to compete with other teams, thus letting them use team members as scaffolding and comparisons of team performances to focus attention on better ways to carry out a task.

Of these four building blocks, the *content* building block includes knowledge and procedures specific to a domain, a "domain" simply referring to subjects, such as Russian literature, photography, structural engineering, cooking, economics, dancing, or statistics. The content block also includes strategies for effectively using and expanding one's grasp of domain-particular knowledge and procedures. These strategies correspond roughly to what are called the higher order thinking skills, taught, not separately, but in the context of particular content.

The *methods* building block describes the work relationship of teacher and students—their roles and responsibilities. It also identifies ways of making visible and accessible to the students and teacher the reasoning, knowledge, and strategies that students bring to their problem-solving.

The third building block focuses on the *sequencing* of learning. It talks about deepening knowledge—increasing the student's expertise. It talks about broadening knowledge—understanding more about where and how the knowledge and skills can be appropriately used. It talks about how to stage the initial acquisition of knowledge—finding ways to let the student "see" the whole before trying to develop the subskills implicated in producing the whole. For example, being able to watch an expert tailor construct a garment gives students mental representations or cognitive maps of their ultimate goal. They can then use that map as an "organizer" for their early attempts to acquire the subskills involved in the expert performance.

The final block is the *sociology* building block. "Sociology" refers to reproducing in the learning situation the characteristics of the real world situations in which what is being learning will be used. The characteristics include the technology, the social relationships and incentives that govern the accomplishment of tasks in the real world, and the time frames for real-world tasks. For example, the learning situation should set up both co-operative and competitive incentives for learning. It should teach content in the context of real world problems.

Examples of Cognitive Apprenticeship

Instances of cognitive apprenticeships occur not just in the annals of cognitive scientists, but also in real world

school courses and projects, designed by real world school teachers. Although these examples come from schools, this does not mean that work-based apprenticeships cannot incorporate cognitive apprenticeship principles.

Redesigning the American Constitution. Salomon (1990) describes a project for studying the American Constitution. Recognizing that studying constitutions is not very exciting for eighth graders, the designers first thought about structuring the project so that the students could create a computer database that they could use to sort information, reconstruct it into newly invented categories, and so forth. However, they immediately asked themselves: Why would students want to do this? They realized that individuals rarely classify novel information and cross-tabulate it without having a motive, a reason, a purpose for doing so. "And how does one classify legal clauses, according to what criteria, in the absence of a clear purpose?" (p. 8). Salomon and his colleagues were struggling with the issue of meaning for the students, the problem addressed by authentic situated learning.

They created a purpose. The students took the positions of different stakeholders—the federalists, the loyalists, representatives from the different colonies (New York, Pennsylvania, Virginia, etc.), plantation owners. Working in teams of three, the students treated the Constitution as a draft, the study teams proposing changes in it according to their stakeholder perspectives. This gave them reason and framework for dealing with the Constitution in database form, inviting them to reclassify its legal clauses, compare them, and draw out their implications for their political positions. They then formulated proposed changes in the Constitution, to be introduced in subsequent inter-team debate.

In other words, the Constitution is not treated as The Word, but as a document that was originally built out of dynamic political forces and that students can rebuild in the same spirit.

The project culminated in a Constitutional Convention, where the teams, as delegations and under the guidance of George Washington (the teacher), debated the changes that they wanted adopted. Three students became clerks of the Convention to count votes and announce decisions, and other students served as an audience. Creating a position to take to the Convention generated opportunities for the students to articulate their positions, knowledge, reasoning, and problem-solving. It also let them reflect on their efforts by letting each student compare his/her own problem-solving processes with those of other students in the team. The Constitutional Convention created more opportunities for articulation, for reflection, and, because it had important elements of competition and public comparison, for focusing the teams' attention on the strengths and weaknesses of their performances.

Building and racing a solar-powered car. Students from Conval High School in Peterborough, New Hampshire, built and raced a solar-powered car as an applied science project (National Council on Vocational Education, 1990). The project demonstrates all four blocks of the cognitive apprenticeship model.

The project extended over nine months, an unusually long time frame for a school, but a realistic one for real world tasks. It culminated in the team's competition in a 234-mile, five-day race from Montpelier, Vermont, to Boston, a goal that created both cooperative and competitive incentives.

The project required the students to acquire and use a wide variety of skills spanning many academic and practical disciplines, including physics and mathematics, basic solar engineering, hydraulics, electronics, drafting, model fabrication, metal working, and welding. Ten models were built and tested before the students finally decided on a production design, the decision process requiring the students to articulate and reflect on the strengths and weaknesses of each model.

The students quickly learned the necessity for other skills as well. They had to acquire the business skills necessary to manage some grant funds. They also had to learn the English, journalism, and graphics skills needed for a public relations effort about the project. Perhaps most surprising to the students, they had to acquire the leadership, management, and interpersonal relations skills necessary to construct a rational division of labor to keep the project moving forward. Among the more significant outcomes of the management process was a negotiated decision to build the car for racing safety at the sacrifice of speed, a decision that forced students to articulate their positions, to reflect on the merits of those positions, and to cooperate with each other.

Mr. Bigelow, the instructor, had four educational goals: (1) the project should control curriculum in a way that enabled students to see worthwhile connections between their work and real environmental and economic problems; (2) the students would become managers of their own learning—in other words, they would learn what they needed to know to accomplish specific goals through team decision-making; (3) the project would integrate study across the curriculum, for example, the project's success depended as much on a solid PR effort involving journalism skills as on understanding the physics of photovoltaics and (4) the students would learn the necessity for building bridges to critical local resources to acquire the technical support and financial assistance required.

Reciprocal teaching to strengthen reading comprehension. Palincsar and Brown (1984) developed reciprocal teaching to increase students' reading comprehension, especially that of poor readers. Collins et al. (1991) observe that reciprocal teaching embodies several features of cognitive apprenticeship. The method involves modeling and coaching students in four strategic skills: formulating questions based on the text, summarizing the text,

making predictions about what will come next, and clarifying difficulties with the text. Both teacher and students first read a paragraph silently. Whoever is playing the role of teacher formulates a question based on the paragraph, constructs a summary, and makes a prediction or clarification. The teacher initially models the process and then turns the role of teacher over to the students, coaching them extensively at first on how to construct good questions and summaries and critiquing their efforts. The teacher ultimately fades into the role of monitor, providing occasional hints or feedback.

Poor readers improved their reading comprehension scores from 15 to 85 percent accuracy after 20 training sessions. Six months later they were still at 60 percent, recovering to 85 percent with one session.

Collins et al. (1991) attribute the success to several factors. First, the method engages the students in activities that help them form a new conceptual model of the task of reading. They are reading to understand what they are reading, and developing the critical ability to read to learn.

The second factor seems to be that the teacher models expert strategies in a shared problem context. Students can compare their own questions or summaries with the questions or summaries generated by the group. They can reflect on any differences, trying to understand what causes them. The third factor seems to be the provision of scaffolding. Finally, students assume the dual roles of producer and critic. They not only must produce good questions and summaries, but also learn to appraise those of others. By becoming critics as well as producers, students are forced to articulate their knowledge about what makes a good question, prediction, or summary. This knowledge then becomes available for use in their own summaries and questions. Moreover, once articulated, this knowledge is freed from its contextual binding and becomes available for use in different contexts.

Designing the six-room interior of an historical Victorian house. Stasz et al (1990) describe a high school interior design class where students had six weeks to complete a contemporary interior design for an historical Victorian house. They had to research the original house and the design tradition, draw the house, draft the floor plan, select furnishings and coordinate colors, and prepare boards to display the proposed design. Most of the students worked in teams of four to six people, but some worked individually.

To help students learn from errors, the teacher frequently provided active coaching and support. However, in general, she backed away from active coaching. She tried to structure the project assignment so that it naturally produced opportunities for students to learn skills such as "monitoring as you go."

She worked to foster what Collins et al (1989) call exploration. Although some aspects of the interior design project were constrained, she deliberately under-constrained the task to encourage students to create their own problems and solutions. She pushed students to the boldness and risk-taking associated with exploration. She told the research team: "If I had spoon-fed the kids, it would have defeated the whole purpose of the project; they would have never shifted gears. They were frustrated when they did not get the answer, but they learned that it's okay for them to have an opinion as long as it's backed by a rationale . . . Liking something is not enough" (p. 26).

* * *

We do not yet know how effective cognitive apprenticeship will be, especially if the question is about effectiveness in routine, as opposed to hot house, learning situations. However, the ideas are unusually well grounded in a century of thought and research, and small studies suggest the potential for spectacular improvements in learning.

At the same time, learning situations that reflect cognitive apprenticeship principles are not thick on the ground. Extending them in schools will require dealing with institutional, curricular, pedagogic, evaluation, and professional training issues. The magnitude of the changes required to shift from a traditional K–12 paradigm of learning to a cognitive apprenticeship paradigm cannot be underestimated. It will involve theoretical considerations as well as the practical consideration of location.

WHERE SHOULD APPRENTICESHIPS BE LOCATED: WORKPLACE, SCHOOL, OR SOME MIXED ARRANGEMENT?

The current explosion of interest in apprenticeship in the United States has conceived of it as work-based, not school-based, for several reasons. The German, Austrian and Swiss work-based apprenticeship systems are better-known in the United States than the school-based systems of Sweden, Denmark, or France. The U.S. Department of Labor saw the traditional, work-based, apprenticeship programs under its jurisdiction as a base for a work-based system that could be extended to younger ages and a wider range of occupations. It was also generally acknowledged that many school-based programs—even many vocational ones—are divorced from the needs of the workplace. Some do not connect with the knowledge and skills needed at work, and some do not reflect the ways in which knowledge and skills are used in the workplace.

Thus, a work-based system seemed a good solution. It seemed to eliminate the problem of coordinating work-oriented schooling with the workplace because learning and the workplace were coincident with one another. It

seemed to reduce the school-to-work transition problem for youth for the same reason.

Work-based apprenticeship presumes an apprenticeship learning situation and the workplace as the locus of that situation. These represent two separate assumptions; one does not logically require the other. The previous section argued for apprenticeship forms of learning, albeit modified to reflect the greater cognitive and theoretical demands of contemporary activities, especially in restructured workplaces. Still unresolved is the optimal location for cognitively-oriented apprenticeship. Although we associate apprenticeship with the workplace, it is a paradigm of learning that can be implemented in schools, workplaces, or some combination of school and work. It promotes the principles established in Chapter 1: programs should use work-based learning methodology and be connected to schools and, if programs are school-based, they have to include and build on real work experience.

We can evaluate possible apprenticeship locations using several criteria. (1) Is the interest in apprenticeship learning broad enough to support a national system? (2) Is the option organized to deliver effective learning? (3) Is it organized to deliver efficient learning? (4) Does it reflect the knowledge demands of the workplace and the work contexts in which knowledge and skill have to be used? (5) Does it develop broadly applicable knowledge and skills? (6) Does it blur the division between the academic and vocational educational tracks?

(1) *Is interest in apprenticeship learning broad enough to support a national system?* Neither workplaces nor schools appear broadly responsive to apprenticeships, but for different reasons. For employers the issue is their willingness to undertake coherent training of the less educated and the very inexperienced. Although these patterns could change, employers now tend to focus their formal training on the better educated and on the not-so-young (Tan, 1989). Thus, employers' training policies, staffing, and arrangements are structured for an older and better educated group than we envision for work-based apprenticeship. The fact that cooperative learning, a cousin of work-based apprenticeship, has remained a minor work-based educational alternative in the United States is consistent with these traditional investment patterns.

Employers' traditional training patterns reflect structural arrangements that isolated policy incentives cannot be expected to change. For example, a mass production organization of work generates the need to train technical specialists, supervisors, and managers (the older and better educated), not novices or experienced workers in the less skilled occupations (Berryman and Bailey, 1992). When companies shift from mass to flexible organizations of work, we see attendant shifts in their training patterns to include all workers. However, companies make these shifts in response to economic incentives far more powerful than any policies can be expected to generate.

The United States also differs from our competitor nations, such as Germany or Japan, in the social contracts between employers, workers, the educational system, and government. For example, American individualism seems to show up in a tenuous commitment of management and workers to one another, giving employers the flexibility to fire and employees the flexibility to change jobs. Relative to competitor nations, American policy is correspondingly fairly mute with regard to employers' freedom to fire, layoff, and contract work out. This cross-national policy difference manifests itself in various ways. For example, during recessions American companies tend to maintain stock dividends and fire workers; Japanese and European employers tend to reduce dividends and retain workers (Lichtenberg, 1992). The relatively tenuous ties between American workers and employers affect the incentives of both parties to invest in skills. Another national difference is how various social benefits, such as health care, are financed. Allocating the costs of health insurance to employers in the United States can further weaken employer-worker ties, in that it creates an incentive for employers to resort to contract workers who are ineligible for company benefits.

Although schools focus on the education of the young and inexperienced, the problem here is their receptiveness to apprenticeship forms of learning. Even a casual comparison of the traditional K–12 paradigm of learning with that of cognitive apprenticeship shows the major changes that will be required to replace one with the other. For example, curricula need to change; teachers' roles need to shift markedly, requiring retraining; evaluations need to include performance-based assessments, such as portfolios; the daily schedule needs to change to create the blocks of time required for students to work on problems of significant scope and complexity.

(2) *Is the location organized to deliver effective learning?* Work-based apprenticeship has tended to assume that if school-based programs are bad learning places for work, then workplaces must be good places. This may turn out to be true empirically under some circumstances, but is bad logic. In fact, observations of informal on-the-job training of the less educated also raise questions about the workplace as learning place. They show that informal on-the-job training can be catch-as-catch-can. Its quality depends heavily on who happens to be around to train. In work groups with high turnover, almost-novices are training novices, a situation that violates all models of good apprenticeship training. (This problem is analogous to "out of field" teaching in schools, as when the coach is drafted to teach chemistry.) Even experienced members of a group can only pass on their understanding of the job and the corporate context in which this is embedded.

This understanding is rarely monitored and can vary wildly (Scribner and Sachs, 1990).

At the same time, another Scribner and Sachs study (1991) shows that the key issue for the workplace as a learning place is no different than for school-based learning. How work or school activities are set up is what enhances or inhibits learning. For example, a company that organizes work or a school that organizes learning as a set of segmented tasks will limit what its workers or its students learn. (Companies with mass production organizations of work will be more apt to structure learning as segmented tasks.) Whether in the workplace or the schoolroom, what is emphasized and encouraged in the setting helps learners develop either a conceptual understanding or a highly routinized, inflexible set of responses. Since most companies follow a mass production organization of work, we may face a Hobson's choice between two worlds (schools and the workplace), neither of which is routinely well designed for powerful learning.

The inherent power of the location to motivate the learner also affects learning effectiveness. Collins et al (1989) note the motivating quality of a work-based option:

> . . . apprentices are encouraged to quickly learn skills that are useful and therefore meaningful within the social context of the workplace. Moreover, apprentices have natural opportunities to realize the value, in concrete economic terms, of their developing skill: well-executed tasks result in saleable products (Collins et al, 1989).

At the same time, actual school-based trials of cognitive apprenticeships show that intrinsically motivating learning situations can be set up in the school (Schoenfeld, 1988; the Vermont example). A motivational key seems to be whether the learning situation is organized around the natural learning system of human beings—around the fact that we are naturally sense-making, problem-solving, and environmentally interactive.

