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ABSTRACT

This report examines a variety of options that are being implemented in schools and in school-business partnerships to train workers for the increasingly technical and changing jobs of the future. The report contains eight sections that cover the following topics: (1) joining supply-side and demand-side policy at the local level (educational planning to provide workers for jobs and jobs for workers); (2) apprenticeship (the German system, the U.S. system, and possibilities for expanding apprenticeship); (3) cooperative education--CO-OP (federal support, prevalence of CO-OP, effects on employment, and expanding CO-OP); (4) school-based enterprise--SBE (studies of SBEs in the United States, an exemplary program of SBE, and possibilities for expanding SBE); (5) vocational academies (historical perspective, evaluations, and possibilities for expansion); (6) tech-prep and 2 + 2 programs linking high schools with two-year colleges (examples of tech-prep programs and ways of expanding them); (7) school-business partnerships and ways of expanding them; and (8) improving the options for students. (Contains 94 references.) (KC)

COMBINING SCHOOL AND WORK:

OPTIONS IN HIGH SCHOOLS AND TWO-YEAR COLLEGES

U.S. Department of Education
Office of Vocational and Adult Education
March 1991

UNITED STATES DEPARTMENT OF EDUCATION

OFFICE OF VOCATIONAL AND ADULT EDUCATION

THE ASSISTANT SECRETARY

March 1, 1991

Dear Colleague:

This report is an outgrowth of the national conference, "The Quality Connection: Linking Education and Work," that was sponsored by the Secretary of Education and the Secretary of Labor in Washington, DC, May 15-17, 1990. The conference brought together business, education, government, and labor leaders to discuss the role of vocational-technical education in the transition from school to work.

Vocational-technical education has much to offer all students in their preparation for work. What needs to be known is how it does so. This report brings to the fore some of the traditional approaches to school-to-work transition, such as cooperative education, as well as some of the latest innovations, such as tech-prep, which exist in vocational-technical education.

I hope that this report will foster closer integration between academic and occupational education at all levels as well as strengthen the employer connection. The importance of cooperation and coordination among the different players in school-to-work transitions should be recognized and acted upon.

Quality vocational-technical education can help to make the transition from school to work for students efficient, effective, and meaningful. This report identifies possible pathways leading to the competent and highly skilled work force the Nation needs to be internationally competitive.

Sincerely,

Betsy Brand

Betsy Brand

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Executive Summary

American employers are seeking to achieve a faster rate of continuous improvement in methods for producing goods or providing services, in order to keep up with the faster pace of technological change and international competition. Such improvement requires employees who can adapt to new technology and devise new procedures that improve quality, lower cost, or reduce the time to respond to customers' demands. Achieving continuous improvement means that learning becomes an integral part of the work itself. Accordingly, some firms have deliberately redesigned their work processes to be more "learning-intensive."

Educators and employers are facing the challenge of how to prepare young people for this kind of workplace. Efforts to meet this challenge can build on a solid base of existing programs in vocational-technical education. One existing option is cooperative education, which structures students' experience in paid jobs to promote learning that extends what is taught in the classroom. The "co-op" method gives students direct practice in learning at the workplace. Many vocational-technical education programs also operate their own school-based enterprises, which likewise provide opportunities for students to learn through the process of producing real goods and services. These options make deliberate use of work as part of the learning experience and bridge school and work directly.

In addition to these time-tested approaches, significant new options are emerging in vocational-technical education. Career-focused "academies" and the "tech-prep" movement are offering high school students rigorous courses of study that concentrate on occupational themes and at the same time give more students the option to go to college. Like cooperative education and school-based enterprise, these new programs are intended to help students see more clearly the connection between school and work -- work that itself will involve an increased amount of continual learning. These options are reconstructing the high school curriculum to unite vocational with academic disciplines, and operate within the school itself, bridging the boundary between work-oriented courses and coursed oriented toward further schooling. Youth employment and training policy in the United States has evolved toward greater coordination of supply-side and demand-side programs at the local level. During the 1970s public policy comprised a mix of programs on the demand side and supply side of the labor market.

The alarm over teenage and youth unemployment, which preoccupied public policy in the 1970s, was replaced in the 1980s by worry about an insufficient supply of qualified young workers. This new concern was prompted not only by the diminishing size of the youth cohort but also by the perceived inadequacy of their knowledge, skills, and attitudes. By the end of the 1980s, corporate spokesmen, academics, public officials, and the media had reached consensus that restoring American competitiveness required major improvements in the preparation of young workers.

As the 1990s unfold, there are signs of a new kind of policy emerging, one that addresses supply and demand together in a coordinated fashion. The essential idea is that improvement must occur jointly in employees' skills and in the organization of work.

Employers concerned about the shortage of workers for the new workplace are increasing their investment in partnerships with local schools. Some of these are opening up more jobs for students, with supportive supervision, so that students can understand and learn to meet expectations for high performance. Some business-school partnerships are also reaching into the school itself and producing major changes in curriculum. Local collaboration of this kind, producing changes on both sides of the school/work boundary, is a hallmark of the evolving new policy.

Both options described in the report strengthen the school to work connection in order to improve the preparation of young people for a more learning-intensive workplace. One kind of program directly ties school to work by engaging students in both activities simultaneously, and structuring the work experience in a way that promotes learning. Cooperative education is the main example in this country, enrolling approximately 5 to 10 percent of all students in high schools and two-year colleges. Further expansion of cooperative education (co-op) is limited by schools' ability to afford the time of coordinators who arrange appropriate job placements, help students write training plans, and monitor students' performance. It is also limited by employers' willingness to provide co-op positions and spend the extra time required to support students' learning on the job. Employers' limited willingness to invest in training also constrains the expansion of apprenticeship, another traditional approach to linking learning with work.

Apprenticeship requires more initiative by employers than does cooperative education, and in part for that reason is even more limited in this country, enrolling hardly any students in high school and fewer than 2 percent of high school graduates. Expanding structured learning in conventional workplaces will require additional institutional support and perhaps financial incentives to encourage individual employers to act in their own collective best interests.

Many schools have developed their own productive enterprises to give students real, though usually unpaid, work experience that is designed to promote learning. School-based enterprises make schools less dependent on outside employers to provide training positions, which may be unavailable in some localities or during economic downturns. Some schools provide work for students both in school enterprises and in co-op programs. This combination offers both a desirable mix of work experiences and a way of guaranteeing that students will have work even if employers are not offering a sufficient number of co-op placements.

The second kind of program for strengthening the connection between school and work operates within the school curriculum itself, combining academic and vocational courses. The integrated curriculum gives students the benefit of occupational preparation and college preparation at the same time. It also infuses academic courses with the practical, problem-solving approach of vocational-technical education. It also avoids invidious tracking of students. Tech-prep programs and vocational academies both represent efforts to reconstruct the high school curriculum in this way.

Developing these bold, new programs requires collaboration between academic and technical teachers. Tech-prep programs and vocational academies will expand as instructors in academic subjects, in particular, find reason to participate. One possible incentive for these teachers is that more students may be drawn to some advanced academic courses if they can see more practical relevance. Academic teachers may also be persuaded by the recent research in

cognitive science, which suggests that abstract information is sometimes best learned through authentic application.

In addition, instructors in college-prep classes might consider the fact that most college students today hold paid jobs during the school year. The best preparation for college therefore entails more than taking prerequisite courses. It also includes qualifying for high-wage jobs, so that it is possible to spend fewer hours on the job while working one's way through college. Thus consideration for students' practical as well as intellectual interests may induce academic teachers in high school to collaborate with their vocational and technical colleagues in developing the new integrated curriculum.

The two kinds of options -- integrated curriculum and structured work experience -- can positively reinforce each other. It is not unusual for tech-prep programs and vocational academies to provide co-op placements in jobs related to the program's curricular focus, e.g., health careers or electronics. School-based enterprise can also be used to support an integrated academic/vocational curriculum, as in a proposed production line at Minuteman Tech in Lexington, Massachusetts, where MIT's Lincoln Laboratory and local electronics companies are helping to develop a new curriculum in manufacturing technology. School-supervised work experience reinforces and extends what students learn in classes. Such work also takes on more meaning for students when it is part of an integrated curriculum.

If the new kinds of curriculum take hold in more high schools, and if they are combined with structured work experience, then it will be possible for all students to have the benefit of rigorous academic instruction and practical vocational education at the same time. Ideally, every high school student would be able to choose among several possible curricular specialities, some of which would organize the core academic curriculum around a particular occupational theme, and would provide related part-time employment during the school year and summer. Some students might enter related full-time employment after completing the program. Others might go on to college, equipped with the skills that will enable them to support themselves efficiently along the way. Some of those who go to college might continue in the same career line; others might not. The point, as the vocational academies have demonstrated, is that this kind of curriculum can make sense to students, whatever their postsecondary plans may be.

Further expansion and improvement of these programs will take money and commitment. Additional resources could usefully be spent on developing lists of exemplary programs, writing technical assistance guides, formulating industrywide standards of competence in specific occupations, creating new curricula at the local level, and providing released time for teachers and others to implement new programs.

Building a real connection between school and work will also require vision. Now, more than ever before, individuals are working and learning at the same time. The fraction of students in high school and college who hold paid jobs during the school year has risen steadily during the past several decades, growing to a clear majority. Although most students' jobs are unconnected to their studies, there are programs that do tie school and work together. Meanwhile, in the workplace itself, technological change and international competition are requiring more employees to keep learning while they work. Programs that combine school and work for young people thus emulate the learning-intensive workplaces of today and tomorrow, extracting educational

benefits from students' jobs and giving an opportunity to practice learning through work. This kind of work experience is most meaningful when attached to a course of study that combines academic and vocational content. Whether these programs expand will depend on the strength and clarity of vision shared by educators and employers who see the potential of work for promoting human development.

Introduction

American employers are seeking to achieve a faster rate of continuous improvement in methods for producing goods or providing services, in order to keep up with the faster pace of technological change and international competition. Such improvement requires employees who can adapt to new technology and devise new procedures that improve quality, lower cost, or reduce the time to respond to customers' demands. Achieving continuous improvement means that learning becomes an integral part of the work itself (Hirschhorn, 1984; Zuboff, 1988). Accordingly, some firms have deliberately redesigned their work processes to be more "learning-intensive" (Stern, 1990).