(3) *Is the option organized to develop skills and knowledge efficiently?* Here the school-based option may have an edge over the work-based option. Collins et al (1989) point out that the problems and tasks given to learners in standard, work-based apprenticeships arise not from pedagogical, but from workplace, concerns:

> Cognitive apprenticeship selects tasks and problems that illustrate the power of certain techniques, to give students practice in applying these methods in diverse settings, and to increase the complexity of tasks slowly so that component skills and models can be integrated. Tasks are sequenced to reflect the changing demands of learning. Letting job demands select the tasks for students to practice is one of the great inefficiencies of traditional apprenticeship (Collins et al, 1989).

Since a highly motivating work-based apprenticeship means that individuals learn whatever they are trying to learn quickly, the inefficiency of a work-based option seems to reside, not in the initial speed with which learning occurs, but in its potential for learning "holes" and unnecessary repetition.

(4) *Does the option reflect the knowledge demands of the workplace and the work contexts in which knowledge and skill have to be used?* A workplace location seems to be a winner here with two caveats. First, if a work-based apprenticeship system picks up a normal sample of workplaces, it will include many with traditionally organized work contexts. If one objective is to prepare individuals for a restructuring economy, the nature of the work contexts has to be monitored carefully.

Second, a key principle of cognitive apprenticeships—which were developed as school-based—is that they mirror the non-school conditions under which knowledge and skill are used. Thus, a school-based option can meet this criterion, but not as automatically or easily as the work-based option.

(5) *Does the option develop knowledge and skill that are broadly applicable?* We noted earlier that modern activity is relatively changeable and non-routine, requiring an arrangement of learning that develops higher order cognitive skills and an understanding of the principles that govern the domain under study. A school-based option would seem to have the edge here. A work-based option can be set up to develop higher order cognitive skills in the context of the domain being learned. However, the embeddedness of the learning within a work situation makes it harder to insure that learners grapple with issues and problems outside the limits of that situation.

At the same time a work-based option can be designed to develop broader skill and knowledge. Without extensive academic, professional, or even on-the-job training, people can achieve conceptual understanding on the job. Again, the issue is the nature of the individual's job responsibilities—how the work situation is set up. Some work activities, in and of themselves, are educationally rich. The question is the probability of finding such arrangements in the workplace versus the school.

(6) *Does the location blur the division between academic and vocational?* Parents, poor and rich alike, have clearly understood the society's message: "college"—and the high school academic track that gets you there—is the only routing destination that gives their children a shot at an economically viable future. In the absence of a national system organized around preparing students for middle/higher-skill jobs, anything other than the academic track and college amounts to no preparation, which at best translates into low skill jobs.

Thus, parents resist any reform that sounds as though it might preclude college for their children. They are willing to settle for the "general" track, a virtual wasteland, because it purports to give weaker students "academic," albeit applied academic, training. "Vocational," "workplace," or "applied" are all heard as warning bells. In

fact, early returns from some work-based apprenticeship demonstrations show that parents are reluctant to place their children in work-based apprenticeships. They see these options as foreclosing college for their children, whether or not they in fact do. (However, see the Hamiltons' contrary experience described in Chapter 3—ed.) A school-based cognitive apprenticeship, even if focused on an occupational domain such as interior design, blurs the division better.

In sum, on these six criteria, work-based apprenticeships and school-based cognitive apprenticeships have both advantages and disadvantages. A mixed strategy may ultimately turn out to be optimal, but what that strategy might look like is now unclear. We need much more experience with, and analysis of, work-based and school-based apprenticeships.

There is a final reason to think carefully about the location of apprenticeship learning. A fundamental impetus for work-based apprenticeships is that schools generally have done a poor job of preparing the non-college-bound. The question is whether we let the schools off the hook of taking educational responsibility for this large group of students. If the workplace turns out to be the learning place of choice for this group, well and good. However, we need to be careful that we do not resort to work-based apprenticeships to finesse problems with the schools. We are already paying for second chance programs and remedial college programs to get done what the K-12 system should have done properly in the first place.

Notes

1. Cognitive science is an interdisciplinary field that encompasses psychologists, linguists, anthropologists, computer scientists, philosophers, and neuroscientists. The work "cognitive" refers to perceiving and knowing, and cognitive science is the science of mind. Cognitive scientists seek to understand perceiving, thinking, remembering, understanding language, learning, and other mental phenomena. Their research is very diverse, ranging from observing children learning mathematics or experienced workers handling the cognitive demands of their jobs, through programming computers to do complex problem solving, to analyzing the nature of meaning (Stillings et al., 1987).

2. The subtitle of the authors' original paper on cognitive apprenticeship is revealing in this respect, "teaching the craft of reading, writing, and mathematics." The subjects might be seen as "academic," but their practice is defined as a craft.

3. Table 1, with some changes to simplify language is based on Collins et al (1989). Collins et al (1991) is a more accessible discussion of this table.

4. In cognitive domains, this requires the externalization of usually internal cognitive processes and activities. For example, an expert's exercise of cognitive self-management skills is normally a silent and unobservable activity. In cognitive apprenticeship situations, the expert (teacher) might model the reading process by reading aloud in one voice and verbalizing her/his thought processes in another.

5. An article on school reform in Vermont gives an example of reflection:

> "In Mrs. Rainey's eighth-grade algebra class at Shelburne Middle School in Shelburne, Ryan Galt, 13, swiftly explained with a lighted overhead projector how he got the solution to a problem. He calculated madly, his pencil flying through numbers as he talked. Suddenly out of the darkened classroom came the kind of sheer admiration usually reserved for a wheeling, over-the-head basketball jam by the Chicago Bulls guard Michael Jordan: 'Jeez, that's sweet,' cried Casey Recupero. He had had the same correct answer as Ryan, he explained, but was delighted by the other student's elegant methodology. As the class ended, clusters of students compared their approaches to the problem with the passionate ardor that teachers everywhere dream of inspiring. 'I had an interesting way of doing it, but I messed up,' one student said. 'That's because you did this here,' his classmate said, pointing out an error" (*New York Times*, April 24, 1991, p. A23).

V

GUIDELINES FOR EFFECTIVE SCHOOL-EMPLOYER LINKAGES FOR APPRENTICESHIP

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EMPLOYERS NEED HELP FROM SCHOOLS THEY DON'T TRUST

Employers realize that jobs require increasingly higher academic preparation. Yet, the skills of young people coming into the workplace are not keeping abreast with these needs. At the same time, the youth cohort is shrinking, and *qualified* young employees are increasingly difficult to hire. These changes have begun to impact business practices. While land costs and taxes were once the main factors affecting the location of a new office, firms now consider local high school quality and workforce availability.

Many employers are making good faith efforts to improve schools by creating business-school partnerships, spending (in the aggregate) large amounts of money for well-intentioned efforts. However, these attempts have not been satisfactory or productive because they lack a clear conception of how to improve student motivation and school effectiveness. Employers are concerned, but they are not sure what to do.

A long history of complaints and mistrust between schools and employers thwarts reform efforts. American employers have complained that youth have poor academic skills and work habits, and they blame schools for these deficiencies. Employers also worry that schools are unresponsive bureaucracies, unwilling to serve their needs. Meanwhile, high schools have criticized employers for not hiring their graduates or for hiring them only for menial jobs with no training or advancement potential. Many school staff also worry that employers will try to manipulate the school curriculum into narrow vocational training at the expense of academic skills (Useem, 1986).

Both kinds of mistrust are misguided and unproductive. In fact, employers and teachers have several shared interests. Both employers and teachers want youth to acquire discipline, motivation, and work habits. In every Gallup poll over the past 19 years, discipline has been identified as one of the top problems in public schools. Students' problem behaviors in schools—absenteeism, tardiness, disruptive behavior, insubordination, failure to do assignments, and substance abuse—are the same as employees' problem behaviors in workplaces. Therefore, employers and teachers share an interest in reducing these common problems.

Both employers and teachers want higher academic standards. While teachers think employers only care about job-specific skills, employers complain that they cannot find enough employees with the thinking and problem-solving skills required by today's jobs. Moreover, many employers do not want schools to provide vocational skills since employers can quickly provide these at work sites, and skills taught on a school's obsolete equipment must be unlearned and retaught by employers (Osterman, 1980). While teachers' concerns may have been true formerly, increased numbers of technical and clerical jobs that require a variety of academic skills have made employers more interested in a broad background rather than narrow vocational skills.

Employers' concern that schools are unresponsive bureaucracies ignores schools' strong responsiveness to colleges. Most high schools extensively interact with colleges, assist students' college applications, and revise

their curricula to respond to colleges' changing demands. Teachers are willing to impose and maintain high standards for college-bound students—particularly those who aspire to selective colleges—because they know that selective colleges expect high standards.

In sum, the high level of mistrust between schools and employers is based on faulty assumptions and jeopardizes cooperation. Many people have hoped that partnerships between schools and employers might overcome this mistrust and create more effective cooperation, but they cannot do it without a systematic look at the ways they presently interact and without comprehensive planning for a more productive relationship.

WHY FOCUS ON APPRENTICESHIP NOW?

The present enthusiasm about apprenticeships is appropriate because German apprenticeships work very well, and they seem to have outcomes that would be great improvements over this country's current labor market situation. Apprenticeships are attractive because they help schools and employers meet each others' needs: Schools promise to teach the academic skills needed for apprenticeships, and employers promise to recruit students with good academic skills into apprenticeships. Moreover, German apprenticeships seem to have several desirable outcomes—educated and disciplined youth, effective schools, good skill training by employers, and strong trust among these actors. However, it is not obvious what features of German apprenticeships the U.S. should copy to reap the same benefits. The first reaction—imitate the Germans exactly—is unworkable, for we will not restructure our schools to reduce college options. We must be selective about what we copy, but it is hard to know which practices to replicate. Apprenticeship is not just putting any student in any job. The specific features of the German system are likely to be crucial—which students are selected, how they are selected, which types of jobs offer apprenticeships, and what specific commitments schools and employers make to each other and to students. Apprenticeships are not a single decision effort. They are complex, they have many elements, and they require many choices. The task of learning from the German experience is more complex than it first seems.

Moreover, the excitement over apprenticeships may be overdone and too uncritical. Apprenticeship programs are not sure successes; indeed, some have been failures. Although the experience with apprenticeships indicates that they are a promising approach to youth training, it is important to be aware of the potential problems. The following section reviews some of the pitfalls of previous apprenticeship programs and considers what apprenticeships must do to avoid these. We then turn to some guidelines of effective school-employer linkages that help make apprenticeships successful.

PAST FAILURES SHOULD INFORM CURRENT PLANNING

As we prepare to enter the 21st Century, it is ironic that we are considering a practice that died out in the U.S. over 150 years ago. Youth apprenticeships were common in 18th century America, but they gradually diminished over the next century because of several shortcomings in the system. Similarly, in the 1920s, Japan created an apprenticeship system to deal with a serious shortage of skilled workers, but this system did not succeed. Examining the issues that confronted apprenticeship programs in the past can lead planners to avoid those problems now.

Youths' Failures. While German apprentices develop strong academic skills and work habits (Hamilton, 1990; Glover, 1983), 18th-century American apprentices often had poor work habits and poor discipline. Amid a general concern about youth "idleness, luxury, profanity, Sabbath-breaking, intemperance, lasciviousness, [and] wantonness," 18th-century employers often had to deal with "an apprentice who was insolent, idle, or disobedient" (Rorabaugh, 1986, pp. 44–5). Similarly, after setting up apprentice programs in the 1920s, Japanese employers still had difficulty, despite a high unemployment rate, finding youth with the academic skills and work habits needed for skilled jobs. Clearly, apprenticeships, in themselves, do not assure that youth will acquire the necessary academic skills and work habits.

School Failures. Although German schools prepare youth well for apprenticeships, Japanese employers in the 1920s felt that schools poorly prepared youths for their apprentice programs. Schools focused on educating the elite who would pursue higher education and professional occupations. Japanese youth who sought apprenticeships generally received a poor education in their schools. Like German apprenticeships, Japanese apprenticeships were meant to meet employers' needs for better prepared youth, but Japanese schools were only weakly connected with employers and were not very responsive to them. Apparently, apprenticeships do not assure that schools prepare youth for those positions.

Employer Failures. Another common complaint in apprenticeship systems is against employers—too little training and too much menial work. This was a common complaint in 18th century American apprenticeships, in the 1920s in Japan, and in the British youth training program in the 1980s. In each case, employers, eager to get apprentices as cheap labor, assigned them simple tasks,

like chopping wood, cleaning floors, and picking weeds in the family garden. Employers often exploited apprentices as personal servants. They gave them little training, and they withheld trade secrets in order to keep apprentices from becoming independent. Despite the success of German apprenticeships in providing good job training, this is not assured in apprenticeship programs.

Failures in Controlling Apprenticeships. In 18th century America, the states tried to create legislation that would assure that employers and apprentices would keep their commitments to each other. Laws were generally successful in enforcing employers' obligation to support apprentices financially, but employers' training responsibilities were not easily enforced. Parents were the only protection to keep youth from entering bad apprenticeships, but parents often lacked good information about the nature of the apprenticeships. Indeed, state guardians of parentless children often did a better job of getting children good apprenticeships than parents (Rorabaugh, 1986, p. 127).

These pitfalls do not indicate that these apprenticeships were total failures; 18th century American apprenticeships were often successful. But the important point is that apprenticeships do not necessarily eliminate problems. The most attractive features of German apprenticeships—educated and disciplined youth, effective schools, good skill training by employers, and strong trust among these actors—are not inevitable outcomes of apprenticeship programs. In fact, when these problems did occur, they tended to erode the effectiveness of previous apprenticeship programs. Since poor employer training, poor youth motivation, and poor youth education are serious problems in the U.S. today, we must be careful that they not undermine our new apprenticeships, as they have done in the past.

GUIDELINES FOR EFFECTIVE SCHOOL-WORK LINKAGES

To implement more effective forms of apprenticeship, we must identify which circumstances help apprenticeships avoid these pitfalls. Most significant is the nature of the linkage between schools and employers, particularly the incentives and commitments they offer each other. This linkage is likely to have the strongest effect on the success of apprenticeship programs. Analyzing two successful programs (in Germany and Japan) and one unsuccessful one (in the U.S.), we can identify four guidelines of effective school-employer linkages that encourage mutual responsiveness and reduce these problems (see also Rosenbaum, 1989 and Rosenbaum, et al. 1990).

1. *Effective linkage programs give students incentives to work in school.* The German system gives work-bound students strong incentives to work in high school. Schools provide relevant preparation because German high schools provide strong academic and vocational preparation to work-bound students (Osterman, 1988). Employers hold high school training in high regard because German employers trust students to have a dependably high level of vocational and academic skills. Students get help in finding jobs when they leave school because the German Federal Employment Office provides job counseling to 60–80% of youth leaving school (Arnow et al, 1968). Finally, and most important, school achievement pays off in better jobs because the German Federal Employment Office uses grades in deciding which students to recommend for various apprenticeships (Faist, 1992). German employers also select youth for apprenticeships partly based on their school grades and tests administered by the company (Konig, 1989; Faist, 1991). Therefore, students' school achievement—both academic and vocational—affects whether they get apprenticeships and which ones they get.