Educators and employers are facing the challenge of how to prepare young people for this kind of workplace. Efforts to meet this challenge can build on a solid base of existing programs in vocational-technical education. One existing option is cooperative education, which structures students' experience in paid jobs to promote learning that extends what is taught in the classroom. The "co-op" method gives students direct practice in learning at the workplace. Many vocational-technical education programs also operate their own school-based enterprises, which likewise provide opportunities for students to learn through the process of producing real goods and services.

In addition to these time-tested approaches, significant new options are emerging in vocational-technical education. Career-focused "academies" and the "tech-prep" movement are offering high school students rigorous courses of study that concentrate on occupational themes and at the same time give more students the option to go to college. Like cooperative education and school-based enterprise, these new programs are intended to help students see more clearly the connection between school and work -- work that itself will involve an increased amount of continual learning.

The importance of such programs has been reinforced by recent research on the value of "situated learning" (Resnick, 1987a, 1987b; Brown, Collins, and Duguid, 1989; Raizen, 1989; Sticht, 1979, 1987). This research has produced new evidence that learning through the work process itself is an effective method for acquiring work-related knowledge. In contrast, what is learned in classrooms, while useful in classrooms, does not always transfer to actual work situations. A considerable number of empirical studies have now demonstrated the lack of correlation between school-taught knowledge and problem-solving in the context of actual production. These studies corroborate the value of learning by doing. They also suggest that instruction in academic subjects may benefit from the kind of practical orientation that characterizes vocational-technical education.

The following sections describe two sets of programs that respond to the challenge of preparing young people for a more learning-intensive workplace. One set of options, including cooperative education, apprenticeship, and school-based enterprise, make deliberate use of work as part of the learning experience. The second set of programs, including vocational academies and tech-prep programs, are reconstructing the high school curriculum to unite vocational with academic disciplines. While the first set of options bridge school and work directly, the second set of programs operate within the

school itself, bridging the boundary between work-oriented courses and courses oriented toward further schooling.

Employers play an important part in all of these programs. Traditionally, employers have given active support and advice to vocational-technical education. Cooperation with employers is especially vital in programs that include work as part of the curriculum. In new programs that are integrating vocational with academic instruction, employers are continuing to perform a supportive and advisory role. Some employers are also forming other kinds of partnerships with schools to bring about even broader restructuring. As the next section explains, increasingly close collaboration between educators and employers at the local level may be seen as a defining characteristic of contemporary employment and training policy.

This paper was written by David Stern, School of Education, University of California at Berkeley, under contract to the U.S. Department of Education.

I. Joining Supply-Side and Demand-Side Policy at the Local Level

Youth employment and training policy in the United States has evolved toward greater coordination of supply-side and demand-side programs at the local level. During the 1970s, public policy comprised a mix of programs on the demand side and supply side of the labor market (Hahn and Lerman, 1985; Taggart, 1981). Demand-side interventions were intended to increase the total number of jobs available in the economy, by means of targeted tax credits, wage subsidies, and outright public employment. Supply-side programs included training, education, and counseling, and were designed to help young people qualify for any job. Supply-side and demand-side efforts complemented each other in the aggregate, but they were not usually connected at the level of local labor markets.

In the 1980s, there was a pronounced movement away from any government intervention on the demand side, toward exclusive reliance on supply-side measures. Replacement of CETA by JTPA was the most important example of this policy shift. Several factors contributed to the change in policy. The Reagan administration in principle opposed government interference with decisions by employers. Even liberal economists were not sure that wage subsidies or public employment really could increase the number of jobs available (e.g., Baily and Tobin, 1978). Finally, as the baby boom cohort grew older, the number of young people in the labor market began to decrease, easing concern over excess supply in the youth labor market.

Despite the fact that unemployment among 16 to 19 year-olds remained above 15 percent throughout the 1980s, the alarm over teenage and youth unemployment, which preoccupied public policy in the 1970s, was replaced in the 1980s by worry about an insufficient supply of qualified young workers (e.g., Johnston and Packer, 1987). This new concern was prompted not only by the diminishing size of the youth cohort but also by the perceived inadequacy of their knowledge, skills, and attitudes (e.g., Committee for Economic Development, 1985). By the end of the 1980s, corporate spokesmen, academics, public officials, and the media had reached consensus that restoring American competitiveness required major improvements in the preparation of young workers.

As the 1990s unfold, there are signs of a new kind of policy emerging, one that addresses supply and demand together in a coordinated fashion. The essential idea is that improvement must occur jointly in employees' skills and in the organization of work. To compete successfully, producers of goods and services generally must offer higher quality, lower cost, and a quicker response to customers. Proponents of the new supply-and-demand policy contend that this kind of economic performance is best achieved in work organizations that delegate more decision-making and problem-solving to front-line production workers (Dertouzos, Lester, and Solow, 1989; National Center on Education and the Economy, 1990). Employees in these high-performance work organizations require high levels of skill and knowledge. The problem is not a short supply of skills for the kinds of jobs that presently exist, but scarcity of skills required in the kinds of jobs that will have to be created in much larger numbers if the

nation's economy is to regain its competitive edge. The creation of skills and the redesign of work go hand in hand.

Employers concerned about the shortage of new workers for the new workplace are increasing their investment in partnerships with local schools. Some of these are opening up more jobs for students, with supportive supervision, so that students can understand and learn to meet expectations for high performance. Some business-school partnerships are also reaching into the school itself and producing major changes in curriculum. Local collaboration of this kind, producing changes on both sides of the school/work boundary, is a hallmark of the evolving new policy.

II. Apprenticeship: A Limited Option

Many discussions of education and the economy nowadays make some reference to the desirability of expanding apprenticeship in some form (e.g., National Governors' Association, 1990; U.S. Government Accounting Office, 1990; Lerman and Pouncy, 1990). Hamilton's (1990) book, Apprenticeship for Adulthood, gives a well-researched argument in favor of making more apprentice-like roles available to young people. A newly created Office of Work-Based Learning in the U.S. Department of Labor is sponsoring demonstrations of training models based on apprenticeship (U.S. Department of Labor, 1989). And the Carl D. Perkins Vocational and Applied Technology Education Act Amendments of 1990, which reauthorize federal support for vocational education, mentions apprenticeship several times.

The German System

Germany, which operates the world's most extensive system of formal apprenticeship, is often cited as a model. In what was formerly the Federal Republic of Germany as of 1989, 1.7 million young people were apprenticing with approximately half a million employers to earn formal certification in 380 different occupations (Schmidt, 1989). About 70 percent of the 16 to 19 age group enroll in apprenticeships (Raddatz, 1989). German apprentices typically spend four days each week on the job and one day at "work school"; this twofold division of apprentices' activity gives the "dual system" its name. The duration of apprenticeship is usually three years.

Operation of the German apprenticeship system involves an extensive set of institutions, including individual companies, unions, employers' organizations, chambers (organizations descended from medieval guilds), labor offices, and public school authorities (Hamilton, 1990). Individual companies, which pay apprentices' stipends and absorb the cost of on-the-job training, are free to decide how many apprentices to sponsor, if any. Employers invest in apprenticeship and other forms of training because they view employees as assets of the firm, not as expendable resources. This view is reinforced by German labor law which, among other things, makes it very difficult to fire an employee, and which also gives employees formal representation in the workplace. Such laws, in turn, reflect the power of German labor unions, which represent roughly half the work force. Unions and employers' organizations exercise considerable influence over government policy regarding employment and training, including apprenticeship.

In addition, every employer is required by law to join one of the chambers. The chambers collaborate with state and federal education authorities on the continual revision of the "work school" curriculum and the all-important examinations which apprentices must pass at the mid-point and at the end of their indenture. The fact that all apprentices in a given occupation take the same examinations, nationwide, ensures employers that apprentices trained elsewhere have achieved a known standard of proficiency. Finally, public labor offices, analogous to employment offices in the U.S., are the primary source of apprenticeship listings and employment counseling (Hamilton, 1990). The German apprenticeship system, in short, is part of a tightly interwoven set of labor market institutions enforcing employment practices which are in employers' collective self-interest but which, acting in isolation,

companies would not be likely to undertake (Streeck, 1989).

Despite its success in inducing German firms to provide training from which they all may benefit, there are two main reasons why the German system could not be replicated in the United States. First, the elaborate set of institutions, laws, and social norms that evolved over the course of centuries and now sustain the German apprenticeship system do not exist in the United States and could not be created by fiat. Second, the German system imposes more restrictions on individual choice than Americans would tolerate. German students are divided at an early age into those who may attend a university and those who may not. Apprenticeship is mainly for the latter group. In recent years there have been attempts to create second-chance opportunities for students to get into universities, but these options are still limited. Individual choice is further restricted in the German system by the fact that employers decide how many apprenticeships to offer; therefore some students are unable to find openings in the fields they want (Lipsmeier, 1989).

The American System

In the United States, compared to Germany, apprenticeship is far less widespread, enrolling approximately 300,000 individuals (U.S. Department of Labor, 1989). Fewer than two percent of high school graduates enter apprenticeships (Glover, 1988a), which typically begin at age 18 and usually require a high school diploma. At least three-fourths of all apprentices are preparing to be skilled craftworkers either in the unionized construction industry or in large-scale manufacturing (Glover, 1988a). Employers in these two sectors have particular incentives to sponsor apprenticeships. In construction, the federal Davis-Bacon Act, which requires contractors on federal projects to pay prevailing wages, allows lower wages for apprentices. In large-scale manufacturing, economies of scale and relatively low turnover make it worthwhile for employers to sponsor formal training of machinists, tool and die makers, and other skilled workers.

National standards governing apprenticeship are more limited in the U.S. than in Germany. Current federal regulations, issued in 1977, identify characteristics that apprenticeship programs must possess in order to be registered. These include the existence of an organized training plan, a minimum of 144 hours per year of classroom instruction, a minimum of 2,000 hours on the job under a written training agreement, a progressively increasing wage scale, and specific administrative requirements (Glover, 1988a). In 23 states these standards are administered directly by the federal Bureau of Apprenticeship and Training in the Department of Labor (U.S. Department of Labor, 1989). In the remaining 27 states the Bureau shares responsibility with state apprenticeship councils. Federal regulations do not specify the actual content of training or examinations. Unlike Germany, employers in the U.S. therefore cannot assume that the content of apprenticeship training is the same nationwide, except in certain trades (such as carpentry, bricklaying, insulation, and painting), where voluntary national associations or unions have developed standards that they are enforcing on local programs (Glover, 1988a).

Expanding Apprenticeship

The federal government sponsored several initiatives to expand apprenticeship in the late 1970s (Glover, 1988a). One idea, to promote apprenticeship within the federal government itself, was a nonstarter. A second effort, the

National Industry Promotion Program, was designed to spread apprenticeship beyond construction and manufacturing: the quantitative impact of this effort was small, and most of the new activity lasted no longer than the federal funds. A third initiative organized consortia of small employers to sponsor apprenticeships: while the program succeeded in creating the desired number of new apprenticeships in some communities, only about half were outside the usual occupations, and the program suffered from the absence of national standards or models for high-quality training.

In contrast, Glover (1988b) describes a fourth initiative, to create part-time apprenticeships for high school students, as generally successful. After graduation, students were to become full-time apprentices, completing their related training in a community college or area vocational school. Evaluation results found that students in this program were in fact more likely to continue in jobs related to their training than were other high school students who had participated in regular vocational education. Students and employers expressed strong satisfaction with the program, and several sites continued the program after federal funding stopped. Glover views this as a successful demonstration of the feasibility of starting apprenticeship during high school. Lerman (1990) concurs.

Despite the evident success of this last effort, none of these initiatives in the 1970s provided a spark that started a prairie fire of spontaneous replication. Apprenticeships still prepare only a tiny fraction of new workers. Currently the Office of Work-Based Learning in the U.S. Department of Labor is sponsoring another set of demonstrations to spread the apprenticeship concept. Instead of attempting to transplant the skilled-craftworker apprenticeship model from construction and manufacturing into other sectors, the current demonstrations are experimenting with new models of "work-based learning" for new entrants, existing employees, and small businesses. The demonstrations for new entrants are being conducted by the National Alliance of Business, which has developed a set of rigorous design guidelines for using the work process to promote learning (Komatsu, 1990). Rigorous standards are an essential component of successful apprenticeship systems both in Germany and the U.S.

New work-based learning initiatives are also taking place within vocational and technical education. For example, the Indiana Commission on Vocational and Technical Education is sponsoring demonstrations of programs that combine classroom instruction and workplace experience for secondary and postsecondary students. The curriculum in these programs must be proficiency-based, using statewide standards for major occupational areas developed by a new Vocational Technical Proficiency Panel.

Whether these current initiatives will spark widespread change remains to be seen. However, Germany illustrates that widespread participation by employers in apprenticeship depends on the existence of labor market institutions that can articulate and enforce a social contract. Such institutions are lacking in the U.S. In the absence of institutions to promote their collective self-interest in a well-trained workforce, most individual employers try to minimize their own investment in training and rely on schools or other firms to train their new employees. But since other firms are following the same policy, in the end most individual firms do not provide enough training. An individual company that does invest heavily in training risks losing that investment as trained employees are lured away to other jobs. Historically, it was worker

mobility that caused apprenticeship agreements to unravel in the U.S. (Elbaum, 1989). But worker mobility is a cherished right in a free society. Therefore, the prevailing incentive is for firms to offer only the minimum amount of employee training, unless there are enforceable agreements among employers to insure against worker mobility by requiring all firms to provide training.

The National Center on Education and the Economy (1990) recommends creating, from scratch, a system of Local Employment and Training Boards that would exert the influence necessary to enforce and coordinate a higher level of investment in training by employers. The proposed Boards would oversee the certification of workers' competence at various levels, help to manage programs that combine work and schooling, and coordinate recruitment of individuals into various new training programs. If such a far-reaching institutional change could be accomplished, it would make possible a broader array of apprenticeships or apprentice-like opportunities, as envisioned by the National Center and by Hamilton (1990). But unless and until some such new institution is put in place, the U.S. will not have widespread participation in apprenticeship as in Germany.

III. Cooperative Education (CO-OP)

A more commonly available option for work-based learning in the U.S. is cooperative education. Schools take the lead role in running these programs, enlisting local employers to "cooperate." Normally, the classroom instructor arranges job placements and writes a training plan detailing what each student is expected to learn on the job. The student's supervisor on the job evaluates performance in terms of these training objectives, and this evaluation becomes part of the student's grade in the co-op class. Usually the classroom instructor has some released time to visit students' job sites and monitor the situation. "Cooperation" thus involves job supervisors taking on some of the responsibility of instructors, and vice versa. Co-op is intended to create a close connection in students' minds between the job and the classroom.

Close to a million students each year enroll for co-op in high schools and two-year colleges. Most of these are in high schools. A good example of a high school co-op program can be found in Roanoke County, Virginia. The Roanoke County school district operates four comprehensive high schools and an area vocational center. Total enrollment in grades 10 through 12 at the high schools was 3,277 students in 1988-89. Approximately 340 students, or slightly more than 10 percent, were enrolled in co-op. Of these, 265 were in marketing education and 57 were in business and office education. Most of the marketing students are placed in department stores or smaller retail businesses in Roanoke's several shopping malls. Employers seeking part-time student employees often call the schools to let them know positions are available. The co-op program is run by 15 coordinators who teach related classes. The marketing co-op teachers, for instance, may teach introductory marketing courses in addition to the co-op class. Students are eligible for co-op placements in marketing if they have taken the introductory classes and enroll in the co-op class concurrently with their co-op job. Good attendance and grades are used as criteria for selecting co-op students. Co-op coordinators have released time during the day to visit co-op students at the work site and talk with their supervisors. All co-op students have written training plans and are assessed at the end of the semester by both their job supervisor and their teacher on how well they have met their objectives.

In general, co-op offers potential advantages to students, employers, and schools. Students gain access to meaningful jobs where they can acquire skills and knowledge that are relevant to their possible careers (Stone, Stern, Hopkins, and McMillion, 1990). Employers gain access to a relatively reliable and well-motivated group of students, whose performance on the job will also be monitored by the school. For the school, co-op offers a real-world work setting where students can see the relevance of what they are studying.

Most cooperative education arrangements are worked out locally between individual employers and school staff, subject to various state laws and local customs. An unusual example of a cooperative education program organized on a national scale is General Motors' Automotive Service Educational Program (ASEP), which prepares service technicians to work in GM dealerships around the country (Casner-Lotto, 1988). Local community colleges and GM dealers cooperate in supervising a planned two-year sequence of full-time work and full-time study periods lasting one or two

months at a time. Before they begin the program, ASEP students sign employment agreements with the dealers. ASEP is remarkable not only for its nationwide operation but also for integrating community college courses with related work experience.

Federal Support for CO-OP

Vocational education law has provided one source of support for co-op. Regulations governing implementation of the original Smith-Hughes Act in 1917 mandated that the co-op method be made available as an alternative to school laboratories for vocational agriculture (Leske and Persico, 1984). Categorical support for co-op was provided by the Vocational Education Amendments of 1968. In the Perkins Act of 1984, there was no specific amount of money authorized for co-op programs, but section 201(i) stipulated that vocational education services under the basic grant "shall, to the extent practicable, include work-site programs such as cooperative vocational education, work-study, and apprenticeship programs." Money under the Perkins Act flows to both secondary and two-year postsecondary programs. The 1990 Perkins amendments do not mention co-op specifically as an activity funded by the basic grant, but do include it under Community Education and Employment Centers.

Title III of the 1965 Higher Education Act also provided support for co-op programs at the postsecondary level. This was expanded in 1972 by the passage of a new Title VIII (Rowe, 1988; Dube and Miller, 1988), which authorized discretionary grants to colleges for demonstration, training, research, and administration of co-op programs. These funds may not be used to pay students. In the early 1980s the federal appropriation was approximately $14 million per year. Two-year colleges received more than one-third of the money (Christoffel, 1985). In 1986 Congress extended the authorization of Title VIII until 1991, at a level not to exceed $17 million per year (Rowe, 1988).

A third source of federal support for co-op has been the Targeted Jobs Tax Credit (TJTC). Created by the Revenue Act of 1978, TJTC enabled employers to claim a credit on their income taxes if they hired individuals from several specific groups. Co-op students between the ages of 16 and 19 were one of the groups. The other categories included economically disadvantaged ex-offenders, economically disadvantaged Vietnam-era veterans under age 35, welfare recipients, and handicapped individuals who were receiving or had completed vocational rehabilitation. The original law set the maximum credit equal to $3,000 in the first year of employment and $1,500 in the second year. By fiscal year 1981, nearly 179,000 secondary and postsecondary co-op students had been certified as eligible for TJTC. This number was almost equal to the total for all other eligible groups (LeGrande, 1987).

The 1981 Economic Recovery Tax Act curtailed participation of co-op students in TJTC, by limiting eligibility to those living in economically disadvantaged families. One reason for the change was that many employers conceded they would have hired co-op students anyway, without TJTC. Another was that many of the students were from high-income families, and the intent of TJTC is to subsidize employment of disadvantaged groups. As a result of this and other changes (including reduction in the amount of the tax credit), the number of co-op students participating in TJTC fell to approximately 8,000 in fiscal 1983, 7,000 in 1984, and 5,000 in 1985 (LeGrande, 1987). Unpublished figures from the U.S. Department of Labor shows 1,600 in 1987.

Prevalence of CO-OP

The National Center for Education Statistics reported 648,500 students enrolled in cooperative vocational education at the secondary level in 1981-82, and another 81,500 in two-year colleges. Business and marketing programs had the largest numbers of co-op students at both the secondary and postsecondary/adult levels (Craft, 1984).

The Cooperative Education Research Center (CERC) at Northeastern University conducts a yearly survey of co-op programs in two-year and four-year colleges and universities in the U.S. and Canada. The 1987 survey counted 78,000 co-op students in two-year colleges in 1987, of whom 76 percent were in vocational fields. Approximately half of the vocational co-op students in two-year colleges were in business, which was the largest single field of study for two-year co-op students (in comparison, engineering enrolls the largest number of co-op students in four-year colleges and universities).

The 1987 CERC survey found co-op programs in 437 two-year colleges and 549 four-year colleges in the U.S. Most of the two-year college co-op programs started between 1967 and 1981. Many co-op programs in four-year colleges and universities also started in this period, but the original postsecondary co-op programs were all in four-year colleges: 17 co-op programs in four-year colleges and universities that started between 1906 and 1926 were still active in 1987.

The first co-op programs were organized on an "alternating" schedule, under which students spend approximately equal periods of time (e.g., semesters) alternately in full-time schooling and full-time work. This mode still predominates in four-year institutions. Federal support for postsecondary co-op was originally limited to alternating programs. However, most two-year colleges find it convenient, and less disruptive of students' progress, to organize co-op programs on a "parallel" schedule. This means students attend classes on a full-time basis during part of the day and work part-time during the other part of the day. Federal law was changed in 1976 to permit support for parallel programs.