Students are well aware of these facts. When students seek apprenticeships, they know that their grades are the first information that is considered (Faist, 1990). Consequently, these practices create strong incentives for students to improve their school achievement. The Japanese system also gives work-bound students strong incentives to work in school. Despite Japan's difficulties in training youth to meet employers' needs in the 1920s, Japan eventually evolved a system that improved the school achievement and work habits of Japanese work-bound students. Japan implemented a system in which high schools directly influence which jobs their graduates got. Although America and Japan have similar proportions of high school graduates who directly enter the workforce (about 40%), American high schools help only 10% of these students to find jobs, while Japanese high schools help over 75% (Rosenbaum and Kariya, 1989).

Japanese high schools do not just give advice; they give access to jobs. Schools have long-standing relationships with certain employers who offer the same number of jobs to a school each year. These employers ask teachers to nominate the seniors with the best grades for their best job openings, and employers usually hire those nominees. These employers cannot choose among all interested students, only those selected by teachers, and students cannot apply to these employers without the school's nomination. Thus, youth compete for jobs before entering the labor market, and teachers make the first selections. Since the school's nomination is based on grades, these practices create strong incentives for students to improve their school achievement.

In contrast, most American work-bound youth do not see any reason to exert effort in school (Stinchcombe, 1964). While college-bound students have strong incentives to work in school because their grades determine

college admissions and financial aid, work-bound students lack such incentives. Most American employers ignore students' grades when they hire recent high school graduates (Crain, 1984). Large surveys have found no relationship between students' grades and their early wages, jobs, or unemployment in the years right after high school (Rosenbaum and Kariya, 1989, 1991). Ironically, while American employers urge work-bound students to get academic preparation, employers' hiring practices undermine their incentives to do so.

We often overlook the influence of incentives and exaggerate the influence of personal motivation. For instance, although many observers have noted Japanese youths' high motivation and attributed it to their culture, few observers have noted that the most motivated Japanese youth—the ones admitted to colleges—show a laziness, inattentiveness, and misbehavior in college that would not be allowed in American colleges. Their poor motivation and discipline does not arise from an impairment of their intrinsic motivational capacity; it arises because college graduates are hired based only on their colleges' prestige, not their college grades. When they have no incentive to work, Japanese college youth do not work. Interestingly, students in engineering and science continue working in university, but these are the only programs where professors' recommendations affect subsequent employment.

Few youth are so driven that they will work without incentives, and few are inherently incapable of being motivated. Most youth will work hard if offered an incentive they care about. Youths' poor motivation in school usually indicates that they do not see incentives. That is not a defect of youths' motivational capacity; it is a defect in the incentive structure.

The German and Japanese systems rely on an essential principle identified in Chapter One: To motivate work-bound students, linkage programs must give students incentives to work in school. Since the most important goals for work-bound students are good jobs, employers hold the key to their efforts. If employers offer better jobs to students with good grades, work-bound students would see incentives for school achievement.

2. *Effective linkage programs give teachers authority to impose high standards.* German employers give teachers authority to influence students' future work careers, and they expect teachers to set high standards for academic skills. Youth with poor grades do not get apprenticeships, and the best apprenticeships require the highest academic achievement. The emphasis on students' grades gives teachers a powerful influence over the apprenticeships and future careers of work-bound students.

The Japanese system gives even stronger influence to teachers. Japanese teachers actually select which students can apply to each employer. Moreover, although employers can reject a school's nominee, this is rarely done. Employers usually accept the students that teachers recommend because employers wish to keep good relationships with the schools. Japanese teachers are literally gatekeepers to the job world for work-bound students.

Japanese employers highly value student grades. Some employers value grades because they believe that academic skills contribute to youths' ability to handle skilled jobs. Other employers value grades, not because they care about the specific academic skills, per se, but because they believe that students who do well in school have demonstrated good work habits and the general competencies needed to learn on the job.

In contrast, American employers mistrust teachers and their evaluations. American employers, like much of the American public, blame teachers for failing to impose high standards of achievement and discipline. This criticism assumes that teachers like to have low standards and poor discipline. The assumption is usually false. Most studies indicate that teachers are extremely frustrated with the poor discipline in their classes and unruly behavior in their schools (Sedlak et al., 1986). Teachers do not like to have students be absent, tardy, disruptive, or inattentive in their classes.

The problem is not that teachers are failing to exert their authority. The problem is that teachers have little authority to exert since they are not authorized to bestow any rewards that work-bound students value. As a result of their limited authority, teachers must reduce their expectations for students' achievement and work habits. Teachers make an implicit bargain with students where they demand little of students if students will demand little from them: "In most high schools there exists a complex, tacit conspiracy to avoid sustained, rigorous, demanding basic inquiry" (Sedlak et al., 1986). As a high school senior reported, "As long as I don't cause too many hassles for teachers, they will let me get by and graduate" (Rosenbaum, 1976, 1978).

Teachers do not feel they can ask more of students because they lack the authority to enforce their demands. Nor do teachers think that lower standards will bother employers. Work-bound students can bargain with teachers to reduce standards because employers do not state any academic expectations other than the requirement of a diploma. Employers may grumble about students' academic skills and work habits, but employers do not do anything in their daily practices that would strengthen teachers' hand in imposing higher standards.[1]

In fact, American employers contribute to the problem they deplore. Voicing the mistrust that is common among employers, one employer commented, "I wouldn't give those teachers the power to recommend a good worker; they cannot even control their classes." This statement not only reveals a consequence of teachers' problem, but also its cause. Employers who ignore teachers' evaluations contribute to teachers' ineffectiveness by depriving them of any authority over work-bound students.

Yet, when teachers are given authority by employers in Germany and Japan and by selective colleges in the U.S., teachers demand high standards from students —and they get high achievement. When teachers are not given authority by employers—as is true for Japanese college teachers and American high school teachers of work-bound students—teachers lack authority to demand high standards from students. If American high schools had linkages with employers as they do with colleges, and if employers had high standards as selective colleges do, then teachers could influence work-bound students.

3. *Effective linkage programs give employers incentives to train youth.* In order to encourage employers to train youth, programs must offer employers appropriate incentives. The best incentive for employers is competent youth. If schools pre-select youth to assure employers of their competence, then employers will value these youth and will invest in training them.

German employers trust high school graduates to have a dependably high level of academic and vocational skills. One indication of this trust is their willingness to give 18-year-olds responsible jobs that Americans don't get until age 25 (Hamilton, 1987). In part, this is because employers feel that the German Federal Employment Office does a good job of pre-screening applicants, and they also believe that they get good information for making their hiring decisions from this office and from schools (Konig, 1989; Faist 1991).

Japanese schools also pre-select students before making nominations to employers, and they assure employers that they will maintain high standards. Knowing that employers will stop offering jobs to the school if the school dilutes its standards, a school will not nominate a questionable student even if the school has not filled its quota of nominations for that employer. Moreover, students feel an obligation to perform well in their jobs since they represent their schools. These quality-control processes reduce employers' risks of getting problem employees and give them more information than they could get if they hired off the street.

Partly as a result of these pre-screening processes, German and Japanese employers *prefer youth as employees.* They see youth as energetic, enthusiastic, receptive to training and fresh ideas and, of course, less expensive. Interestingly, American employers see young college graduates as having the same positive qualities, but they do not view high school graduates this way. In fact, American employers' low valuation of recent high school graduates is so common that it is not even questioned. American employers avoid hiring recent high school graduates because they see them as unskilled, unmotivated, undisciplined, and undependable.

Obviously, these negative stereotypes of youth are not inevitable youth attributes unless we assume that American youth are inherently inferior relative to their counterparts in other nations. Rather, these attributes are, in part, a byproduct of the way American work-bound youth are treated by schools and employers.

The third guideline, giving employers incentives to train youth, depends on a prerequisite—altering employers' view of youth. If employers view youth as untrainable, unmotivated, undisciplined, and undependable, they will see no incentive to train them. However, if employers see youth as energetic, enthusiastic, receptive to training and fresh ideas, and less expensive, then employers will see a strong incentive to train youth. If the latter view of youth is correct, as German and Japanese employers believe, then American employers are missing a valuable productive resource when they refuse to hire youth into responsible jobs for their first 5–10 years after high school. By giving employers access to that resource, and assuring them that youth have good skills, discipline, and work-habits, effective linkages can give employers strong incentives to train youth.

4. *Effective linkage programs create control mechanisms to assure that employers, students, and schools keep their commitments.* The preceding three guidelines stressed incentives. While incentives are necessary, they do not guarantee that employers, students, and schools will do what is expected. For instance, the fact that employers have incentives to provide training does not assure that they will provide it. If employers, students or schools do not meet their commitments, control mechanisms are needed to monitor performance and to take appropriate actions.

Three kinds of mechanisms may be useful for these purposes. *Informal contracts* between employers and schools can allow violators to be punished with reductions in benefits. In Japan, employers form semi-formal contracts with schools in which schools are expected to nominate high-quality students for their best jobs; and schools know that if their nominees disappoint an employer, the employer will offer the school fewer jobs in future years. As a result, schools make sure they comply with employers' expectations. If an employer offers 20 jobs, and the school only has 15 qualified students, only those 15 will be nominated. An ongoing commitment with an employer means that schools can anticipate future interactions with that employer, and this counterbalances any pressures coming from a personable student or a politically influential parent. Indeed, students' social class background has little influence on jobs in Japan (Rosenbaum and Kariya, 1991).

Government controls can monitor training programs and provide protections or sanctions. The German government can levy a payroll tax if a firm fails to provide its share of apprenticeships (Hamilton, 1987). While government regulation cannot easily monitor poor training, it can monitor poor outcomes. The German government requires all employers to stand behind their apprentices.

If a youth does not get a job after completing an apprenticeship, then the employer must retain that individual and pay them a full worker's wage.

Certification systems can monitor the quality of graduates of schools and apprenticeship programs. German schools provide achievement testing of all students so employers have objective measures of the academic skills of apprentice applicants (Osterman, 1988). At the end of apprenticeships, an examination is given that measures occupational competence, and this affects a student's next job (Cantor, 1989). Japan takes certification even further. Academic tests influence employers' preferences for particular schools. Employers offer more and better jobs to higher-ranked schools, as measured by average achievement test scores. In addition, employers evaluate students on their grades and test scores. Occupational skill certification tests also have great influence in Japan. Japanese employers encourage employees to improve their specific skills. Employees take courses, get vocational training, and take occupational skill tests throughout their careers. These tests are used to certify the range of individuals' skills to an employer and to signal to potential customers the firm's capability to do highly skilled projects.

PRACTICAL ACTIONS—CAN THE U.S. INCORPORATE THESE GUIDELINES?

Although these guidelines for school-work linkages obviously work well in Germany and Japan, some critics worry that American employers and schools cannot duplicate practices from other nations because of differences in cultures and circumstances. The following section considers how American employers and high schools could make these kinds of commitments to each other.

Can employers make hiring commitments to schools? Many American employers believe that commitments reduce efficiency. They do not want to commit themselves to hiring employees until they need them, and they worry that long-term hiring commitments with schools would limit a firm's flexibility to respond to changing circumstances.

However, in practice, firms often make commitments when it is necessary. When supply shortages arise for a needed commodity, firms solicit bids from potential suppliers, and they make long-term commitments to one or a few suppliers to assure adequate access to the needed commodity. While they would prefer to avoid long-term commitments, firms make these commitments to assure their ongoing operation. The projected shortage of trained workers is a typical supply shortage. This process would seem to apply, so we would expect employers to respond in a similar manner. Obviously, they have not yet done so.

Curiously, employers have responded to the skill shortage by complaining about their workers' skills and criticizing schools for turning out poorly prepared students. Complaining and criticizing are not the ways firms respond to other kinds of shortages. If a manufacturer found his widget supplier to be producing inferior products, he would not make Sunday speeches about the sad state of widget production.

Instead of complaining about schools and youth, employers could respond to the shortage of well-trained youth by following customary business practices. Employers could inform local schools about their skill needs and promise to hire a certain number of graduates from high schools that could assure high-quality graduates. When schools cannot deliver enough students at the requisite standards, they can still promise to nominate only students who meet the standards. Schools can also promise to give the employer reliable information about their nominees.

Of course, as in any contract, sanctions may be needed for enforcement. Employers can terminate or reduce their commitment to schools if they become dissatisfied with the school's products, and schools will be accountable to the public for maintaining their relationship with employers. Similarly, schools can terminate the contract if employers do not give youth good jobs and training.

Can schools make commitments to employers? Some critics doubt that schools can build linkages with employers because often employers think of schools as bureaucracies that are unresponsive to outside demands. While schools' relationships with colleges demonstrate that they can be responsive, some employers and teachers believe that the goals of employers and schools are so different that there is little basis for cooperation.

The Japanese system provides strong evidence against these preconceptions. Japanese schools are as bureaucratic as American schools, and probably more rule-bound, but they are highly responsive to employers. In Japan, teachers in charge of job placement maintain direct contact with employers; they monitor employers' job needs every year; and they keep track of how the school's previous graduates have done. They also make sure that the school nominates highly qualified students for job vacancies so that employers will continue to offer jobs to their graduates in the future. Moreover, teachers maintain this responsiveness to employers without sacrificing academic standards. On the contrary, this relationship with employers is used to reinforce academic standards. Nor is this foreign to the American situation. Top-rated graduate schools of management often have strong linkages with employers, in which the same employers regularly recruit similar numbers of graduates every year, and MBA

students with the best grades get the best jobs and the best pay (Burke, 1984).

In recent years, some public high schools have tried to increase student achievement by improving linkages with employers. The Boston Compact is one example. In 1982, Boston businesses promised to increase youth employment if the Boston public schools improved average student outcomes. Employers offered jobs to Boston's high school graduates, but the schools have not done so well at improving student attendance or achievement (Farrar and Cippolone, 1988).

Although certainly a step in the right direction, the Boston Compact may have failed to have a significant impact because, while it gives *schools* incentives to improve average achievement, it does not give *students* incentives to improve their achievement, as the Japanese system does. A few Boston high schools and employers, however, acting on their own, have extended the idea. They informally agreed to use grades, teacher evaluations, and attendance to determine who gets highly prized jobs, and they report that students responded well to these incentives (Rosenbaum, 1989). The apparent success of these informal arrangements suggest that Japanese linkages are a viable option for the U.S.

Although American public schools rarely have linkages with employers, they do have many other linkages. High school counselors often develop long-lasting, trusting relationships with college recruiters from certain colleges, and their evaluations may carry strong weight with colleges. Like their Japanese counterparts, American counselors won't recommend a student with substandard grades to a college recruiter who visits every year for fear of jeopardizing their relationship. Moreover, standardized tests (SAT and ACT exams) are used as a check on counselors' recommendations and grades in the U.S., as they are in Japan. These similarities are not surprising: Much of Japan's system was modelled after the U.S. system. The only difference is that Japan extended our college admission system to jobs, a step we have not taken.

One model of how to create school-employer linkages can be seen in private post-secondary technical schools (Virginia Mills, 1977, and research in progress). This proprietary school views its goal as serving two "markets"—students and employers. To serve students, this school has an active placement office that does an extensive range of activities. Initially, the placement office disseminates various kinds of information to aid students' planning: information about job opportunities in their field, jobs recent alumni have gotten, companies recruiting for those jobs, and tips on career planning. Later, information gets more specific. The placement office informs students about the steps in the recruitment process, specific companies that will visit the campus, and extensive information on interviewing techniques, resume preparation, career self-appraisal, self-presentation at interviews, typical recruiter questions, and techniques for locating prospective employers in their home towns. The placement office reviews and critiques students' credentials, resumes, and cover letters. Students register for placement assistance and ask to meet with particular recruiters who are scheduled to visit the school. As interviews are going on, the placement office learns of student difficulties in interviews, and counsels them how to improve future interviews.