Despite its diversity, the defining characteristic of co-op is the close relationship between students' work on the job and in the classroom. In two-year colleges, the 1987 CERC survey found that teaching faculty participate as co-op advisers or coordinators in 79 percent of co-op programs.

Effects of CO-OP on Graduates' Employment

According to Wilson (1988), evaluations of co-op at the college level generally have found positive effects on students' academic performance and career development. However, not all the evidence on employment outcomes is clear-cut. For instance, Wilson and Lyons (1961), Gore (1972), Cash (1979), and Jagacinski, LeBold, Linden, and Shell (1986) failed to find a significant advantage in starting salary for co-op graduates compared to non-co-op graduates, though Gore did find higher average salaries for co-op graduates a few years after graduation.

Jagacinski et al. suggest that earlier studies were deficient because they did not contain information about the work experience of non-co-op students while in college. Many college students who do not enroll in a formal co-op program nevertheless find summer jobs or part-time jobs during the year, and some of these jobs are directly related to students' academic majors. Using data from the 1981 National Engineering Career Development Survey, sponsored by the National Science Foundation, Jagacinski and associates

discovered that engineering co-op graduates' salaries were slightly lower than salaries of non-co-op engineering graduates who had engineering-related work while in college. Both groups earned higher salaries than engineering graduates who had no work experience while in college, or whose jobs while in college were not related to engineering. This study indicates the importance of taking into account the amount and kind of work experience non-co-op students have, when trying to measure the effects of participation in co-op.

Research on co-op at the secondary level has suffered from the same problem. This research was reviewed in detail by Stern, McMillion, Hopkins, and Stone (1990). Generally, studies have found that secondary co-op students are more satisfied with school, though their employment and earnings after graduating from high school are not significantly better. But again, this research has generally ignored the in-school work experience of non-co-op students, as well as variation in the quality of co-op jobs. The implicit assumption has been that differences among co-op jobs are negligible compared to the difference between co-op positions and jobs held by non-co-op students. This seems unlikely. Even in co-op programs that are identical with respect to training plans, visits to the work site by the co-op coordinator, and other procedures, some placements nevertheless provide more complexity, opportunities to learn, better supervision, and other characteristics conducive to students' development. Inevitably, some non-co-op jobs will actually be better than some co-op positions. Without information on the quality of both co-op and non-co-op jobs, it is not possible to measure accurately the effects of the co-op program. Some information of this kind is now being produced by research at the National Center for Research in Vocational Education (Stone, Stern, Hopkins, and McMillion, 1990).

Expanding CO-OP

Like the advocates of apprenticeship, proponents of cooperative education have recommended expansion (National Child Labor Committee, 1984; Committee for Economic Development, 1985; Parsons, 1987). However, there are two main obstacles. One is cost. Co-op coordinators must spend substantial amounts of time finding good job placements, monitoring students' experience at the job site to ensure that the desired learning actually takes place, and dealing with problems that may arise. A second problem is that, even if schools could commit more money to pay co-op coordinators, employers' willingness to provide training opportunities is limited. Lewis (1987) points out that the Youth Incentive Entitlement Pilot Project, which offered wage subsidies to employers who provided part-time jobs to disadvantaged high school students, attracted participation by only 18 percent of employers even when the subsidy rate was 100 percent. That was in the 1970s, when young people were a glut on the market; perhaps the response would be higher in the 1990s when young workers are relatively scarce. Not limiting the subsidy to disadvantaged students would also raise the participation rate. Nevertheless, the biggest obstacle to expanding co-op is the same as the barrier to expanding apprenticeship: in the absence of enforceable agreements among employers, most cannot afford to spend much time training students.

IV. School-Based Enterprise (SBE)

School-based enterprise (SBE) can be defined as an activity, sponsored or conducted by a school, that engages a group of students in providing services or producing goods for sale or use to people other than the participating students themselves. SBEs are a common feature in vocational education at both the secondary and postsecondary levels: for example, school restaurants, house-building and other construction projects, print shops, farms, child care centers, retail stores, hair styling, and auto repair shops. Traditionally, school farms were a particularly important form of SBE in vocational education. Outside vocational education, SBEs have been less common, but there are some notable examples, such as Foxfire (Wigginton, 1986). School newspapers, yearbooks, plays, and concerts are extracurricular forms of SBE. Like apprenticeship and cooperative education, the appeal of SBE stems from the belief that students learn better if they can put what they are learning to immediate, productive use.

While there are probably hundreds of thousands of students in U.S. high schools and community colleges who participate in some kind of SBE each year, the overwhelming majority of students do not. SBEs seem to exist all around the edge of the educational system, but not to affect its basic structure.

Studies of SBEs in the U.S

According to Stone (1989), most SBEs described in the literature have been created for one of four reasons: to teach entrepreneurship, provide application of skills and knowledge taught in other courses, enhance students' social and personal development, or to stimulate economic development in the community.

Teaching entrepreneurial skills is perhaps the most common reason. As reported by Stone (1989), "Kuratko (1989) observed that the number of colleges and universities offering courses related to entrepreneurship reached 3000 in 1987. Interest in teaching entrepreneurship has also existed for some time at the secondary level (Stone, 1980). The initial objective in most of these programs is 'to develop basic skills relating to starting and managing a small business' (McFarlane 1981, p. 138). The work experience gained through SBEs takes on more importance in light of the fact that 40 percent of today's entrepreneurs reportedly are high school graduates only and another 26 percent have some college but no college degree (Ashmore, 1988). High school SBEs therefore may provide a valuable opportunity for potential entrepreneurs to gain experience in operating a small business. Indeed, Buzzell (1989) argues that entrepreneurship should be center stage in all vocational education." (p. 2) SBEs might play a particularly important role in improving entrepreneurship opportunities for minorities who are under-represented among small business owners.

Stone (1989) also gives several examples of SBE reinforcing knowledge and skills gained in regular classes. "The application of classroom skills was highlighted by Rallo (1986) in his discussion of several SBE programs where the primary emphasis was on providing an opportunity to practice the use of class taught skills. Similarly, ... Cooper (1988) described the application of basic academic skills in a bicycle repair shop run by students in a middle school. This SBE ... gave pupils an opportunity

to learn the basics of computing by keeping track of profits they were making." Students made real "application of basic math concepts (fractions, percentages), business concepts (figuring profit and loss), writing skills (the students wrote a grant proposal to fund the project), and personal consumer skills (the 'company' had a checking account)." (pp. 2-4)

Another example of SBE applying academic and vocational course content is the project run by Mt. Edgecumbe High School in Sitka, Alaska. According to Stone (1989), "The enterprise involves students from the math, art, business and computer, and Pacific Rim Culture classes. The aim ... is to combine cultural focus with a strong vocational program and apply both vocational and academic skills in an import-export business. The enterprise sells smoked fish, and its business is directed toward competitive Asian markets.... Knapp (1989), assistant to the superintendent in Mt. Edgecumbe, asserts, `We have a cross-curricular approach to entrepreneurship, and it works'." (pp. 7-8)

An unusually ambitious example of teaching regular course content through SBE was the FEAST program (Stern, 1984). FEAST, Food Education and Service Technology, began in 1965 as an effort to organize a curriculum for high school students around running a restaurant. Conceived by Hilda Watson Gifford, the initial effort was sponsored by the Hotel and Restaurant Foundation of the City College of San Francisco, with a grant from the Ford Foundation. Kennedy High School in Richmond, California, was one of several schools that sent a team of teachers, administrators, and student services staff for intensive training starting in the summer of 1965. For several years, FEAST staff at Kennedy included a math teacher and two English teachers, a counselor, a lab (restaurant) instructor, and the manager of the school cafeteria. Students received a two-year course of instruction in food preparation and service, along with English and math courses in which the content was related to the commercial food industry. The program also provided work experience in local restaurants, the school cafeteria, a restaurant operated by students on campus, and an after-school club that did outside catering.

As identified by Stone (1989), a third objective pursued through SBEs is personal and social development. "For example, Moskowitz et al. (1982) present a case where a student-operated store was one of the devices employed in a drug-abuse prevention program among high school students.... The store was organized around three teams, each of which was responsible for one aspect of the store's operation. Students worked in the store three days a week, 80 minutes every day. This was about 8 percent of their total school time, and by the end of the course they had spent about 20 hours devoted to actual service delivery.... Pretest data on the students included general information regarding their attitudes toward school and self ... and information regarding prior drug abuse." However, post-tests did not find evidence of reduced drug abuse. One of the possible reasons for the failure of the project suggested by the authors is that it did not last long enough (only one semester). (pp. 10-11)

While it is probably too much to expect that SBE would prove effective against drug abuse, there is evidence that participation in certain kinds of enterprise can have a positive effect on more proximate measures of students' social development. Notably, Conrad and Hedin (1982) found that students who participated in community service projects showed gains in their professed sense of personal and social responsibility.

In Stone's (1989) enumeration, a fourth objective associated with some SBEs is

community economic development. "Nappi (1986) described a college program, which he felt was easily transferable to a secondary setting, where business students adopted a small town and went about a series of activities designed to rejuvenate a declining downtown." (p. 3) Economic development is also a major objective of REAL Enterprises, Inc., which is currently working to start SBEs in rural communities around the country. After careful market research and financial planning, students start enterprises with help from the school, then continue working in them after they graduate, and eventually become independent of the school. One of REAL Enterprises' early successes is the Way Off Broadway Deli, on Interstate 95 in St. Pauls, North Carolina (REAL Story, Winter 1988/89).

Although available descriptions of SBEs illustrate the purposes for which they are intended, there does not yet appear to have been any systematic, longitudinal research on whether SBE in fact provides the intended benefits to students. However, there is evidence that students assess their experience working in SBEs more favorably than in jobs outside of school. Stern (1984) surveyed students working in two student-run restaurants, asking a parallel set of questions about the quality of work experience in the SBE and in their most recently held paid job outside of school. Students indicated that their SBE jobs gave them substantially more opportunity to learn skills that would be valuable in future employment. They also reported that working in the SBE more often gave them a chance to do what they did best, and to work as part of a team where co-workers help each other. Compared to jobs outside of school, the SBEs were also more often said to be interesting and enjoyable, but also more important to them and more significant in the broader scheme of things.