To serve employers, the placement office maintains contact with hundreds of companies that employ appropriate personnel. The placement office solicits recruiter visits by mailing letters describing the training graduates receive, the quality of the school's graduates, and the help the school offers to recruiters. Interested employers are sent resumes of all graduates from the program in which they have expressed interest, and then employers are contacted by telephone. The placement office offers extensive assistance to recruiters including space for company presentations, employment tests, and private interviews, scheduling of interviews, and transcript information on interviewees. When job offers are made, the placement office makes sure that graduates respond in a timely fashion. The placement office also helps identify aspects of jobs that most appeal to students, preselects students by interests and talents, extends recruiting hours into the evening so out-of-town recruiters can finish in one day, and helps recruiters understand why they lost a desired candidate.

The school makes extensive efforts to assess its programs. The president and deans of the school meet with recruiters to get feedback on programs, students, and changing industrial requirements. The school staff visit employers and former alumni about changing job requirements and the appropriateness of the school's curriculum. The school offers faculty members sabbaticals in industry so they can catch up with changes in the field and incorporate those changes in the curriculum.

This school provides a good example of the many ways that a school can build incentives for employers to recruit from the school. This school's success is indicated by its high job placement rate (over 92% within 90 days of graduation). In contrast, less than half of high school graduates in a national survey were employed at graduation, and most (58.3%) of those were only continuing in the same part-time jobs they had in high school (Nolfi, 1978).

Obviously, some of the school's activities are more narrow and technical than a public secondary school. But these extensive activities are not totally foreign to public high schools. High school counselors do similar activities for college recruiters and for their college-bound students. What this example shows is that it is possible to do many of the same activities for employers and work-bound students.

Of course, a private proprietary school differs from public high schools in some important respects. It is selective,

taking students with the motivation and financial resources to pay the tuition and taking students who have acceptable achievement. Public high schools cannot be selective on any of these grounds. A post-secondary school can offer advanced technical training tailored to unmet needs of employers. Most public high schools cannot offer advanced technical training. Yet, even if public schools only offered strong academic skills, they could respond to important unmet needs of employers.

STEPS FOR EMPLOYERS

We have proposed that effective linkages require: (1) student incentives, (2) teacher authority, (3) employer incentives, and (4) control mechanisms. Employers can share the responsibility by taking these four steps: *show students that some desirable jobs are available to them, hire students before they leave school, hire based on grades, and confer authority to teachers by cultivating dependable "supplier linkages" with schools.*

Employers can show that some desirable jobs are available to students. Students will not see any reason to acquire math and writing skills if they can only anticipate a job flipping hamburgers when they graduate. Employers must give some good jobs to recent graduates, jobs that offer training and responsibility and require the skills learned in school. These jobs will be stronger incentives if they are clearly on a career ladder to better jobs. Although employers are reluctant to hire employees under age 25 for responsible jobs, firms must end these age limits if high school students are to see some incentive to acquire work habits and academic skills. Such changes would help students see a path from school to work that makes schoolwork relevant.

Employers can hire students before they leave school. Rather than letting youth fend for themselves and flounder in the labor market, employers and schools could collaborate in the hiring process. Employers could tell schools about openings, training, and apprenticeships, and the kinds of youth they intend to train or hire; they could ask schools to recommend promising students; and they could make hiring selections while students are still in school, so schools could help advise students' choices and employers' selections. If hiring occurred while students were still in school, schools could help work-bound students to find jobs, training, or apprenticeships just as they help college applicants; and work-bound youth would not have to face long periods of job search, job hopping, and involuntary job turnover.

Employers can hire based on grades. This would give employers better information about students' skills and work habits than they can get from any other source. This can also create incentives for work-bound youth to work in school and to acquire basic skills, and it can put these incentives under the control of teachers so they have authority over students.

Employers can authorize schools to influence students' work options. Employers are already cultivating partnerships with schools by contributing volunteers, equipment, and money. But these partnerships rarely contribute to teachers' effectiveness. By directing their contributions in ways that support teachers' authority, employers would make schools more effective.

STEPS FOR SCHOOLS

Schools can reduce the work-entry problems of work-bound students and bolster the authority of teachers by offering the same services to work-bound students that they now offer to the college-bound: *developing and maintaining strong ties with employers, advising employers and students, and making their evaluations useful to employers.*

Schools will be more effective if they have strong ties to employers. The Boston Compact did this by having an employer group (the Private Industry Council) select career specialists who worked in the schools and who were in charge of placing students in jobs (Farrar and Cipollone, 1988). This new job was created because it was felt that guidance counselors are too busy advising students' course and college selections to help with jobs. These career specialists know employers' needs and are trusted by employers so they can effectively place students in jobs. This, in turn, makes them more effective in encouraging school achievement and in giving teachers greater influence over youths' careers.

Schools can help advise employers and students. While employers usually assess applicants based on only a brief interview, schools can draw upon extensive information about students to recommend qualified students to employers, just as they do for colleges. By pre-selecting job applicants, schools could improve employers' confidence in the quality of employees they are hiring. On the other hand, school advising could greatly improve students' confidence in their first job choices, thereby reducing their job turnover, since work-bound students are at least as confused about their choices as college-bound students. Schools could also help work-bound students to find jobs, training, or apprenticeships, just as they help college applicants.

Schools can make their evaluations more useful to employers. Schools should make the course titles, abbreviations, and grading systems in transcripts easier to understand, and educational organizations should work to develop a standard transcript that is comparable across schools. Grades could also be adapted to be more useful to employers. Instead of giving only one kind of grades, schools could give two kinds of—the standard achieve-

ment grades and "employability grades." Employability grades would be more motivating to students in the bottom half of the class for whom traditional achievement grades are only demoralizing. Qualities measured by the employability grade—such as commitment, perseverance, cooperativeness—may be more important to employers in filling certain kinds of jobs, and they give employers information about work habits that they cannot easily assess in other ways. Moreover, separating these two kinds of grades would make each more valid since teachers are often tempted to raise the grades of low-achieving students who work hard (Rosenbaum, 1976, 1989). As more schools use alternative assessments, including narrative grading and portfolios, prospective employers should have a more comprehensive picture of student achievement than just a letter grade. In addition, attendance and tardiness should be included in the student profile available to employers. These additional grades indicate to students that not only academic grades, but work habits, count for future employment.

These reforms require additional efforts and commitments by all parties, but they also confer great benefits. For the many concerned teachers who are searching for ways to motivate students, these reforms provide incentives that can engage students and provide meaningful benefits. For students, who dream of good jobs but see no actions they can take to get them, these reforms tell work-bound students that their school efforts will improve their chances of getting good jobs. For employers, who anticipate a shortage of good employers, these reforms make schools more effective in preparing and prescreening their job applicants.

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Note

1. Of course, teachers still control diplomas, which students need to get jobs. However, all-or-nothing rewards like diplomas can only encourage students to satisfy minimum requirements, and failure is not a credible threat against what Theodore Sizer has described as a "common front of [student] uninterest," since teachers cannot fail all students if performances are "uniformly shoddy"(Sizer, 1984). Moreover, teachers are unlikely to fight to maintain standards for work-bound students when employers don't care enough to use grades for hiring. Incremental rewards like grades are far more effective at motivating people than all-or-nothing rewards, but not if they don't affect valued outcomes. The motivation and discipline problems of work-bound students indicate how ineffective grades currently are.

VI

CERTIFICATION OF WORK COMPETENCIES

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THIS CHAPTER IDENTIFIES THE CENTRAL FEATURES THAT SHOULD be included in a system for defining and certifying workplace skills. The United States has virtually no experience with a large-scale system for certifying the skills of new entrants or experienced workers. Thus, after reviewing the reasons for setting up such a system, we describe the Japanese system, which has many of the goals currently proposed for the American system. Finally, we conclude with a discussion of design issues that surround the industry- and occupationally-specific certifying boards now being proposed for the United States.

Competency for the world of work-relevant knowledge and skills divides into four kinds:

First are foundation knowledge and skills, including "tool" skills such as reading, writing, mathematics, speaking, listening, and the higher order cognitive skills, as well as knowledge of subjects such as science.

Second are generic workplace skills, which are important across occupations and industries. According to the recent U.S. Labor Secretary's Commission on Achieving Necessary Skills (SCANS), these include working with resources, people, information, systems, and technology. For example, for "resources," SCANS (1991) listed "identifies, organizes, plans, and allocates resources" (time, money, materials, facilities, and human resources). "Interpersonal" was defined to include "participates in a team, teaches others new skills, serves customers, exercises leadership, negotiates, and works with diversity."

Third are industry- or occupation-specific knowledge and skills, such as the skills needed to be a radiological technician or a bookkeeper.

Fourth are firm-specific knowledge and skills, such as knowledge of the bookkeeping system used in a particular company.

We see a national certification system as encompassing the second and third types of skills (generic and industry- and occupation-specific). We already have testing and certifying systems for the foundation skills, although substantial effort is being expended to improve these tests. Skills of the fourth type (firm-specific) are, by definition, idiosyncratic, and outside the scope of any national, public certification system.

REASONS FOR IMPLEMENTING A SKILLS CERTIFICATION SYSTEM

There are several reasons for implementating a skills certification system. Such a system *permits evaluation of program quality.* Work-based programs vary greatly in quality, and they are hard to monitor because much of the training occurs in highly dispersed work sites. Skill testing permits policy-makers to identify good programs and improve (or eliminate) bad ones.

Skills recertification makes work-based programs a valid alternative approach to learning. For students who have difficulty learning in school, tests can show their skills acquired in work settings. As we shall show, by ratifying skills learned at work, these tests can provide alternative routes to attaining work-skill competence.

While work-bound high school students now have little incentive to learn in school because employers ignore their school achievements (Rosenbaum and Kariya, 1990), a certification system used by employers provides clear incentives for youth to learn skills. (See Chapter 5 for a complete discussion of incentives.)

Skills certification can help overcome employers' mistrust of youth. Many employers do not hire new high school graduates into jobs offering training, advancements, job security, and better wages ("the primary labor market") because they consider youth to be poor workers (Lester, 1954; Malm, 1954, Hill and Nixon, 1984; Osterman, 1980). A survey of employers found that from 50% to 75% of employers in 10 U.S. cities reported that they did not hire youth under age 20 for full-time time jobs (Gavett et al. 1970). Indeed, several Fortune 100 corporations have policies against hiring applicants under age 25 for full-time jobs (Hamilton, 1987; Rosenbaum, 1989).

Despite employers' concerns about youths' unstable productivity, research finds that young employees are as productive as older employees (Rhodes, 1983; Waldman and Avolio, 1986). That youth are capable of greater productivity if given the chance becomes obvious when we look at other nations which do not share American attitudes about youth. By the age of 19, many German and Japanese youths have jobs that Americans are not allowed to hold until their mid-20s, and they perform these jobs very well (Hamilton, 1990; Rosenbaum and Kariya, 1989, 1991). A certification system could help employers have confidence in youths' capabilities. If employers were committed to this system, then they would be willing to hire certified high school graduates into good jobs and salaries.

A certification system encourages employers and employees to invest in more on-the-job training. In traditional apprenticeships, apprentices earn a lower wage during the training period, because at the end they receive certification that is recognized in the labor market. Since most on-the-job training does not provide such certification, employees are reluctant to accept lower wages during the training period for fear that they will not recoup their investment. Employers, for their part, are reluctant to finance training because they lose their investment if the trainees leave. As a result, in the absence of certification, there tends to be too little investment in on-the-job training (Stern and Ritzen, 1991). A certification system will make employees more willing to accept training wages because they can have more confidence that their training will be recognized. Employers also can be less fearful of losing trained employees if they know they can hire certified workers who have been trained by someone else.

If appropriately designed and used, *skill certification tests could be helpful to minorities.* While some people have raised concerns about the bias of skill certification tests, performance-based tests are likely to be less culturally biased than the paper-pencil aptitude tests that sometimes inadvertently depend upon cultural knowledge. Moreover, employers currently hire few youths, and even fewer minority youth, for desirable jobs, so minority youth have little to lose and much to gain if these tests could overcome employers' prejudices. While testers must be vigilant against the potential risks of bias, tests could potentially have great benefits for minorities who ordinarily are poorly served by schools and regular hiring procedures.

A MODEL FOR A HIGH-SKILLS SYSTEM

Currently, there is considerable interest in the proposal of the *America's Choice* report (NCEE, 1990) for a two-staged system that builds high-level vocational skills on a strong base of academic skills. Indeed, the state of Oregon is initiating such a system. We can get a better understanding of how such a system might operate by looking at Japan, which has established an actual system that does this.

Although Japan has a different culture, the basic structure of Japanese schools was largely designed from the American system during the American occupation after World War II. Both Japan and the U.S. have reached the "universal" stage of secondary education and the "mass" stage of higher education (Trow, 1961). In 1981, 95% of Japanese youth graduated from high school (even though they are not required by law to do so), while 85% of American students did so. About 46% of American youth and 37% of Japanese youth enrolled in college or other post-secondary schools. Therefore, work-bound youth are about the same portion of the youth cohort in Japan and in the U.S. Indeed, Japan makes a better comparison with the U.S. than does Germany, where a smaller percentage of youth pursue higher education after high school and where the school curriculum is more specialized (Teichler, 1985).

Like the *America's Choice* report, Japanese employers are clearly committed to the idea of academic skill prerequisites of vocational skills. The most desirable employers hire high school graduates based on academic achievement, and then give youth vocational skill training and tests after they advance to jobs requiring specific skills. The most desirable employers seek youth from highly ranked academic schools and students with high academic grades and test scores, which employers consider to be indicators of ability to adapt and learn (Rosenbaum and Kariya, 1989). Although vocational high schools exist in Japan, employers usually prefer to hire graduates of academic high schools and then teach them specific vocational skills.

Even in vocational high schools, academic courses have a strong presence. The Ministry of Education stipulates that at least one third of school hours should be devoted to academic subjects, and in practice, these subjects consume about half the total school hours and can be quite rigorous. For instance, in industry-related subjects, students learn calculus in the third year.

Although employers want youth to get occupational training, they do not press teachers to introduce narrow occupational skill training in high schools. Japan stresses academics in school and leaves vocational skill training to come later, after youth enter the workforce. Japanese employers believe that youth who have learned strong academic skills, strong motivation, and good work habits in school will learn job skills more easily and quickly.

Work-skill tests are sometimes conceived as an alternative to academic skill tests. In contrast, like the *America's Choice* report, the Japanese system makes academic skills prerequisites to strong work skills. In Japan, work skills are built upon, rather than substituted for, academic skills.

The German system is also built upon a strong emphasis on academic prerequisites. While German apprenticeships offer practical skill training, in interviewing students for apprenticeships, the first question employers ask is about students' grades (Faist, 1990), and the answer determines which apprenticeships students get. The most desirable apprenticeships, those training the most valuable skills, select only students with strong school records who have mastered basic skills. Students with weaker academic records get apprenticeships in small firms or in occupations that offer training in less valued skills (e.g., bakeries), and some students get no apprenticeships at all (30% in the early 1980s, 10% in the early 1990s). Thus, while hiring for first jobs is often based on the value of youths' apprenticeship training, the quality of youths' apprenticeship training is previously determined by their academic skills in schools. Therefore, the German apprenticeship system is less different than it seems from the Japanese system or the two-level achievement system proposed by the *America's Choice* report.