A Notable Example: The Montgomery County Student Vocational Trades Foundations

Since SBE is an important option but has received relatively little attention, it is useful to consider an example in some detail. Montgomery County Public Schools sponsor two enterprises that provide work experience for students in vocational education. The Construction Trades Foundation builds one or two houses each year. The Automotive Trades Foundation reconditions used cars and sells them through two "Mini Dealerships." Both foundations are nonprofit corporations, enlisting members of the local business and professional community to serve on the boards of directors. A third enterprise, the Retail Trades Foundation, opened a flower shop in 1983 but subsequently closed. The Construction and Automotive Trades Foundations are described here.

In 1983 Montgomery County Public Schools built the Edison Career Center, a spacious and well-equipped "career specialization school." The Edison Center can accomodate 920 students, but as of February 1988 only 438 were enrolled. The largest programs at the Edison Center (with February 1988 enrollments) were cosmetology (53), auto mechanics (51), carpentry (35), heating and air conditioning (34), and word processing (29). Students in the Construction and Automotive Trades Projects take some of their classes here, and some in their local, comprehensive high schools (there are 23 high schools in the county).

The Montgomery County Students Construction Trades Foundation was formed as a nonprofit corporation in 1976 on the initiative of Michael Wilson and Allen Brown, who were then vocational teachers at Rockville High School. The board of directors has included local real estate developers, construction contractors,

realtors, attorneys, and architects. In its first year the, Foundation secured a $100,000 loan from the Bank of Bethesda to buy land and materials. The loan was repaid from the sale of the first house, dubbed Young American I, which sold for $106,000 in 1977. Since then, the Foundation has been able to finance subsequent purchases of land and materials from preceding years' profits. Young Americans II and III sold for $149,000 and $167,000 in 1978 and 1979, respectively. The Foundation continued to sell houses on the open market for the next three years.

In 1983, the Foundation started building moderately priced dwelling units under a county program that provided free land, restricted the selling price of the houses built, and limited eligible purchasers to households with incomes below a certain level. Young American VII was sold for $75,000 in 1983. The Foundation continued to participate in this program through 1987, building one or two houses a year. Young Americans XIV and XV each sold for $85,000 in 1987.

In 1988, the Foundation returned to operating on the open market, building a large suburban house that was expected to sell for about $250,000. In addition to building 16 houses through 1988, the Foundation has also engaged students in construction projects for the school system, including a solar demonstration house and a covered bridge at an outdoor education center.

The Construction Trades program was the subject of the cover story in the American Vocational Association's (AVA) Vocational Education Journal for January/February 1987. This was after the program won the first annual prize for excellence in a housing and building program, awarded in 1986 by the Home Builders Institute in conjunction with the AVA. The article, "Building Homes, Building Careers" (pp. 34-36), was written by Meredith Cohn, a journalism student at Rockville High School who participated in the public relations component of the Construction Trades project.

According to Cohn in 1987, approximately 350 students were participating in the Construction Trades project each year. Architectural design students at nine schools compete to design the houses. The winning design is selected by a panel of local architects after a two-stage review procedure, in which some of the sketches submitted in the first stage are chosen for development into finished drawings for the second stage. Other classes at various high schools participate in other phases of the project. Interior design students at Wheaton High School choose the furnishings for the annual open house, when the new home is shown to prospective buyers and the public. Landscaping students at Gaithersburg High School develop the landscaping plan. Food service students at Paint Branch High School and the Edison Center cater a buffet for the open house and an annual construction clinic. Ceramic students at Walter Johnson High School make the cornerstone. Students in cabinetmaking classes plan and build cabinets and counters. Marketing students design brochures and deal with prospective buyers. Printing students produce the brochures. Journalism students (like Cohn) write press releases for local media. Accounting students keep the books and present monthly financial reports to the board of directors meeting.

The students most intensively involved in the construction project are those who take classes in carpentry, masonry, plumbing, heating and air conditioning, or electricity. Most of these students are enrolled at the Edison Center, in either a morning or afternoon class. They come to the Edison Center from their home school, then travel from Edison to the construction site

to work for an hour or so. The large amount of time required for travel is regarded as unfortunate, but similar travel would be required if students were going to work on regular construction jobs.

At the construction site, students work under the supervision of their classroom teachers as well as a site coordinator and the resource teacher for the Construction Trades Project. The site coordinator and resource teacher post a daily "work du jour" plan. Members of the Construction Foundation board come to a weekly "site meeting" to review progress and help iron out any problems. The board members themselves sometimes provide hands-on demonstration and instruction.

Some work is contracted out to professionals. According to the site coordinator, who had been with the program since it began, "if we teach it, we do it." This means that students are not expected to do work for which they receive no instruction, such as pouring concrete, plastering, or operating earth-moving equipment. In addition, if work is behind schedule, subcontractors are hired to do such things as taping drywall and painting. Michael Wilson believed it is important to finish the house or houses started each year, so that students have the satisfaction of seeing the finished product, even if some of the work has to be contracted out. He also preferred to build two houses a year instead of one, so that there will always be plenty of work for students to do. He believed it is better for students to be fully occupied than for 100 percent of the work to be done by students, even though "to get the students to do as much of this as they can is the whole objective" of the program.

In addition to the 1986 award from the Home Builders Institute and AVA, the Construction Trades project has received other honors. These include an award from the U.S. Secretary of Education in 1982, and a Presidential Private Sector Initiative Commendation in 1984, for "exemplary achievement in strengthening the nation's vocational education system."

Two years after starting the Construction Trades Foundation, Michael Wilson initiated the Automotive Trades Foundation, with a similar format and philosophy. The board of directors consists mainly of local car dealers, who are interested in ensuring a supply of well-trained mechanics. The Foundation buys used cars on the open market, reconditions them, and sells them at two advertised annual sales or to buyers who get information by word of mouth. Cars sold by the Foundation are warranteed for 30 days or 1,000 miles. The Foundation's first "Mini Dealership" opened in Rockville in 1978. A second one was established at the Edison Career Center when it opened in 1983. In its first 10 years, the Foundation reconditioned and sold more than 675 cars.

Students who work at the Mini Dealerships are enrolled in auto body and auto mechanics classes. In addition, students from marketing classes help with sales and promotion, and accounting students keep the books.

Students are not paid for their work on the Construction or Automotive projects, though the Foundations do make cash awards to students for outstanding work (the Construction Foundation gave out $22,000 to students in 1986-87). Whatever benefits students receive are mainly educational, and most of these have not been measured. According to the Foundations' public relations coordinator, 90 percent of students involved in these projects in the first nine years have been "placed," that is obtained jobs presumably related to their training. Cohn's article reports that "Roughly 45 percent go on to college or other training related to their foundation activities; 55 percent go directly into jobs in their field." (p. 36) These

figures seem to be educated guesses, however.

When asked about the benefits of experience in school-based enterprise compared to regular, paid jobs, Michael Wilson and his staff made several observations. Since working on the Construction or Automotive projects is part of a class, it is less likely to pull students away from school and lead to dropping out than working on outside jobs, where students become more independent and distant from school. The school enterprise also requires less commitment to a particular specialty. In the construction project, different trades work together, and there is opportunity for a student who comes with a carpentry class, for instance, to do some plumbing or wiring. There would not be as much flexibility on a regular, paid job. Supervision in the school enterprise is presumably better, as well. Supervisors in the construction and automotive projects are teachers whose main responsibility is to help students develop their skills. In regular, paid jobs, supervisors may be inclined to help, but they must also be concerned with getting their money's worth out of the student-employees, and this may mean assigning them to activities with no educational benefit except possibly "building character." Finally, a school enterprise is a more reliable source of job experience year after year, since placements in regular, paid jobs depend on the ups and downs of the local economy and labor market.

Expanding SBE

Creating more SBEs could give additional students an opportunity for "situated learning," without having to rely on private employers who have limited incentive to provide training. Although students are usually not paid for work in SBEs, their efforts can be made to confront the test of the market in other ways. Furthermore, there is evidence that SBEs offer work experience of better quality than in outside jobs.

The barriers to expanding SBEs are different than the obstacles to expanding apprenticeship or co-op. Rather than employers' reluctance, the problem is lack of incentive and resources within the school itself. Making SBE a more central part of schooling would confront people in schools with a very different view of what school is about: actually doing things, instead of merely preparing students to do things in the future. Beyond this problem of initial mindset, there are a myriad of implementation problems, such as finding or training teachers who know how to run a productive enterprise, identifying viable products or services, raising capital, negotiating with local businesses or unions which may view SBEs as unfair competition, and rewriting curriculum to use SBE as a means for students to learn the knowledge and skill that schools are expected to teach. These are major challenges. Still, there are enough examples to indicate the promise of SBE for serving important educational purposes.

V. Vocational Academies: Integrating Vocational and Academic Education

School-based enterprise, cooperative education, and apprenticeship all use work for educational purposes. They build bridges across the institutional boundary between schools and workplaces, between learning and doing.

The line between learning and doing, theory and practice, also runs through the curriculum within the school itself, where it divides "academic" from "vocational" courses. In high school and two-year college, academic courses are intended to prepare students for further schooling at higher levels. Vocational courses are meant to prepare them for work.

The dichotomy between academic and vocational courses has recently come under attack for several reasons. First, the same research in cognitive science that has corroborated the value of combining learning and work also suggests that students learn "academic" material best when they can use it in a real problem-solving context (see Raizen, 1989). As Alfred North Whitehead (1929), one of the century's leading academicians, argued, teaching subject matter unconnected to real application produces only "inert," useless knowledge. Introducing the applied orientation of vocational instruction can breathe life into academic subject matter.

A second criticism of the separation between academic and vocational has come from employers, who began to argue in the 1980s that students need better preparation in academic subjects in order to function effectively as workers. This argument was a marked departure from the historical position of business groups, which advocated the initial creation of vocational education as a separate curriculum (Lazerson and Grubb, 1974), and subsequently were consistent in supporting it. During the 1980s, however, prominent business spokesmen began to issue surprisingly sharp criticism of vocational education (National Academy of Sciences, 1984; Committee for Economic Development, 1985). Their major contention was that students who took a lot of vocational courses in high school were not learning basic academic skills -- in reading, writing, math, science -- required for the workplace of today and tomorrow. Academic subjects should have first priority, these spokesmen said. Competence in basic academic subjects should be a prerequisite for students entering vocational courses, or else should be taught as part of the vocational classes themselves.

A third argument against separating academic and vocational education came from those who opposed it as an undemocratic tracking system, in which students from more affluent families are more likely to enter the academic stream, while less affluent students are assigned to vocational courses (e.g., see Oakes, 1985). To break down invidious track distinctions, advocates of integration insist that taking vocational courses must not reduce a student's chances of going on to higher levels in the educational system.