American and Japanese observers might wonder if German occupational specialization at age 16 narrows students' choices too early. Currently, some German policymakers are considering whether their youth lack the general skills needed to adapt to radical changes in the workforce that might be expected over their lifetimes. Indeed, some German researchers are now conducting a large study of the Japanese work-entry system to examine whether the Japanese system creates a more flexible workforce.

Other European observers have also voiced this concern. While the German apprenticeship system is a successful model, some doubts have been raised about whether it prepares youth to adapt to dramatic changes in the occupational world. As an Organization for Economic Cooperation and Development (OECD) report has noted, technological changes, uncertainty, and job changes require teaching more general skills, including academic skills, so that employees are able to respond to changing demands in the workplace (Furth, 1985).

The above evidence suggests that occupational skill training has little value at the high school level unless it is preceded by strong academic skills. Apprenticeships are not offered to German youth until they have attained academic competence, and even in Germany there are concerns that specialization is occurring before youth have attained adequate mastery of general academic skills. Similarly, occupational skill training is not stressed in Japan until youth have completed a highly academic curriculum in high school. Japan and West Germany provide two different examples of the kind of two-staged system proposed by the *America's Choice* report. Both systems are based on the premise that if youths' skill training is not built on a strong foundation of basic academic skills, there will be serious costs for youths' careers and the national economy. Both systems provide ways for youth to acquire strong vocational skills after receiving strong academic skills. The following section describes how this is done, with particular reference to the Japanese system.

HOW CAN OCCUPATIONAL TESTS AND STANDARDS BE DEVELOPED?[1]

Work-skill tests raise many issues about how they should be devised, how they should be used, and how they should be weighed relative to academic tests. Our aim is not to recommend the Japanese system, but rather to identify choices and alternatives that its system suggests as possible approaches to the development of occupational tests and standards.

1. *Vocational certification does not relate to high school youth.* In Japan, nearly all people taking these tests are over age 20 and have been at work for two or more years. Students are not expected to gain these skills in high school; they are expected to gain good basic achievement in high school. Both employers and government concur in this expectation. In particular, employers do not encourage schools to teach job skills. Employers expect to train youths' job skills after hiring them, and self-development through correspondence courses is widespread among working Japanese. In the matter of determining the standards for basic academic skills, employers do not pressure high schools to narrow their demands.

2. *Employers have the major influence on tests and standards.* In the U.S., employers certify and admit new members. This system arose from the control by guilds, crafts, and other occupational associations over certifying competence, often through apprenticeship experiences. One disadvantage of this approach is that training positions may be rationed and allocated in ways that favor members' kin and thus discriminate against other groups. Low-income and minority youth have suffered from this kind of discrimination.

In contrast, the Japanese system is determined by the consumers of these skills—employers. Employers have a clear interest in knowing that their employees possess the skills required for their jobs, so they take the lead and have the major influence over the construction of skill tests. In Japan, a firm's customers demand high quality products so firms have a strong interest in recruiting highly capable employees. Thus many firms have developed tests to select capable applicants.

3. *Government aids in setting and enforcing skill standards.* In the U.S., the federal and state governments set standards for professional licenses in medicine, law, psychology, and other professions, but not for most other occupations. In Japan, central and local governments set standards for many skilled occupations. There are two kinds of rationales for government involvement.

In areas where there is a public interest, government may establish standards for occupations. Thus, since the oil-crisis of the 1970s, the government has insisted on energy conservation training for certain occupations. Large factories are required to have qualified energy managers to improve the use of fuels, and the Ministry of International Trade and Industry (MITI), organized the syllabus, the curriculum, and the examinations to obtain qualifications for this occupation. Correspondence courses are organized by a center set up jointly by MITI and industry. Other occupations are similarly controlled by national, prefecture, or city regulations about pollution control or safety.

Government also sets high standards to improve quality and efficiency. In conjunction with government's role in inspecting product quality to meet export requirements, government may set occupational standards for high quality and efficient production methods. One way of doing this is by giving formal recognition to the skill-testing procedures of private firms. After one or a few employers have already established tests and standards for an occupation, government may adopt these tests and standards. This leads to consistent standards, clear messages to employees about what they need to know, and efficiency in maintaining and updating procedures instead of redundant efforts by several employers.

However, rather than trust businesses uncritically, government often calls upon schools, colleges, or occupational associations to assist in the process. Some occupational associations were formed explicitly for the purpose of running the competence tests (e.g., the Japan Shorthand Writers' Association, the Japan Welding Engineering Association, etc.), and their expenses are maintained from the fees charged to test takers.

4. *Tests certify employee value and firm quality standards.* Although marketability is less important in Japan since job mobility between firms is discouraged, it is still an important consideration in some sectors of the labor market. Construction is one area where mobility is common, and individuals upgrade their skills so they can get better jobs. Similarly, some clerical workers choose to take tests to improve their proficiency so they can get better paying jobs. Shorthand-writers, for example, can rise from fifth to first grade, which makes them eligible for court stenography, and raises their salary and job opportunities. That explains why testing continues at a high rate over the work career. Obviously, this would be an important motivation if Japan's test system existed in the U.S.

However, the most common reason for taking the test is because employers ask employees to get additional proficiency so the company will have higher quality products and may get new orders from quality-conscious customers. In particular, firms that regularly purchase from a certain manufacturer will state quality standards for their purchases, and these standards often include statements about the number of employees with certified skills. Similarly, government agencies sometimes require employers to have a certain number of employees with certification at some skills to increase the firm's efficiency or to meet safety or pollution standards.

Interestingly, the U.S.-Japan trade negotiations have been one reason Americans have become aware of the need for quality standards for employee skills. In the first year of the U.S.-Japan trade talks, Japanese negotiators repeatedly mentioned these concerns, and Americans ignored them, assuming they were incidental. However, American trade negotiators and American employers are now aware of the need to upgrade and monitor the quality of the workforce if this country is to produce goods of sufficient quality that Japan will purchase them.

5. *Tests certify work-acquired skills, not specific courses.* The major purpose of skill testing in Japan is to raise the proficiency of people who already have jobs and to ratify skills learned at work. Tests often require that a person have 1–2 years in a job before taking the test, and the level of practical proficiency is presumed to accompany this amount of experience in the job. The skills required for the practical portion of tests are usually acquired on a job. Tests provide a standardized way to demonstrate a person's level of accomplishment.

In addition, tests usually have a written component, which requires additional study. What is particularly noteworthy is that these tests are not tailored to any school curricula, even courses in vocational high schools. Only a small fraction of test takers have been in any vocational school training course, and few had been in a vocational program specifically relevant to the test they took. People often get very different jobs than they were prepared for in school (which is also true in the U.S.). Although some people take a short course to prepare for the written component of the test (e.g., 10 sessions over 5–10 Saturdays), most people acquire this knowledge by studying a textbook on their own. Sometimes individuals can be

exempted from the written test in some fields by attending courses and taking small tests for each portion of the course. But regardless of the ways that schools and courses could possibly contribute to the written part, the dominant fact is that there are rarely any formal schooling requirements. The examination does not specify *how* one acquires knowledge; it only certifies *that* one has acquired it.

6. *Tests demand a high level of knowledge, work habits, and skill.* As previously described, most tests have two parts: written and practical. The written part is comprehensive and asks a wide range of content questions about the job, materials, standards, laws, etc. For instance, hairdressers must know health laws, some knowledge of anatomy, physiology, and diseases, and basic physics and chemistry (knowledge of heat, electricity, chemical properties). They must also know basic barbering or hairdressing theory, information about razoring angles, type of curls (curling at roots or ends), chemical properties of cosmetics, etc. Although this may seem excessively demanding compared to American requirements, the Japanese see it as an assurance of professional pride and proficiency.

The practical portion requires examinees to perform certain tasks. The practical portion for hairdressers requires tests of hair cutting and various treatments. Examiners judge the organization of tasks, skill of execution, and quality of the outcomes. For welding, standardized size and materials are welded, and the welds are tested on site and also sent away for X-ray tests in a laboratory. Again, the concern for quality is paramount.

The examiners for the welding test are a panel of 20 experienced members of the welding society. They come from business, government, and post-secondary schools (including university engineering departments) and are paid a small fee for the day, which comes out of the examinee's test fee (which is often paid by employers).

7. *A certification system requires governance of testing and standards.* One way that the government encourages people to take these examinations is to pass laws requiring certain types of businesses to employ a certain number of people with certain qualifications at a certain grade level. That procedure is only used where public safety is at stake. In other cases, the government can give official recognition to the right of certain bodies (usually an occupational association) to set standards and test individuals' ability to meet them. This is the more common way to raise the proficiency in certain vocations.

The occupational associations are sometimes formed at the encouragement of a government ministry (e.g., MITI). Each association may be a 1–3 person office with a council of 20 senior members of the occupation. The former receive low pay, and the latter receive great honor but only token fees for their service. A great variety of such associations exist.

An alternative model is to have the tests run by a government agency. The Ministry of Labor runs tests for 129 trades, including woodwork, machine maintenance, tire retreading, well-digging, metal refining, etc. Some are at several grade levels. Lower grade tests are set locally, based on a national curriculum, and the certificates are signed by the prefectural governor. Higher grade tests are administered centrally for the nation, and the certificate is signed by the Minister of Labor.

The Japanese system does require a complex infrastructure to execute testing. Sometimes the testing is administered by the government, sometimes by a separate occupational association (which may have been started for this purpose by a government agency), and sometimes by an employer. In any case, considerable effort goes into the formation of the test, and the test must be updated and continually administered every year.

LESSONS FROM JAPAN

The Japanese system suggests specific lessons about how to implement a testing and standards system:

- *Three ways to form tests and standards*: by employers who will be doing the hiring, by professional associations, or by governmental initiatives to adopt the actions of one of the above or to initiate a new professional association to propose tests and standards. In Japan, tests and standards for employees are a logical outgrowth of employers' and governments' concerns about the quality of products.
- *Two kinds of tests*: written and practical. These tests not only examine knowledge and skills, but also work habits(especially work habits regarding quality), which are clearly important to American employers.
- *Several uses of tests*: determining entry jobs, ratifying acquired work skills, enhancing the market value of employees, and providing alternative routes to accomplishing work skill competence. However, Japan does not let these tests undercut incentives for academic skills, which continue to have overwhelming importance on careers.
- *The need to keep tests updated.* Tests are reviewed by practitioners every year to make sure test content is current and to monitor for unusually high or low pass rates.

The Japanese examinations are particularly relevant to the idea of testing vocational skills acquired in co-op job experiences. Since these examinations test knowledge and skills learned on the job or related to the job, they do not test the curricula in school courses. Most tests explicitly require relevant work experience before one can take the examination, but few require explicit schooling, courses, or degrees. Of course, one may choose to learn

the knowledge required by the written test in courses, and that would be true in the U.S. as it sometimes is in Japan.

These tests also have the advantage of allowing continuing opportunity for individuals to gain the relevant knowledge and skills after schooling and while they are working, and thus to improve their qualifications, status, and market value. These tests also allow qualifications to be acquired in small packages of narrow training in particular jobs and specific occupational knowledge, rather than in a full degree program that requires 2–4 years of full-time study. As such, these tests are more accessible, and they are more workable for those lacking the desire or finances for extensive schooling.

We must stress that one key reason Japan's system works is because of the high level of basic academic skills in Japan. All tests presume a level of reading, writing, computing, and thinking skills tc answer the questions and do not replace the need for academic skills in school. Rather, they add another reason to gain academic skills while adding other kinds of proficiencies that can be gained in one's job experiences.

As cautioned at the outset, tests provide an alternative route for showing competence; they should not be a barrier. Youth must continue to have the chance to show their capability in schoolwork. Moreover, the introduction of vocational skills tests should not be used to belittle academics or to encourage students to ignore schoolwork. That would be counterproductive to youths' opportunities, employers' needs, and the American economy.

SETTING UP AN AMERICAN SYSTEM OF CERTIFICATION

In recent years, steps have been taken toward developing a certification system in the U.S. The United States currently has a tangled system of certificates and licenses awarded for occupational competencies—for example, in the health occupations. However, many are state-specific; the criteria for earning them vary by state; and their credibility to employers varies. The following section outlines issues that must be considered in moving to a national system.

It is now acknowledged that any national system of serious, coherent preparation for work requires national standards and markers, particularly for youth who do not attain college degrees. Thus, proposed policies for creating such a system include national skill-defining and skill-certifying boards. These are envisioned as boards for industry- and occupation-specific skills.[1] They may ultimately include a board that focuses on generic workplace skills, such as those identified in SCANS.

Purposes of the Boards

Boards that identify and certify types and levels of generic, industry, or occupation-specific competencies required in the workplace can serve several purposes. One is *to help organize and structure the demand side for those who acquire solid intermediate skills.* Serious, coherent preparation will not affect labor market outcomes if it does not affect employers' hiring and wage decisions, and taxpayers and individuals will not invest in this kind of preparation if there is no evidence that employers value it.

National skill-defining and certifying boards cannot create a market response. Employers respond now to certificates and licenses that are legally mandated, as in many health occupations, but the relevant policy question is their voluntary use of certificates. In voluntary circumstances, these boards can create preconditions for a market response—for example, by ensuring that employers are committed to the skill-defining and standard-setting process and by showing that the certified skills actually predict improved workplace performance.

These boards might also be able to work with various networks of quality-conscious companies to create incentives for other companies to value skill-certified employees. For example, a group of companies that won the Baldrige Award (a national award for implementing total quality management principles) has agreed to require their suppliers to apply for the Baldrige, thus increasing the number of companies that focus on the quality of labor inputs and processes. We saw earlier that Japanese firms, which regularly purchase from a supplier, state quality standards for their purchases, and that these standards often include statements about the number of employees with certified skills.

A second mission for these boards is *to set the standards for and to provide continuous evaluation of educational programs via the process of certifying program graduates.* Thus, these boards can serve an accountability function for publicly financed programs and a consumer information function for students choosing among training programs.

A third purpose is *to establish steady communication between skill-developing and skill-using institutions.* At the turn of this century the presidents of Columbia and Harvard Universities helped to create what is now known as the College Board. Their objective was to simplify, systematize, and communicate colleges' skill requirements for college entry to high school students and educators. Almost a century later, the country seems to need analogously visible and organized information about the skills required for workplace entry and for jobs that require middle and high skills.

Analogs to the College Board could help to make employers visible and organized customers of the

schools, just as the College Board helped to make colleges visible and organized customers of high schools. Colleges are more salient customers of high schools than employers. In other words, students and educators customarily organize their activities around post-secondary education. We are consequently in a situation where the education system is stunningly ill-equipped and undisposed to understand the skill implications of the economy, as these affect all students, both the college-bound and the work-bound.

Designing Credentialling Boards

A surprising number of important design decisions have to be made in setting up these national boards. To increase the chances that these boards fulfill their intended purposes, these design issues should be debated.

What functions should these boards have? These boards can have broader or narrower functions. Core functions would seem to include: (1) defining and updating generic or industry/occupational skills by benchmarking them against best international practice; (2) establishing the levels of performance that individuals need in these skills; (3) conducting validity studies of workplace skills to insure that performing these skills well in fact predicts better workplace performance; and (4) certifying, themselves or through designated agents, individuals' possession of these skills.

Additional functions are: (5) acting as a forum and common meeting ground for employers who use the skills and for those who develop them; (6) working to get employers and educators to "buy into" their certifying processes—for example, as mentioned earlier, working with quality-conscious companies to add skill-certified employees as conditions of purchase from suppliers; (7) accrediting training programs; and (8) designing training curricula to develop the skills that the board certifies.

When should individuals be allowed to apply for certification tests? Competitor nations stress the importance of obtaining solid foundation skills prior to occupational experiences and training that generate the skills for which certificates can be awarded. Thus, as we saw, the Japanese certification system does not relate to high school youth. Work skills are built on, not substituted for, academic skills. The German apprenticeship and certification system builds on solid education in foundation knowledge and skills (Faist, 1990).

New York State's Task Force on Creating Career Pathways for New York's Youth decided to recommend a system of three benchmarks: the Career Pathways Certificate, or CPC (mastery of the fundamental academics and SCANS-like work-readiness skills, usually achieved by age 16); a high school degree (demonstrated mastery of academic and work-readiness skills beyond the levels required for the CPC); and Professional and Technical Certificates, awarded for sub-B.A. industry- and occupationally- specific skills. Only those who have achieved the first two degrees (or are working toward the high school degree) are eligible to work toward professional and technical certificates. Thus, the Task Force makes occupational certificates contingent on evidence of having acquired solid foundation skills.

What framework should boards use to organize skill standards? What are the lowest and highest levels for which standards should be set and certificates awarded? Should the levels include the professional level?

Singapore has set up a well-defined career ladder of certificates: professionals, who possess university degrees; sub-professionals and technicians, who have earned technician diplomas or business studies diplomas by attending a polytechnic or a technology institute; junior technicians, who have earned a technician certificate or business studies certificate; and tradesmen, who have earned national trade certificates or other certificates in commerce or in basic vocational training.

The United Kingdom works with five skill levels: preliminary; intermediate; craft/journeyman; supervisor/technician; and professional. In contrast to these countries, New York State's Task Force on Career Pathways for Youth has just recommended a non-baccalaureate system of Professional and Technical Certificates.

For the United States, we see an advantage and several disadvantages to a certifying system restricted to sub-baccalaureate skill levels. The advantage is that it focuses attention on the skills required for middle-level jobs, skills around which we have had no national consensus. The disadvantages include that a system restricted to the sub-B.A. level reinforces the distinction between the academic and vocational tracks. It also means that the credentialling system works with truncated career pathways. It will not show individuals how far they might go and what they need to know to get there, thus making it less useful as a certification system for experienced workers, as opposed to new labor force entrants.

What are the implications of the restructuring economy for conceptualizing skills? A restructuring economy seems to imply a certifying system that prevents splintering and proliferation of certificates; balances "practical" and "theoretical" content; and includes certificates at "professional" or "advanced" levels to encompass experienced as well as entry workers.

The reduction in job categories within modern workplaces seems to imply broader skill categories. All European countries are reducing the number of and broadening the occupations for which they train and certify. For example, in Germany the 42 traditional trades in the metalworking industry have dropped to six. The Swedish training system, which now offers about 30 vocational "lines" related to broad occupational groups, plans to cut the number to about 20 to allow a broader education in the

first year. Denmark has reduced its offerings from 270 to 100 programs in eight main occupational fields.

The greater flexibility required of workers and the need to be able to engage in retraining seem to imply less emphasis on industry-specific practical skills and more on theoretical content. For example, as noted, Japan's Ministry of Education stipulates that even its vocational high schools devote at least one third of the school hours to academic subjects. In practice, these subjects consume about half of the total school hours and can be quite rigorous—for example, calculus in industry-related subjects. As we detailed earlier in this chapter, Japan's certifying tests not only embody high standards of knowledge, skill, and work habits, but are also divided into practical and written sections—allowing for organizing their knowledge for effective task performance and determining if candidates understand the more theoretical dimensions of their work.

Finally, the blurring of earning and learning characteristic of modern economies implies that certifying systems apply to the more advanced skills of experienced workers. For example, as mentioned earlier, in Japan testing continues at a high rate across the work career, not only in response to changed skill requirements of the workplace, but also for career advancement purposes.

How do national boards accommodate existing standards, licensing, certifying, and accrediting processes? Any national certifying system enters a thicket of existing standards, certificates, and licenses. National standards for some professional occupations, such as doctors and lawyers, are under the control of the occupational associations. Mandatory licensing requirements for many occupations are often set by state government boards. Licensing has resulted in a hodge-podge of requirements that differ across states, and for which there is little reciprocity across states. Industry-wide specifications of skill requirements show up in several ways —credentialling, program accreditation, and curriculum design—with some industries using all three approaches.[2]

One possible solution is to have national boards review and accredit existing credentialling systems that would fall within their substantive jurisdiction. For example, as mentioned earlier, Japan's government may give formal recognition to the skill-testing procedures of private firms, adopting their standards and tests as standards for the industry or occupation.

Should certifying processes be based in any way on completing recognized formal training? Certifying processes can be linked to formal training. Or individuals can be allowed to try for, and be awarded, certificates simply on the basis of demonstrated knowledge and skill. The second strategy gives no consideration to "seat time." It thus increases the number of ways in which individuals can meet standards. It also encourages formal training programs to focus on what should be their goal: developing skills that meet workplace standards.

As we saw, the Japanese use a modified form of the second strategy. The practical parts of tests often require applicants to have worked one or two years in a job. However, the written components are not tailored to any school curricula, and applicants often prepare for these tests on their own.

How should these boards be governed? Should these boards be public agencies, some blend of public and not-for-profit, or a not-for-profit organization, with or without an associational basis? The boards will have a national focus. If they are public agencies, they will probably have to be part of the federal structure. They might reside in one of the departments, such as the U.S. Department of Labor or the U.S. Department of Education, or be set up as an inter-agency organization.

There are several pros and cons of federal governance. It is not clear how acceptable federal governance would be to employers. A sense of employer ownership of these boards is key to their success, and American employers are wary of the federal government.

To be credible, skill-defining and certifying bodies also have to be free of actual or perceived control by interest groups, including political parties and politicians. Federal groups can be insulated from politics and still be funded by, and held accountable to, the public interest, the U.S. Bureau of Labor Statistics being an example. However, these situations involve special arrangements that have to be continually protected.

It is hard to get things done within the federal government. For example, commissioning the research and development (R&D) programs needed by these boards means working within the government's cumbersome procurement regulations. On the other hand, central, regional, and local governments are important players in the certification systems of several competitor nations. For example, as discussed, the Japanese government sets standards for many skilled occupations, especially when these standards are in the public interest or government wants to improve quality and efficiency. It works with private firms, schools, colleges, and occupational associations to assist in the standard-setting and credentialling process.

Another governance possibility is what the Europeans call QUANGOs —quasi-autonomous non-governmental organizations. Without using this term, the United States has similar organizations: private agencies that handle public functions, often with a special relationship to government that eases subsidization by the government. For example, the National Academy of Sciences is a not-for-profit corporation, but it is chartered by the U.S. Congress. It receives no annual appropriation, but has a sole source justification for research projects. The Corporation for Public Broadcasting is another such organization.

Such a special arrangement might make sense for these certifying boards.

Finally, these boards could be not-for-profit organizations, with or without an associational basis. Under not-for-profit governance they could be part of existing national not-for-profit organizations or free-standing organizations with a national focus.

In the United States skill-defining and certifying bodies are usually not-for-profit and free-standing, not public and not tied to other organizations. For example, the American Board of Medical Specialties, the National Board for Professional Teaching Standards (NBPTS), and the College Board are all not-for-profit and free-standing. The reasons seem fairly obvious: these Boards need to be credible with disparate constituents and thus independent of any one.

The not-for-profit option allows these boards to be associations. The College Board is an association with about 2,800 members. An association has unique features that may be particularly useful to these certifying boards. It provides a natural way to convene groups that normally do not talk with each other and that do not understand, let alone necessarily share, one another's goals. If shared goals are helpful, if not key, to the success of the skill-setting and certifying process, an associative form provides a forum for airing differences and producing a deeper and wider acceptance of a board's goals.

How should these boards be organized? This question is about structure and membership. Structure depends partly on the focus and functions of these boards. Should these boards have a core umbrella group that provides services such as research and development, quality control, and the administration of sub-boards? How do these boards keep the sub-board structure from multiplying and fragmenting? What case should an occupational group or industry group have to make for a board to create a sub-board and invest resources in defining skills, setting standards, and awarding certificates?

Membership depends partly on the qualifications framework, the governance arrangements that are selected, and the focus and functions of these boards. For example, if employers are to see the certifying system as credible and to begin to use certificates, they need a sense of ownership of these boards. If these boards benchmark their skills against the needs of restructured workplaces, some share of employer members might be drawn from companies that are Balridge Award winners.

How should these boards be financed? These boards require two financing stages: start-up and routine operational costs. While the start-up costs depend on these boards' focus and functions, they include administrative and R&D costs. The start-up R&D bill depends heavily on whether these boards just set standards and accredit others' certifying processes, or whether they also have responsibilities for certifying processes. If they handle the certification process, the R&D bill depends on: whether the assessments will break new ground or can be taken "off-the-shelf"; the number of certificates for which assessments have to be designed; and the number of different assessments that are used for each certificate.

The National Board for Professional Teaching Standards has a five-year start-up period (1988–1993) and estimates that the R&D costs of designing assessments for 30 different teacher certificates will cost about $50 million. The capital costs of bringing the assessment system on line are in addition to the R&D costs. The American Board of Medical Specialties has designed an assessment for a new specialty (emergency medicine) at a cost of $3 million. Start-up costs can be financed by a special Congressional appropriation, foundations, and corporations.

Routine operating costs include at least administrative and on-going R&D costs. Countries finance these costs in different ways. In Japan, applicants pay a fee to take the test, government pays a matching amount, and industry provides examiners and materials without charge. Singapore funds its Skills Development Fund by levying companies that have created low value-added jobs instead of high value-added jobs. The levy is one percent of the earnings of every worker whose monthly earnings are $375 or less. Employers pay the full levy.

In cases of U.S. industry certification or program accreditation, industry primarily funds the cost of developing standards, often in response to strong union contracts. When tests are used to certify skills, individuals usually pay the fee.

Notes

1. The authors of this section are indebted to Dove and Sako (1989), Koike and Inoki (1990) and to Professor Takehiko Kariya at the University of Tokyo for his suggestions.

2. A number of players are involved in the design of industry and occupational boards, for example, the National Governors' Association, the U.S. Department of Labor's Commission on Work-Based Learning, and the U.S. Department of Education's Office of Adult and Vocational Education.

3. The National Institute for Automotive Service Excellence, the Printing Industries of America, the Air-Conditioning and Refrigeration Institute/Gas Appliance Manufacturers Association, and the Associated General Contractors are examples of industry-wide specifications of skills.

VII

CONCLUSIONS AND IMPLICATIONS FOR POLICY AND PRACTICE

James E. Rosenbaum, ***Northwestern University***

MANY SCHOOL-BUSINESS PARTNERSHIPS, AIMING TO PROVIDE YOUTH with better academic and work skills preparation, portray apprenticeships as a promising approach—not only to encourage and support the half of our high school graduates who will not attend college, but also to bolster a flagging economy. However, as we have seen in this report, apprenticeships are not a magic bullet. Instead, we have recommended a careful look at apprenticeships here and abroad and have described a range of experiential education efforts that contribute to our knowledge about how apprenticeships or apprenticeship-like programs function and what circumstances best predict their success. From this analysis of the theory and practice of apprenticeships and other forms of work-based learning, we developed a set of principles that should guide the planning and implementation of programs:

- Programs should use work-based learning methods that build upon school learning and are connected to schools.
- School-based programs should build upon work experiences.
- Experience-based teaching in classrooms should develop cognitive as well as practical skills.
- School-work linkages should reward school learning and effort with good jobs.
- Credentialling procedures should identify clear standards and certify attainment.

Programs that proceed without incorporating these principles may lead to disappointing outcomes, even those modeled on the German or Japanese systems, if they train narrow skills without preparing youth for more demanding and complicated work. Other programs will poorly integrate academic learning and work experiences, and youth will fail to learn academic skills or how to apply academic skills in work settings. In suggesting standards for judging apprenticeships, we have also outlined some ways to work toward achieving these standards.

Chapter 2 noted that if jobs are properly selected and supervised, they will demonstrate the relevance of knowledge and skill acquired in school, and work can reinforce commitment to school rather than undermine it. In describing the range of school-based programs that build upon work experiences, this chapter showed that school supervision of jobs has positive effects on education. It identified key elements of co-op programs—training agreements and training plans for each student. It detailed the key responsibilities of the coordinator—finding suitable placements, identifying suitable students, negotiating training plans, monitoring students on the job, and offering related instruction.

In addition, we saw how academies, an increasingly common experiment across the U.S., help students appreciate and benefit from the relationship between school and jobs. Students from academy programs see for themselves how their school lessons and work requirements are connected, without having a supervisor oversee their work experience.

These conclusions have implications for all school-work programs, including apprenticeship programs. Well-trained coordinators and special classroom discussions are necessary to help students make connections between their school lessons and their work experiences. But employing coordinators and developing new job-based curricula take time and money; and, since pay-offs are hard to see in the short-run, they are prime candidates for cut-backs in austere times.

Chapter 3 reviewed ways that work-based learning methods can build upon school learning and increase student motivation. While traditional school methods often

decrease motivation for students because students feel that school is disconnected from reality, work-based learning increases motivation for learning because job tasks have real consequences and bring youth into working relationships with adults. Work-based learning also shows students how school learning affects a productive process.

However, this chapter cautioned that routine, closely-supervised, undemanding work is mis-educative, especially in jobs without adult co-workers. To contribute to students' learning, job experiences must offer opportunities to apply academic skills, to work with and learn from adult co-workers, to face challenges, to engage in problem-diagnosis, problem-solving, and consideration of alternatives and consequences, and to have an opportunity to reflect on their experiences. These are important elements of successful work sites in any apprenticeship or school-work program. New theories about the workplace suggest that employers may find that redesigning existing jobs to have these qualities will be more motivating to their adult employees and may make their operation more flexible and productive.

In addition, workplace instructors, including the teachers who participate in work-based education program, have multiple coaching responsibilities: demonstrating, explaining how and why, critiquing, and modeling problem-solving; and workplace mentors facilitate school-to-work transitions: initiating youth into the workplace culture, giving career advice, and helping resolve problems. These new roles for adults require training and support so they know how to incorporate these new activities and can become effective instructors, coaches, and mentors.

Chapter 4 focused on the cognitive component of apprenticeship and set forth a theory of experience-based teaching and learning for all classrooms. Of course, this kind of teaching requires a radically different approach than occurs in most classrooms today. This chapter outlined four traditional practices that mitigate against effective learning: passive learning, fragmented learning, fact-based/right-answer learning, and noncontextual learning.

In suggesting how apprenticeships—and all experiential learning—would be more effective, the chapter described how teachers and work-site instructors can modify the traditional apprenticeship model to include characteristics of an ideal cognitive-based paradigm by looking at the content, methods, sequencing, and sociology of apprenticeship learning. Finally, this chapter addressed a practical problem of planning—where to locate work-based programs.

Chapter 5 noted that part of the reason for the effectiveness of apprenticeship learning is that youths' learning is linked to the attainment of adult work roles. In traditional societies and in German apprenticeships, these linkages are an important component of successful apprenticeships This chapter proposed guidelines to improve student motivation to achieve in school, increase teacher authority for imposing higher standards, and promote employer commitment to training youth. It also suggested practical actions for encouraging employers and schools to improve communication and to make commitments to one another that will serve their respective needs. These links require real commitments, so employers and schools often avoid making them when they set up school-work partnerships, but they have demonstrated benefits for all parties.