In response to these arguments, Congress has now mandated that federally funded vocational education be combined with academic instruction. Section 235 of the 1990 Amendments to the Perkins Act specifies that the basic grant shall be used in programs that "integrate academic and vocational education ...

through coherent sequences of courses so that students achieve both academic and vocational competencies." States and localities are developing a variety of approaches, ranging from the infusion of academic content into existing vocational courses, to the creation of whole new curricula (Grubb, Davis, Lum, Plihal, and Morgaine, 1990).

One set of programs that illustrate the successful integration of academic and vocational curriculum are called "academies." Since some of these programs originated well before the 1990 Amendments, their track record has already been documented. At least 100 vocational academies now operate in various locations around the country. All of them have the following three characteristics in common:

- Each academy is organized as a school within a school: that is, a distinct subset of students in a high school take a sequence of courses together.

- Each academy has a particular vocational theme, such as computer-related occupations or health careers. The academy's career focus usually refers to a vertical segment of the occupational hierarchy. For instance, health careers encompass occupations ranging from paramedics to physicians. This is in contrast to traditional vocational education, which prepares students for particular horizontal slices of the job distribution, e.g., licensed vocational nurses.

- Each academy enlists the active involvement of local employers in the relevant sector. Employers' commitment of time, resources, and job placements for students is an investment on the demand side of the labor market which directly complements and validates supply-side investments by local schools and students.

Historical Perspective

The current wave of vocational academies began in Philadelphia in 1969, with the opening of the Electrical Academy at Thomas Edison High School (Neubauer, 1986; Snyder and McMullan, 1987a). At the time, Edison had the highest dropout rate and lowest attendance rates in the city. The academy was intended to keep students in school and prepare them for employment. The Philadelphia Urban Coalition initiated the idea and coordinated the planning.

The Electrical Academy was considered successful enough to warrant replication. In 1972 the Philadelphia Business Academy opened at University City High School, and in 1975 a second Business Academy began at South Philadelphia High School. An Academy of Applied Automotive and Mechanical Sciences started at Simon Gratz High School in 1974. An umbrella organization, the Philadelphia High School Academy Association, was created to support these efforts and maintain communication between city business leaders and school district officials.

The Philadelphia Academies expanded again in the 1980s. A Health Academy opened in 1982 at Martin Luther King, Jr. High School. By 1986, the Business Academy was operating in five high schools, and the other academies had expanded to a total of five other high schools. As of 1987, plans were being made to enroll 5,000 of Philadelphia's 50,000 public high school students in vocational academy programs.

The original Philadelphia Academies were designed to prepare students for occupations not ordinarily requiring a bachelor's degree:

electrical trades, secretarial work, automotive mechanics. These programs fit within the traditional limits of high school vocational education as defined by Smith-Hughes. What was different about the Philadelphia Academies was the school-within-a-school format, which was designed to build more social cohesion among students, and which also demanded that academic and vocational teachers coordinate their curriculum.

In the 1980s, however, the Philadelphia Health Academy took off in a new direction. Instead of focusing on placement of students in full-time jobs after graduation, the Health Academy transcended the traditional limits of high school vocational education by emphasizing preparation for college. The curriculum requires four years of math, science, and foreign language -- including a semester of Latin to give students a basis for understanding medical and pharmacological terminology. As the Health Academy's executive director put it, "the other Academies infused a vocational training program with academics. In the Health Academy, we infused an academic curriculum with a vocational orientation." (Snyder and McMullan, p. D-29)

In 1981 two vocational academies opened in California, based on the Philadelphia model. They were called the "Peninsula Academies" because they are located at two high schools on the peninsula that lies south of San Francisco. One is a Computer Academy at Menlo-Atherton High School, and the other is an Electronics Academy at Sequoia High School, both within the jurisdiction of Sequoia Union High School District. The Peninsula Academies began as a collaborative effort of the Stanford Mid-Peninsula Urban Coalition, the school district, and local corporations. As of 1990-91 both programs were still operating and planning to continue for the indefinite future.

Unlike the Philadelphia Academies, most of which are now four-year programs, the California Peninsula Academies enroll students for only three years, beginning in grade tenth grade. Counselors and teachers refer students to the program whose performance in ninth grade -- poor attendance, low grades, too few course credits -- indicates a high risk of dropping out of school. The 20 to 30 students at each grade level take all or most of their classes together. Courses include an academic core of English, math, and science, as well as a "lab" or shop class in the particular technology on which the Academy is focused. The sequence of topics in different classes is planned so that students can see connections between what they are doing in different courses at the same time. A Replication Guide for the Peninsula Academies (Reynolds, 1984) describes the curriculum and organizational structure in more detail.

In addition to making more manifest the connections between academic and vocational subjects, the Academies also forge direct links between classrooms and workplaces. Local employers' representatives participate in designing the technical-vocational part of the curriculum. Companies donate equipment. They also provide summer jobs and part-time jobs during senior year for Academy students who successfully complete eleventh grade. A feature of the California academies which is not part of the Philadelphia model is that volunteers from participating companies act as "mentors" for Academy students, spending time with them individually to talk about the students' interests and career plans, visit work sites, and help students feel personally connected to a set of work organizations with which they would otherwise have little or no contact.

Evidence of the original two Peninsula Academies' positive effects on students' performance (see below) prompted the California legislature to sponsor replications of

the Academy model at 10 other high schools, beginning in 1985. Four of the 10 new "Partnership Academies," as they are now called, were designed around computer-related occupations, two focused on electronics, two on health services, one on financial services, and one on food services (for a detailed description of the program at each site, see Dayton, Weisberg, Stern, and Evans, 1987). The California legislature appropriated funds to support a second wave of replications beginning in 1988. During the 1990-91 school year the state of California has committed approximately $2.5 million to be spent on 33 Partnership Academies. The state money supplements normal expenditures by local districts; it is supposed to be matched once by equal supplements from district sources and matched again by contributions from local businesses. Several academies have also sprung up around California without state support.

In addition to the Philadelphia and California academies, vocational academies have also started up in other places. In 1982 the American Express Company and Shearson Lehman Hutton started an Academy of Finance in New York City. The curriculum covers the last two years of high school, and is organized around the theme of careers in the financial services industry. As of 1989, the Academy of Finance had spread to 35 schools in 17 metropolitan areas. A spinoff, the Academy of Travel and Tourism, started in 1986 in Miami and New York City, and was operating in four schools in 1989. American Express, Shearson and other companies have now started a National Academies Foundation to replicate the academy model in other locations and other business sectors (Schmidt, 1989).

Evaluations of Vocational Academies

Relatively rigorous evaluations of academy programs have produced reliable evidence of effects on high school completion and performance after graduation. A primary purpose of the Philadelphia and California academies was to reduce the high school dropout rate. In Philadelphia, there is some suggestive evidence of a higher graduation rate among one cohort of Business Academy students (Snyder and McMullan, 1987a, p. D-37). Stronger evidence comes from California. In the two original Peninsula Academies, Reller (1984, p. 76; 1985, p. 31) reported lower one-year dropout rates than among comparable students at the same high schools. Cumulative, multi-year dropout rates were lower for students in the California academy replications than for students in matched comparison groups (Dayton, Weisberg, and Stern, 1989).

A benefit-cost analysis for one cohort of students in the California replication academies compared the program's additional cost with the additional expected lifetime earnings obtained by academy students as a result of the fact that their high school graduation rate was higher than the comparison group's (Stern, Dayton, Paik, and Weisberg, 1989). These additional future earnings were estimated to be worth approximately $2.5 million for the cohort of 327 students. Extra costs of the program for this cohort amounted to approximately $1.2 million (including time of corporate volunteers); the cost to taxpayers alone was about $0.75 million (excluding corporate volunteers' time). The estimated net benefit from dropout prevention was therefore $1.3 million for society as a whole, or $1.75 million for taxpayers.

Conceivably, academies might reduce the dropout rate by watering down the curriculum. If that were to happen, academy graduates presumably would not do as well after high school as other graduates from the same schools. To determine whether academy graduates were succeeding as well as

comparison students, follow-up studies have been conducted. The P/PV evaluation in Philadelphia found that Business Academy graduates, like graduates from other business programs in the same high schools, were more likely to be employed, and less likely to be enrolled in postsecondary education, compared to a random sample of graduates from the same high schools (Snyder and McMullan 1987a, pp. D-45, D-47). Compared to other business program graduates, Business Academy graduates were more likely to be working for "blue chip" companies (p. D-49-51).

Graduates from the original two California Peninsula Academies in 1984, and from matched comparison groups in the same two high schools, were followed for 27 months after graduation (Reller, 1987). No significant differences between Academy and comparison students were found in employment status, wages, or hours worked. However, 15 months after graduation the rate of enrollment in postecondary schooling among Academy graduates, 62 percent, was higher than the 47 percent among the comparison group (p. 25). The proportion both in school and working was 51 percent among the Academy graduates and 34 percent among the comparison group. At the 27-month follow up, the educational objectives of Academy graduates were significantly higher than the comparison group, with 55 percent expecting to complete a four-year degree or more, versus 22 percent in the comparison group (p. 41).

Follow-up surveys in the California replication sites show generally similar patterns of employment and postsecondary schooling among the Academy and comparison groups. About two-thirds of each group were attending school, and about three-fourths of those attending school were in two-year colleges. Between 70 and 80 percent said they intend to get a four-year or graduate degree. The only significant difference was that, among those who were employed, whether attending school or not, academy graduates on average reported working about three more hours per week than comparison graduates.

These results generally do not indicate that higher graduation rates among academy students were achieved by watering down the curriculum. To the contrary, the few significant differences in employment or postsecondary schooling between academy and comparison graduates indicated that academy students were doing better.

Expanding Vocational Academies

High school vocational academies represent one example of the integrated approach to academic and vocational instruction that is mandated by the new federal law on vocational education. The academy model is replicable, and there is unusually good evidence of its success. With additional support, diffusion of the model could be faster and more widespread. Vocational academies do take additional resources, mainly for smaller class sizes and extra preparation time for teachers. Local leadership must create conditions for the necessary collaboration among teachers. Participation by local employers is essential and must be organized. With additional resources of these kinds, vocational academies could become an option for larger numbers of students.

VI. Tech-Prep and 2 + 2: Linking High School With Two-Year College

A major new initiative in vocational-technical education is the "tech-prep" movement. The 1990 Perkins Amendments authorize special grants for secondary schools to join with two-year colleges or apprenticeship programs for the purpose of creating new tech-prep curricula. These encompass the last two years of high school and two years of postsecondary education, "with a common core of required proficiency in mathematics, science, communications, and technologies designed to lead to an associate degree or certificate in a specific career field" (Section 344). In awarding funds, special consideration is given to programs "developed in consultation with business, industry, and labor unions" (Section 345). Here again, participation on the demand side is to accompany new effort on the supply side of the local labor market.

Like vocational academies in high schools, tech-prep programs are intended to combine academic and vocational courses that have traditionally been kept apart in separate tracks. Dale Parnell, an early and influential proponent of the tech-prep concept, wants it to "break down the walls between vocational education and academic education" (1990). The Illinois State Board of Education (1990) has adopted the following definition: "Illinois tech-prep represents an educational track that integrates college preparatory coursework with a rigorous technical education concentration. It is a planned sequence of courses, both academic and technical, that begins at 9th grade and is articulated with a postsecondary experience leading to an associate degree. Because Tech-prep prepares students for a lifetime of learning, it also provides preparation for advanced education such as a four-year baccalaureate degree. Tech-prep prepares students with the skills and competencies necessary to meet employers' performance standards not only for entry level jobs, but also for career advancement."

The importance of integrated curriculum is also asserted by a tech-prep program called PACE (Partnership for Academic and Career Education) in Pendleton, South Carolina, which lists as one of its goals: "Increase students' motivation to learn academic concepts by using career-related examples from business, industrial/engineering technology, health, and public service fields in the teaching of math, English, and science courses" (American Association of Community and Junior Colleges, 1989). As indicated in these statements, the rationale for tech-prep is similar to the theory behind vocational academies: an integrated curriculum presents academic course material in a way that is more meaningful to students, in order to prepare them for both employment and further education.

For example, a program to prepare "master technicians" was produced by local school districts on the Virginia Peninsula, in conjunction with the Virginia Department of Education and the Virginia Community College System. Curriculum development involved four kinds of innovation. First was the 2 + 2 concept, enabling students to combine the last two years of high school with two additional years of community college to earn an associate in applied science degree in electronics/electromechanical technology. Second, "the program is designed for maximum

`student flexibility' in selecting career options. Students who enter the workforce from any level beyond high school will possess marketable skills. In addition, they can pursue advanced education, return to work, and reenter education at any point. A special feature of the program is the built-in safeguard that prevents students who change their career choice in midstream from losing valuable time. The third innovation is the `academic and vocational mix'. The academic disciplines of math and science are blended with the vocational program services of technology education and trade and industrial education. This unique blend will produce a comprehensive, coordinated curriculum which will allow students a variety of education and career options. Fourth, the project is made possible and its progress is ensured through collaboration with business/industry/government." (Virginia Peninsula Local Education Agencies, 1990)

Variations: 4 +2 and 2 + 2 + 2

The Illinois definition explicitly calls for tech-prep to begin in grade 9, thus including all four years of high school instead of only the last two as specified in federal law. This is an example of a "4 + 2" program, which seems to be a common variation on the "2 + 2" theme. Similarly, the PACE program operated by Tri-County Technical College and neighboring high schools in Pendleton, South Carolina, provides "a coordinated, sequenced series of academic and vocational course starting in grade 9 and continuing through completion of two-year college occupational certificate, diploma or associate degree programs" (American Association of Community and Junior Colleges, 1989). Another example of 4 + 2 is the tech-prep program offered by Richmond Community College and surrounding high schools in Richmond, North Carolina. School officials there explain that if they waited until junior year to recruit for tech-prep they would not find enough students who had completed prerequisite courses, particularly algebra (Dornsife, 1990). This appears to be a common view.

Another variation is 2 + 2 + 2, which combines the last two years of high school with two years of community college and then two more years at a four-year college, culminating in a bachelor's degree. An example is the ACE (Achieving College Education) option offered at South Mountain Community College, part of the Maricopa Community College system in Phoenix, Arizona. "The goal of the program is to increase the number of students who achieve bachelor's degrees after successfully completing high school and community college" (South Mountain Community College, 1989). The program permits high school students to take college classes offered at local high schools. It facilitates the eventual transfer to four-year college by directing students into community college courses that have already been pre-approved for lower division credit at the state university. ACE specifically targets minority and economically disadvantaged students, and offers additional support services, including financial aid information and parent involvement.

Examples of Tech-Prep

The Center for Occupational Research and Development (CORD) has developed a detailed process for designing tech-prep programs (Hull, 1990). The "drawing board" for a tech-prep curriculum is a grid showing courses to be taken during each year of high school and two years of college (Pedrotti, 1990). Each row of the grid is for a particular subject: math, English, science, humanities, two "technical core" subjects, two "technical specialty," and two other.

Using this grid, CORD has created models for tech-prep programs in electronics, majoring either in telecommunications or digital/computer applications. Both programs start in the first year of high school with Applied Math I, a lab science, Technology Education, and health or physical education. In sophomore year students would take Applied Math II, Principles of Technology I, a computer literacy course, and an elective course such as fine arts or foreign language. Junior year brings geometry, Principles of Technology II, and courses in DC/AC circuits and circuit analysis. As seniors, students would get Algebra II, a semester each of technical graphics and electronic fabrication and testing, and a first year of active devices. Students in the digital/computer major would have a course in digital devices; those in the telecommunications major would take linear integrated circuits/analog circuits.

During the two postsecondary years, students in both majors would take trigonometry, calculus or statistics, technical writing, physics for technicians, interpersonal/industrial relations, economics in technology, industrial fabrication, industrial electrical power, instrumentation and control, properties of materials, mechanical and fluid devices, microprocessors, a second year of active devices, and an elective such as introduction to lasers. Digital/computer majors would also take linear integrated circuits/analog circuits, computers/interfacing, electronic controls, digital circuits, computer programming, and a digital project. Telecommunications majors would instead take digital devices, microwave communication, audio, communication circuits and systems, optoelectronics, and a telecommunications project.

Actual tech-prep programs around the country are being built from these CORD prototypes. For example, in Owensboro, Kentucky, the high school, community college, and area vocational center have developed tech-prep programs in process control technology and computer technology (Owensboro Public Schools, 1990). Both programs include the same courses during the four years of high school. Freshmen take basic algebra, English I, biology, technology education, and health or physical education. Sophomores get Applied Math I, English II, earth science or elementary chemistry, computer literacy, and life skills. Juniors go on to Applied Math II, Applied Communications, Principles of Technology I, U.S. history, technical graphics, fundamentals of electricity and electronics, and mechanical devices and systems. Seniors take geometry or algebra II, English III, Principles of Technology II, government, fundamentals of digital electronics, industrial electrical power and equipment, and fluid power.

At the post-secondary level, students in both programs take trigonometry, pre-calculus, technical writing, computer applications, industrial relations, economics in technology, circuit analysis, heating and cooling, electromechanical devices, instrumentation and controls, properties of materials, and manufacturing processes. Students specializing in process control technology also take fundamentals of process control, process control elements, control systems I, control systems II, analytical instrumentation, and microprocessor-based systems. Students specializing in computer technology instead take digital devices and techniques, active devices and systems, digital computers, computer programming, and analog devices and systems.

A nursing curriculum developed in Paris, Texas, illustrates the 2 + 2 approach (Paris Junior College, 1989). In grade 11 high school students take Health Careers I, a one-year course that combines academic and clinical experience. In grade 12 they go on to Health Careers II, provided they can demonstrate

competencies, such as CPR and first aid, taught in Health Careers I. Other high school prerequisites for the articulated program are algebra I and II, geometry, physical science, biology I, chemistry, and biology II or anatomy and physiology. At the community college, students can become eligible to sit for the Licensed Vocational Nurse examination by taking two semesters of full-time coursework, plus general chemistry and a course on entry into professional practice during succeeding summers. They can become eligible for the Registered Nurse examination by taking two years of coursework, with general chemistry during the summer in between.

Once a community college has designed a tech-prep program with local high schools in a particular technical specialty, it becomes easier to design programs in other specialties. Community colleges are thus offering diverse tech-prep options, generalizing the model across the curriculum. Richmond Community College and Richmond County, North Carolina, pioneered with 4 + 2 programs in engineering, health/human services, and business. Similarly, Sandhills Community College and Moore County, North Carolina, offer 4 + 2 sequences in business and marketing, engineering and industry, and health and human services. Bristol Community College and two local high schools in New Bedford, Massachusetts, have developed tech-prep programs in engineering technologies and business technologies. In Anchorage, Alaska, the Anchorage School District and University of Alaska at Anchorage are offering 4 + 2 versions of tech-prep in aviation maintenance, electronics, welding, architectural and engineering technology, food service, and home economics (fashion merchandising).

Some community colleges are now using tech-prep to organize programs with local high schools in a range of subject areas. A leading example is in Oregon, where Dale Parnell gave impetus to tech-prep when he served as State Superintendent for Public Instruction. In 1986, Portland Community College joined with local high school districts in forming PAVTEC (Portland Area Vocational Technical Education Consortium), which as of 1988 included 26 high schools in 13 districts. PAVTEC now coordinates tech-prep programs in approximately 50 separate occupational specialties. These include accounting, building technology, computer field service, dental hygiene, electronic engineering technology, fire protection technology, graphic reproduction, hotel-motel management, industrial drafting, landscape technology, medical laboratory technology, nursing, restaurant management, sous chef, veterinary technology, and welding, among others (PAVTEC, 1990). Each high school participates in a subset of these programs. For example, 34 of the 50 programs are available at Hillsboro High School. Some courses at the high school level are sufficiently advanced that students who pass them are given credit for equivalent courses at Portland Community College. However, most of the high school courses in the tech-prep sequence are prerequisites, not substitutes, for the postsecondary part of the sequence.

Other localities are emulating the Portland model. For example, three county school districts in southern Maryland joined in 1989 with Charles County Community College to form the Southern Maryland Educational Consortium. They have organized tech-prep curricula in each county to articulate with the community college. For instance, the proposed automotive mechanics program in St. Mary's County includes four years of regular or college prep courses in English and social studies, four years of math, including geometry and algebra II, one course each in biology and chemistry, two years of Principles of Technology, and auto mechanics for two periods in grade 11 and three

periods in grade 12 (out of a seven-period day). This could lead into the Management Development Program at Charles County Community College and to several other identified postsecondary options. The Southern Maryland consortium also has identified particular courses at each of the cooperating high schools for which credit will be given at the community college to students who pass with specified grades, if they enter a designated tech-prep program.