Chapter 6 recommended that a certification system would improve the linkages between schools and workplaces and would build trust between educators and employers. The Japanese model presents several design issues for an American system. That model opens opportunities by allowing individuals to gain certification for skills learned at work, and it allows skills to be improved in short "mini-courses" which are shorter, less expensive, and more manageable than full degree programs. Current efforts along these lines are proceeding in the U.S. and will be a resource that local programs can use in the future. While employers must be involved, ultimately a testing and standards program is a common social good whose benefits would be shared across the society.

Most Americans fear excessive control, bureaucratic pettiness, and test biases from such a system. But the opposite is also a great concern—without some tests and standards, youth have no goals to strive for except the empty credentials of a diploma or degree. This undercuts teachers' efforts to require standards since students know that they must only do the minimum requirements to obtain a diploma. When solid and comprehensive credentials, along with grades, determine future possibilities, recent graduates who seek employment will realize that "nearly failing" grades are not good enough. Word spreads quickly that school performance matters.

Tests and standards should pose high standards and must include practical performance tests as well as paper and pencil tests. Performance tests are expensive, but there are ways of making them feasible. The Japanese system is administered by a mix of current practitioners and recent retirees, an idea that could be translated to the U.S. In addition, researchers have noted that workers in their middle and later careers often want to mentor younger workers and give something back to their field. These program features could provide an outlet for this desire, while conferring prestige to the participants.

IMPLEMENTATION REQUIRES INCENTIVES AND IMPROVED CAPABILITIES

Implementing these reforms will require considerable effort by employers and teachers and attractive incen-

tives that encourage both to make serious commitments. One high hurdle is changing the way employers view youth as workers. From a comparative perspective, German and Japanese employers see youth as highly desirable workers who are energetic, eager to learn, and easily taught, and who have a fresh outlook and recent education. Current American attitudes about youth prevent this nation's employers from benefitting from these potentially desirable workers. Certainly, the negative view that employers hold of youth stalls any efforts to implement serious reform efforts. On the other hand, if teachers and employers, who have had success with apprenticeship learning, take the lead and incorporate the principles and program features outlined here, attitudes will change when success stories replace the misguided image we currently have of young workers.

As noted in Chapter 1, serious changes in the labor market are increasing employers' need for more skilled and educated workers. Moreover, the extensive employer efforts at school-business partnerships indicate that employers have begun to realize the importance of these factors and are looking for ways to make improvements. Based on demographic facts and changing workplace production methods and protocols, employers do not have to be convinced that investment in training is important. However, they do have to be persuaded to take a comprehensive view that better uses time and resources for more far-reaching results than most school-business partnerships now have.

To increase employers' willingness to invest in training co-op youth, Robert Glover (1983) suggests that students must promise to stay with an employer for a longer period of time. The longer apprentices promise to stay with an employer, the more training employers are willing to give. Employers need to know that they can get a payback from the training they invest in youth. If young people promise to stay with employers for a full year, then employers can provide training with the knowledge that they have time to recover benefits from it. While such promises are not legally binding, they could be made "morally" binding, so that youth would feel a sense of obligation to honor this promise. Practical incentives could also reinforce these commitments.

In addition, employers are more likely to invest in students who "are screened by the schools for their abilities and interest in the trade" (Glover, 1983, pp. 146). As described in Chapter 6, if teachers promise employers that certain students have personal qualities that would make them productive at certain tasks, employers will be more interested in investing in these students. Employers could benefit from knowing students' academic skills, motivation, work habits, and occupational skills. This could be provided by teachers' evaluations and a testing system if a linkage system existed to communicate between schools and employers. These could give employers information that would increase their willingness to invest in youth.

Teachers have a similar problem with these proposals. Historically, the high school mandate has been to prepare students for college, and most schools consider work preparation outside their mission. Even when schools provide vocational education, these programs have not considered academic courses part of work preparation. However, changes in the labor market have increased the need for academically well-prepared workers, and employers are increasingly aware that they need more educated workers. If teachers are to respond to these changes, they must begin to see academic preparation of work-bound youth as part of their mandate, as well as view experiential education as a central feature of all K–12 curriculum and instruction. They must utilize the cognitive learning paradigm described in Chapter 4 as well as the sound principles of effective experience-based learning that underpin this report. Only then is it possible to prepare youth for the demands of the new workforce.

Of course, one strong incentive to teachers is increased student motivation and improved interest in learning. These various activities require some effort to set up, and they require teachers to learn new approaches. Yet, they greatly improve students' motivation and learning. Ultimately they make teachers more effective and more satisfied with their accomplishments. Teachers try these strategies if they receive good training and see that these strategies help them cope with their difficulties in teaching and motivating work-bound students.

These strategies should include:

- *Rewarding school performance with better jobs.* For example, one school began rating students on their "employability." Althougl. this plan required teachers to do additional work, 94% of teachers voted to do this rating twice a year. Moreover, after trying this system, teachers were so impressed that they voted to increase their evaluations to six times a year. What most impressed teachers was that it motivated students to care about their school work and to improve their performance. Students were quickly won over to this plan. One "at-risk" student told his teacher: "I work hard at my job, but I don't work for school grades, because they don't really count." The teacher explained that with the new "employability" rating, "your grades now count with employers." This student's school effort immediately improved.
- *Making school activities more relevant to students' interests and experiences.* Students participating in co-op could be given the opportunity to reflect upon their work experience in class discussions and papers for academic courses; as stated in Chapter 3, reflection is the difference between an experience and a learning experience.

- *Allowing students to be more actively involved in their lessons.* The kinds of instruction used in traditional apprenticeships and suggested by cognitive science will help students take responsibility for their own learning and actively participate in the classroom.
- *Involving students in productive enterprises.* Students can participate real, productive work under the auspices of the school itself. Many existing vocational programs operate small enterprises on campus where students can practice what they learn in class. English or social studies teachers, for example, could help students write for school publications that are distributed to the community. Teachers in math, English, science and social studies could make use of existing school enterprises, giving students credit for analysis of the school restaurant, store, vegetable garden, or auto repair shop. Academic and vocational teachers could also be encouraged to co-sponsor enterprises that would join their separate specialties.

If teachers are to provide lessons that are relevant to work demands and student ratings that are valuable to employers, they must become aware of workplace operations. Schools must find ways to reduce teachers' mistrust of employers and to help them see that these principles will help them accomplish their instructional aims. Teachers are often reluctant to contact employers, so programs must create incentives and procedures to encourage them to do so. Interestingly, teachers who were initially reluctant to go into workplaces have reported that they enjoyed the experience after they were forced to do so (Mills, informal communication; Grubb et al 1990).

Improving Teachers' and Employers' Capabilities

One simple way to improve the capabilities of teachers and supervisors would be to establish regular interaction. As a part of a larger reform effort, Prince Georges County (MD) gave teachers summer jobs in the workplaces where their graduates were working. Besides providing a summer salary to teachers, this program provided them with first-hand experience in the work world. Teachers reported that this gave them new ideas about how to teach their courses, including courses in academic subjects. Following this with monthly meetings between teachers and supervisors would help teachers to make school academic lessons build upon work experiences and would help supervisors make work experience build upon school learning.

This program was not easy to implement. Employers had to be convinced that they could benefit from having teachers around for the summer, and teachers had to be convinced that they could gain something from the experience. However, after implementation, both were enthusiastic about the results.

In addition, schools must encourage teachers in academic subjects to interact and learn from co-op coordinators and vocational teachers who perform valuable functions in making linkages with employers, but who are often seen as marginal to the academic aims of schools. Vocational teachers are segmented off in the "vocational" wing of the school building where they have little interaction with teachers of academics. Schools should encourage them to talk with academic subject teachers about employers' concerns, interests, and needs. They should be encouraged to help academic-subject teachers develop lessons and plan curricula that relate their subject material to students' work experiences and to employers' future needs.

Even if incentives are created to make employers and teachers willing to institute these practices, it is likely that employers and teachers currently lack the capability to teach youth according to these principles. Foremen are not selected for their teaching abilities, so it is not easy for them to start doing it immediately. Similarly, teachers may not know how to use experienced-based procedures. They have become comfortable with didactic procedures they were taught in schools of education and have practiced over many years.

Teachers, however, are aware that students are largely unmotivated by their classroom activities, and they realize the ineffectiveness of their current didactic practices. Yet, teachers need substantial retraining for their experimentation and opportunities to try them out, make mistakes, and receive feedback in a supportive environment.

In addition, schools must loosen lesson plan controls on teachers. Teachers often feel that they must race through the authorized textbook to meet the school's expectations. Sometimes these expectations are posed by the state department of education, and often they are embodied in final examinations. Schools and state authorities must create circumstances that allow teachers to feel authorized to spend time discussing work experiences and providing experience-based practices to develop students' cognitive and work skills as well as support alternative assessment tools that value performance-based learning.

One institutional response for improving capability is to create special positions comparable to the German "meister" craftsman. Employers could use this special status to indicate that an employee was sufficiently expert to teach apprentices. Similarly, American schools could create special status for teachers with authority to teach this special apprenticeship curriculum. Another step would be for employers to train their adult workers in these principles of apprenticeship. By authorizing and supporting them to spend time training youth and by dispel-

ling their fears about being replaced by lower-cost youth, employers can encourage adult workers to serve as models and mentors to young workers.

Improving the capabilities of schools and workplaces to use these principles raises the same issues in both schools and workplaces—how to increase the institutional commitment to these methods and how to increase individuals' capabilities to do them. Ultimately, the question of commitment and capability to implement apprenticeship learning cannot be answered in the abstract; it must be seen in particular communities that try out these ideas.

WHICH YOUTH SHOULD BE CHOSEN FOR THESE PROGRAMS?

This is a complex issue that involves difficult decisions by communities. While we cannot answer this question for individual communities, we can identify some issues involved.

On the one hand, while our concern is motivated by the neglect of "the forgotten half" of youth who do not go to college, programs targeted only at this group risk becoming stigmatized as inferior, rigid "tracks" that preclude postsecondary education. Some vocational programs are viewed as dumping grounds for students who cannot handle academic courses, and some vocational programs offer watered-down academic courses and a lesser number of such courses, so they prevent students from satisfying college entrance requirements (see Rosenbaum, 1989, 1991).

Yet the school-work programs we call for will not water down the curriculum in quality or number of academic courses. Quite the contrary, they aim to prepare youth for more responsible and more demanding jobs, so they will raise requirements and standards. Employers will expect schools to recommend youth with sufficient academic skills and work habits. In return, employers will offer good job training and some advancement potential. School selectivity and employers promising good jobs should attract desirable youth and give the program a prestigious reputation. Although some vocational programs have poor reputations, quality vocational programs are often highly valued and much sought after. Under such circumstances, such programs are less likely to be stigmatized or to block educational opportunity.

On the other hand, if college-bound students are allowed to enter good apprenticeship and co-op programs, then work-bound students may be squeezed out. Indeed, university-bound students often take the best apprenticeships in Germany, sampling this training for a year or two before going on to universities and professional jobs. Only 3,500 youth apprenticeship positions exist in the entire U.S. Many more adult apprenticeships exist (about 283,000), but the best apprenticeships have 10–20 applicants for each position (Glover, 1983). Even if youth apprenticeships were greatly expanded, it would be a long time until there are enough positions to accommodate a large number of students who can benefit from them. In the meantime, deserving work-bound students may have difficulty getting these positions. Given the limited number of good apprenticeships, admitting college-bound students to these programs seems contrary to the aims of helping non-college-bound youth for whom these experiences could have great benefits.

Of course, college-bound students could also benefit from such an applied program. Besides giving them an intellectually demanding curriculum, such a program would contribute to their vocational skills. Given the large number of college students who work while attending college, vocational training would contribute to their earning power, while giving them useful training and experience. However, opportunities for college-bound students are plentiful; increasing opportunities for the young people who will not attend college is the primary concern of this report. Some schools may want to include college-bound students and others may not, and this choice will depend on school concerns and on employer interests.

As we approach the 21st century, our nation's place in the global economy increasingly depends on the education of our youth. The authors of this report have expressed different perspectives on issues relating to apprenticeship and experience-based education. The choice of how to proceed must reside with local communities, and they will have to resolve these issues according to their individual priorities. However, the principles established in Chapter 1 and described in detail throughout the report should offer direction to all schools and employers trying to establish apprenticeship-style programs. The current enthusiasm for apprenticeships will be more effective if it is informed by careful analysis and planning.

A COMMENTARY

Richard Kazis, *Jobs for the Future*

INTEREST IN YOUTH APPRENTICESHIP HAS SWELLED DURING THE past five years. Numerous articles have appeared in the general and business press. Experimental programs have been created and funded in a number of cities and towns. A dozen states have initiated efforts to create youth apprenticeship programs or statewide systems. Both major candidates in the presidential campaign of 1992 went on record in support of expanding youth apprenticeship efforts. Several different bills have been introduced in the Congress to promote youth apprenticeship in the United States.

As is common with social policy innovations in this country, interest and enthusiasm often outstrip experience and knowledge. It appears that more journalists and policy analysts are chasing youth apprenticeship sites than there are bona fide programs to show them. In the rush, youth apprenticeship is being touted in some circles as a kind of silver bullet—a powerful solution to myriad social and economic ills.

As James Rosenbaum rightly warns, this tendency is dangerous. Many solid reform ideas have crashed and burned as they have undergone the "familiar cycle of overblown hopes, hastily assembled programs, disappointing results, and ultimate abandonment of the effort." It would be preferable to avoid that cycle this time around. Youth apprenticeship deserves careful, realistic appraisal.

Timely Questions

Publication of this volume by the William T. Grant Foundation Commission on Youth and America's Future is therefore quite timely. The Foundation's influential 1988 reports, *The Forgotten Half*, advocated expansion of youth apprenticeship opportunities in this country. With interest in this strategy still growing and the allocation of significant scarce public and philanthropic resources under serious discussion, now is a good time to take a hard look at youth apprenticeship's potential as a broad school-to-work transition strategy:

- What design elements make youth apprenticeship a model worth exploring?
- Can youth apprenticeship grow significantly or is it too complicated and demanding for American employers and schools?
- Are there other program models that might be easier to implement, more efficient, and more likely to have desired learning and earning results? Or does youth apprenticeship offer benefits that other models cannot?
- Abstracted from any particular model, what principles should guide the development of expanded and improved school-to-work transition options in this country?

This volume is an important step in the process of inquiry. The questions the authors ask are critical ones if efforts to improve career opportunities, particularly for the non-college-bound, are to proceed responsibly. The several chapters reflect a serious consideration of youth apprenticeship by noted experts on youth employment and schooling. The effort that has gone into this volume is itself an indication of the important place youth apprenticeship has already assumed within current debates on the preparation of today's young people for a future of productive work and citizenship.

The authors of this volume often approach youth apprenticeship with skepticism. This is probably wise, given the difficulty of building and institutionalizing *any* significant education or employment policy reform. However, it is also a relatively safe stance, one which runs the danger of discounting new and untested alternatives *because* they are new and untested.

Jobs for the Future (JFF) comes to these important questions about youth apprenticeship with a perspective

different from that of most of the university-based authors of these chapters—the perspective of practice. For almost two years, our National Youth Apprenticeship Initiative has been exploring the potential for youth apprenticeship in this country through a close relationship with ten national demonstration projects implementing or moving toward youth apprenticeship and through a partnership with a dozen state governments working to create youth apprenticeship systems or programs.

We have learned a great deal from these fledgling efforts. Some of our learning reinforces the views of the authors of this volume, who tend to argue from analogy to international experience and from the evidence of past domestic efforts to integrate school and work. However, we find that some of what we are learning leads us to different emphases and conclusions. We highlight our learning to date in the remainder of this short commentary.

Defining Youth Apprenticeship

First, a word about definitions. There is significant confusion and vagueness about what is meant by the term "youth apprenticeship," even among the authors of this volume. Broad assertions about the potential impact of youth apprenticeship often arrive at different conclusions because they start from different assumptions and definitions.

Jobs for the Future defines youth apprenticeship as a learning program for young people, age 16 and older, that combines on-the-job learning with classroom instruction, that bridges secondary and post-secondary schooling, and that results in certification of mastery of work skills. Like traditional apprenticeship, youth apprenticeship relies on a pedagogy of learning by doing and of learning in a real work context through guidance by an expert. And like traditional apprenticeship, youth apprenticeship provides structured entry into the world of work and career advancement.

Unlike traditional apprenticeship in this country, youth apprenticeship begins with in-school youth and continues into post-secondary education. As such, the in-school component of the program carries much greater weight and centrality than in traditional apprenticeship. Youth apprenticeship, as Stephen Hamilton points out in this volume, is as much a part of the educational system as is the training system.

Youth apprenticeship combines three types of programmatic and institutional integration that Harvard University education economist Richard Murnane identifies as the hallmark of new efforts to improve the school-to-work transition:

- the integration of academic and vocational learning
- the integration of school and work-based learning experiences
- the integration of secondary and post-secondary learning

It does so through a learning program characterized by two distinct elements: 1) a pedagogy of learning by doing; and 2) work and training opportunities that connect young people to the adult labor market and that incorporate the assessment and certification of skills needed to advance in particular occupational clusters. That is, youth apprenticeship is premised on the assumption that new career pathways for young people must combine both a more contextual and meaning-creating pedagogy and a more structured, formal connection to employers, jobs, and career opportunities.

Work Experience: Necessary But Not Sufficient

At Jobs for the Future, we tend to focus much of our research and development activity on the work-based side of the equation. That is, we emphasize the potential of work settings to motivate young people to learn, to take themselves seriously, and to mature. As Hamilton notes, young people view work as real and understand that their actions on-the-job have real consequences. They can see the immediate benefit to learning skills and developing knowledge, as well as the future career payoff. And they respond to being treated as responsible adults by adult supervisors and mentors.

We see this in the programs with which we work. Here is a typical example. A student at Boston's Project Pro-Tech, which involves three Boston high schools and six hospitals in a four-year program in the allied health fields, works in a histology lab processing human tissues for diagnosis. She has been given a position with responsibility. As she puts it: "Our main priority is to be sure that everything is right before it leaves the lab, because if we make a mistake, a patient could be misdiagnosed." According to her supervisor, if the tissue is not handled properly, another biopsy might be needed. Only 17, this student has become one of the lab's most valued employees. After one year of full-time summer employment and part-time work during the school year, she is functioning at the skill entry level of a lab technician.

Like the authors of this volume, we at Jobs for the Future do not believe that work experience per se is sufficient. The educational challenge is to integrate work experience with classroom learning and to use each venue to promote the learning best suited for that environment. As Sue Berryman concludes from her thoughtful analysis, "We suspect that some mixed strategy may ultimately turn out to be optimal, but what that strategy might look like is now unclear." Like Berryman, we see the need for much more experimentation with and analysis of work-based

and school-based apprenticeships—and with the way learning in both places is coordinated.

Differences of Emphasis Based on Site-level Experience

James Rosenbaum summarizes the arguments advanced in this volume into a set of five essential principles for improving the effectiveness of school-to-work programs:

- Programs should use work-based learning methods that build upon school learning and are connected to schools;
- Experience-based teaching in classrooms should develop cognitive as well as practical skills;
- School-based programs should build upon work experiences;
- School-work linkages should reward school learning and effort with good jobs; and
- Credentialling procedures should identify clear standards and certify attainment.

These principles seem quite sound. Our disagreements with several of the authors of this volume are primarily differences of degree and emphasis. In their desire to challenge an uncritical advocacy of work-based learning, Berryman, Stern, and Rosenbaum swing back toward more school-based approaches. We think they swing too far, particularly in tone. At times, out of a legitimate fear of badly designed and implemented programs, they seem to deemphasize the motivational power of work-based learning for young people. At times, they seem to focus on cognitive learning theory at the expense of labor market theory about the importance of networks of contacts in opening up career options.

At JFF's demonstration sites, we see no contradiction or tradeoff between these two requisites of an effective program—the educational and the labor market components—and neither do program staff. If anything, we see universal interest in expanding, improving, and systematizing the work-based component of these programs in order to better serve, better motivate, and better prepare participating students. In fact, what has surprised us most about JFF's demonstration sites is the conviction of administrators and teachers in programs that are already national models for integrating school and work—including academies, Tech Prep programs, and leading edge vocational schools—that they must move further in the direction of work-based learning and the integration of school-based and work-based learning.

Among JFF's sites are programs in very different school settings: two career academies in California; a Tech Prep program in South Carolina infusing a work-based component into what has been a school-based partnership; an award-winning vocational high school in Massachusetts; a work-study high school in Boston that wants all its job placements to have a stronger connection with the school curriculum; and a regional vocational school in Michigan creating school-to-apprenticeship programs in traditional and non-traditional occupations. Without exception, JFF youth apprenticeship sites are placing a high priority on identifying better job placements, developing more extensive mentoring programs, and creating more systematic and formal learning programs at work. This is particularly true in large urban districts where so much of high school education is disastrous and where young people's connections to the labor market are extremely weak. These sites and their staff understand from experience the importance of providing young people what they cannot get in the classroom: paid work, responsibility and assignments that matter, and being treated as adults by adults.

The fact that these programs see a need to extend their work-based components toward an apprenticeship model does not guarantee that what they want to do is actually doable. The critical questions asked in this volume remains: Is youth apprenticeship a viable model for the U.S.? In what industries and occupations is it most appropriate? Does this model ask too much of schools, employers, and young people?

JFF's experience provides some perspective on two components of this question. First, does youth apprenticeship ask too much of young people in terms of their time at and commitment to work? Second, are there sufficient incentives for employers to make the level of commitment required of them? Space allows only a few comments.

Young People and Work: This volume argues that having young people spend a lot of their time learning on-the-job may be unwise and that focusing on occupational skills may be less important than focusing on cognitive skill-building. We understand this concern. However, we think that it is not as serious an obstacle to youth apprenticeship as it might first appear to be.

The authors treat youth apprenticeship as a high school program. As a result, they assume that the last two years of high school must carry the full weight of an apprenticeship training program. As noted above, we see youth apprenticeship as a program that begins in high school and continues into post-secondary education. In fact, this bridge, constituting a transition to work, is a critical component of the model.

When youth apprenticeship is viewed as a three-to four-year program, the argument about work takes a different emphasis. What may seem unwise or unreasonable in the eleventh grade may be critically important two years later. Twenty hours a week on the job may or may not take away from classroom learning opportunities in high school; that is the subject of much empirical research. However, half-time employment or more is a fact of life for high school graduates. If young people are to make the transition from high school to post-secondary learn-

ing, the work-based component of the program becomes a critical incentive, perhaps even a prerequisite, for participants. The connection to the labor market and to clear career ladders takes on greater importance.

Similarly, it may be difficult to find employers willing to make an extensive training commitment to 16-year-olds, but we know that employers look to community colleges to fill the ranks of their technician-level workforce. Employers are likely to be more interested in participating if the commitment expected from them is phased in as apprentices develop greater maturity and skill.

Just as the optimal mix between school- and work-based learning must be worked out through experience and experimentation in different programs in different occupations, so too must the mix between work-based learning and skill development in the high school years and in the post-secondary component of a youth apprenticeship program. The almost exclusive emphasis in this volume on the high school years clouds this critical issue. It also obscures an important finding of our work in the field: without significant support and preparation, many participants in high school youth apprenticeship programs will lack the academic skills to transfer successfully into post-secondary occupational programs in their chosen fields.

Employers and Youth Apprenticeship: Will employers want to participate? Rosenbaum cites a group of business executives who wanted to start a youth apprenticeship program but abandoned the idea when they saw how complicated it was and learned what would be required of them. At our sites, we see something different. We certainly see firms declining to participate or wishing to make a more limited commitment. At the same time, though, even during an extended recession, we see firms—particularly in health and metalworking—willing to make a surprisingly serious commitment to hiring and training young people.

In Tulsa, Oklahoma, employers that include American Airlines and Hilti Corporation will be paying young people this year for the hours they work *and* the hours they are in school. In Boston, the business community that created the Boston Compact as a way to use jobs as incentives for school achievement has created Project ProTech, a youth apprenticeship program in the health field, as the next step in the evolution of that partnership. Six local hospitals have made the commitment to move from a guarantee of entry-level jobs to the creation of more structured routes into high-paying careers.

This does not mean that large numbers of employers nationwide will automatically jump at the opportunity to take youth apprentices. As David Stern and others point out, the expansion of co-op education has been limited by employer willingness to participate—and, if anything, youth apprenticeship requires a far greater commitment. Without both the institutional capacity-building and the establishment of incentives to spread costs and risk, large numbers of employers are likely to balk.

It does mean, though, that there are pockets of employers—in particular labor markets, in industries with shortages in specific occupations—willing to make commitments that might at first blush appear economically irrational. A critical research task for Jobs for the Future and others during the coming years is to learn more about these employers, their motivations, and their experiences so that any new incentives can be well-targeted and well-designed.

Youth Apprenticeship As Positive Incentive

The authors of this volume are right to emphasize the importance of incentives —for employers, teachers, schools, and young people. As they do elsewhere, though, they tend to undercut their own arguments in their desire to be critical observers of the apprenticeship model. The ability of youth apprenticeship to expand rapidly is indeed limited by current incentive structures. However, youth apprenticeship also creates important incentives. Paid work, access to career ladders, and a contract with an employer who cares what happens to students, in school and out, can be powerful motivators to young people. In fact, without a work-based component, it is unclear whether typical high school students would be sufficiently motivated to take a classroom-based cognitive apprenticeship program seriously—no matter how much better the instructional approach might be. Sue Berryman acknowledges this in her chapter, but the point deserves sharper emphasis.

Youth apprenticeship can change the incentives available to schools and employers, as well as to students. By definition, an apprenticeship model creates relationships of mutual obligation. Youth apprenticeship can be a mechanism for building trust and for forging a new social contract between employers and schools in a locality. It can be the vehicle for changing the working relationships between schools and employers and for deepening the local "infrastructure of trust." An apprenticeship model—as we have seen with some of our sites—can push schools to a new sense of responsibility and responsiveness by bringing them into a reciprocal relationship with employers who have a stake in school outcomes and who have clout with district and school-level decisionmakers. Again, here is an area for further experimentation and research.

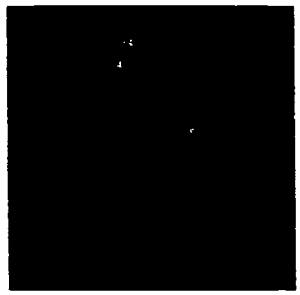
What role will youth apprenticeship play in the reconfiguring of school and work in this country? It is far too early to tell. We should, however, be prepared to take the long view. *The isolated programs that exist today would be a lot stronger and more viable if they were part of a statewide or nationwide system in which youth apprenticeship were one of a number of recognized and sup-*

ported career pathway options, preceded by effective career education, and linked to clearly defined academic standards and to industry-based occupational skill standards. Similarly, these pilots would appear more replicable if mechanisms for intersite learning, staff development, and other ways to build program capacity were already institutionalized.

Taking the long view does not mean turning away from the important questions being asked in this volume. As Rosenbaum argues, it would be unfortunate if attention to youth apprenticeship came at the expense of, and deterred schools and employers from pursuing, less intensive strategies for improving the connection between school and work and for creating new pathways into good careers.

Fortunately, JFF's field experience leads us to conclude that this fear is largely unfounded. We see our sites using the elements of youth apprenticeship as the vehicle for pushing their partnerships toward greater integration—of academic and vocational learning, of school and work, and of secondary and post-secondary learning. At the same time, we do not see them rigidly adopting an all-or-nothing approach. Once one leaves the world of the national press and the presidential campaign, youth apprenticeship is appropriately seen not as a silver bullet, but as a powerful model that still needs much testing and development.

In the end, youth apprenticeship is about building competence, confidence, and connections for young people. We would emphasize the mutually-enforcing nature of these three goals. Labor market connections can motivate young people in ways that build real-world confidence and open young people's minds to the possibility of developing marketable competence. As the authors of this volume argue, there may be other ways to achieve these goals. And only time will tell how well youth apprenticeship will meet them all. It is our hunch that for many young people, the labor market aspects of linking school and work will be critically important. We would be making a mistake if, in an effort not to embrace work-based learning strategies uncritically, we were to consistently underestimate the power and potential of employers and workplaces for unlocking motivation in young people, providing real economic opportunity, and changing the dynamics of school politics. At times, the authors of this volume come perilously close to this position. When they do, their generally compelling arguments falter. When they maintain balance in their emphasis on confidence, competence, *and* connection, they provide an important guide to those working to build youth apprenticeship programs and other work-based strategies to improve career pathways for our nation's young people.



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As a Fulbright Senior Research Fellow, Professor Hamilton studied West Germany's apprenticeship system in 1983–84. The major product of that study is *Apprenticeship for Adulthood: Preparing Youth for the Future* (Free Press, 1990), which contrasts the transition from school to career of non-college youth in the United States and West Germany and recommends adaptation of elements of apprenticeship in the United States. And he has investi-

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David Stern is a Professor of Education at the University of California, Berkeley. In 1972, after receiving his Ph.D. in Economics and Urban Studies at M.I.T., he coordinated a study of school finance for the California Senate, then joined the Economics Department at Yale before coming to Berkeley in 1975.

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Third, he has authored a number of studies on work experience for students, vocational education, and secondary school programs. His most recent book is *Career Academies: Partnerships for Reconstructing American High Schools* (1992, with Marilyn Raby and Charles Dayton). He also co-edited (with Dorothy Eichorn) a 1989 volume on *Adolescence and Work: Influences of Social Structure, Labor Markets, and Culture*. Under the auspices of the National Center for Research in Vocational Education, he is currently collaborating on studies of school-supervised work experience and school-based enterprises. He is actively involved with efforts to create a youth apprenticeship system in California.

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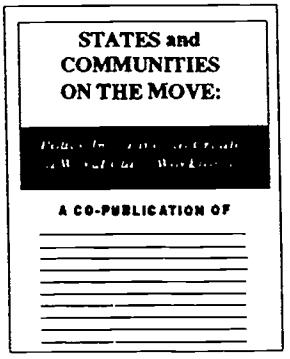

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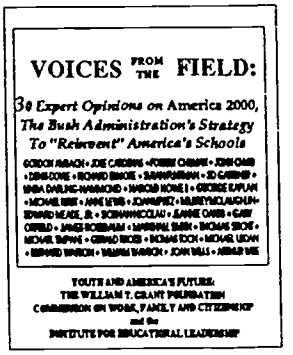

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