Expanding Tech-Prep

The tech-prep concept evolved from the movement in the 1960s and 1970s toward "articulation" between high schools and community colleges (Walker, 1989). Articulation usually means that students can take community college courses while in high school, enabling them subsequently to get through community college faster. However, as high school enrollments fell in the late 1970s and 1980s due to the "birth dearth" of the 1960s, the idea of diverting high school students to community college courses became less attractive to high schools that were having difficulty filling their own classes. The 2 + 2 approach avoids competition for students between the high school and community college. Instead, students complete their full four years of high school courses before going on to college.

According to the National Tech-prep Clearinghouse, as of June, 1990 there were 122 tech-prep programs operating in 33 states. Three states had legislated mandates of their own, and six others were considering them. Some of these existing programs may represent the older form of articulation rather than the new definition of tech-prep in federal law.

As envisioned in federal law, tech-prep denotes a coherent four-year curriculum leading to an associate degree in a technical field of work. Within the high school, tech-prep is meant to be more rigorous, high-powered, and prestigious than the "unfocused and watered-down general education curriculum" into which many middle-quartile high school students have drifted, argues Parnell (1990). In Richmond County, North Carolina, where the tech-prep option was introduced in 1985-86, approximately 30 percent of high school students (grades 9 - 12) were opting for it in 1990-91, while enrollment in the pre-college track was also approximately 30 percent -- up from 25 percent in 1985-86 and 1986-87 (Dornsife, 1990). The name "tech-prep" stands alongside "college prep" as a high-status option, designed to "raise the self-esteem level of general and vocational track students by enabling them to identify with a program that has direction, status, and visible support from local employers," in the words of the PACE program (American Association of Community and Junior Colleges, 1989).

Boosted by the 1990 Perkins Amendments and an appropriation of $63.4 million in the final budget for fiscal 1991, tech-prep is sure to spread. It promises to unite high school vocational/technical and academic instructors in a common mission to prepare students for the advanced vocational/technical preparation offered in two-year colleges. Tech-prep offers a clearer sense of direction for high school students and faculty alike. For the two-year colleges it offers better-prepared students, and a vehicle for responding to changing labor market demands. Employers will benefit from the increased availability of employees with advanced technical preparation and the capacity for continued learning. Finally, tech-prep graduates should gain access to highly paid technical specialties that offer interesting work, stable employment, and opportunity for advancement.

VII. Business-School Partnerships

Close collaboration with employers has been a strong tradition in vocational-technical education. At the federal, state, and local levels representatives of business and industry serve on advisory councils, helping to determine priorities and strategies. Many individual programs in vocational-technical education rely on local employers in their fields for timely advice about changing curriculum in response to new technologies and production processes. All of the programs described above depend on active participation by employers who provide work stations for cooperative education, give technical and organizational assistance to school-based enterprises, supply mentors and other kinds of support for vocational academies, and help to design new curricula for tech-prep programs.

The 1990 awards by the U.S. Secretary of Education for outstanding vocational-technical education programs featured several that illustrate close collaboration with employers in both traditional and innovative ways. In Hackensack, New Jersey, the Bergen County Technical School District operates a Supermarket Careers Program for educationally handicapped students. Wakefern Food Corporation/Shop-Rite Supermarket helps run the program, which includes competency-based instruction in a simulated setting, as well as cooperative work experience in real jobs. In Orlando, Florida, Stromberg-Carlson and Martin-Marietta Corporation have joined with Valencia Community College to prepare technicians in computer-integrated manufacturing. The companies provide training space and technical input. Because of this program, Valencia Community College has been designated as a technology transfer center, to help small- and medium-sized businesses upgrade their technology and personnel. At Thief River Falls Technical College, in Thief River Falls, Minnesota, a program in aviation maintenance technology prepares students for work in this field, or for further education. Northwest Airlines provides internship opportunities for the teaching staff at its Minneapolis base. Another example is the automotive technology program at Longview Community College in Lee's Summit, Missouri. Here the college has cooperative partnerships with Ford, General Motors, and Toyota. The companies provide equipment, technical manuals, and instructor training. Students find co-op placements with affiliated car dealerships.

In addition to these ongoing forms of traditional partnerships between employers and vocational-technical education, during the 1980s a growing number of businesses and business organizations initiated new kinds of partnerships in local schools. The vocational academies described above were one example of new business initiatives. Generally, employers' involvement in schools took three forms (Snyder and McMullan, 1987b): efforts targeted directly to students, such as Careers in the Classroom in St. Louis; programs targeted to individual schools, often called "adopt-a-school"; and efforts targeted at entire school districts, such as the Boston Compact. The general motivation for business was to alleviate the perceived shortage of qualified workers. In the words of John Carter, Chairman of the National Alliance of Business, "We need workers who are able to think on their feet and learn the job quickly. However, our schools are producing entry-level workers who lack the basic skills necessary to do the jobs that we have available." (National Alliance of Business, 1989: p. 3) Given this

perceived skills gap, businesses felt compelled to take more direct action.

The "centerpiece" in many of the new business-school partnership programs is part-time or summer employment for students (Snyder and McMullan, 1987b, p. 27). Increased employment while in school is counted as one of the main benefits of these programs. However, the true magnitude of this benefit is not known. A large proportion of the students placed by these programs presumably would have found jobs anyway, since most high school students nowadays do hold paid jobs during the school year and summer. Also, despite the fact that having a job while in school has been found to improve students' prospects for employment after they graduate, there is also evidence that it can undermine their eventual educational attainment (Mortimer and Finch, 1986). Evaluations of business-school partnerships have not taken these considerations into account.

Moreover, unlike cooperative education or apprenticeship, the jobs provided by the new business-school partnership programs have not always been structured to promote specific learning objectives. Instead, jobs have sometimes been used simply as incentives for students to meet certain standards of attendance or performance in school. Nevertheless, there is some recognition that business partners have to accommodate the needs and limitations of high school students. The National Alliance of Business (1989) urges companies to provide extra training and support for student employees, as well as for their supervisors, who have to be sensitive to students "intimidated by the environment and reluctant to ask for clarification or direction or to express concerns" (p. 13). This adaptation of the workplace as a site for learning is the hallmark of programs that link supply-side and demand-side efforts on the local level.

Another form of partnership is business sponsorship of efforts to improve programs, with companies providing grants to schools in much the same way that foundations and public agencies do. A notable example is Cooper Industries' $375,000 program in ten communities. Cooper Industries, headquartered in Houston, Texas, is a 156-year-old diversified manufacturing company, with plants in approximately 100 communities around the country. In 1989 it chose 10 of those communities to give unrestricted grants of $10,000 each, for the purpose of improving high school vocational-technical education. The company expected to give each of these 10 schools an additional $10,000 in each of the succeeding two years. It also planned to choose one of the 10 schools each year to receive an additional $25,000, based on how well it spent its $10,000 grant. One of the $10,000 grants in 1989 went to the Arnold Burton Technology Center in Salem, Virginia, where it was invested in developing curriculum for a tech-prep program in automated manufacturing technology. Another grant was given to the Knox County Joint Vocational School District in Mount Vernon, Ohio, which spent it on computer software to improve students' basic academic and technical skills. A third recipient was the Cullman Area Vocational Center in Cullman, Alabama, where the money was passed on to students in the form of incentives for attendance and achievement, and scholarships to local postsecondary institutions.

Expanding Business-School Partnerships

Close collaboration with employers is a firmly institutionalized feature of vocational-technical education. It occurs in both traditional programs and in new initiatives, such as vocational academies and tech-prep. The additional upsurge in business-school

partnerships during the 1980s was a response to employers' growing perception of a skills shortage. This perception is likely to persist unless a recession reduces demand for skilled employees or new immigration laws bring in enough skilled immigrants to satisfy the demand, or until the echo of the baby boom once again increases the supply of young workers, or -- the worst scenario -- U.S. employers ship enough skilled jobs abroad to reduce the demand for skilled employees here. Desire to avert this last possibility is one of the main reasons why public policy is supporting partnerships between employers and educators to upgrade preparation for work (National Center on Education and the Economy, 1990).

VIII. Improving the Options

Two kinds of options have been described here for strengthening the school/work connection in order to improve the preparation of young people for a more learning-intensive workplace. One kind of program directly ties school to work by engaging students in both activities simultaneously, and structuring the work experience in a way that promotes learning. Cooperative education is the main example in this country, enrolling approximately 5 to 10 percent of all students in high schools and two-year colleges. Further expansion of co-op is limited by schools' ability to afford the time of coordinators who arrange appropriate job placements, help students write training plans, and monitor students' performance. It is also limited by employers' willingness to provide co-op positions and spend the extra time required to support students' learning on the job. Employers' limited willingness to invest in training also constrains the expansion of apprenticeship, another traditional approach to linking learning with work. Apprenticeship requires more initiative by employers than cooperative education does, and in part for that reason is even more limited in this country, enrolling hardly any students in high school and fewer than 2 percent of high school graduates. Expanding structured learning in conventional workplaces will require additional institutional support and perhaps financial incentives to encourage individual employers to act in their own collective best interests.

Many schools have developed their own productive enterprises to give students real, though usually unpaid, work experience that is designed to promote learning. School-based enterprises make schools less dependent on outside employers to provide training positions, which may be unavailable in some localities or during economic downturns. Some schools provide work for students both in school enterprises and in co-op programs. This combination offers both a desirable mix of work experiences and a way of guaranteeing that students will have work even if employers are not offering a sufficient number of co-op placements.

The second kind of program for strengthening the connection between school and work operates within the school curriculum itself, combining academic and vocational courses. The integrated curriculum gives students the benefit of occupational preparation and college preparation at the same time. It also infuses academic courses with the practical, problem-solving approach of vocational-technical education. And it avoids invidious tracking of students. Tech-prep programs and vocational academies both represent efforts to reconstruct the high school curriculum in this way.

Developing these bold new programs requires collaboration between academic and technical teachers. Tech-prep programs and vocational academies will expand as instructors in academic subjects, in particular, find reason to participate. One possible incentive for these teachers is that more students may be drawn to some advanced academic courses if they can see more practical relevance. Academic teachers may also be persuaded by the recent research in cognitive science, which suggests that abstract information is sometimes best learned through authentic application. In addition, instructors in college-prep classes might consider the fact that most college students nowadays hold paid jobs during the school year (Stern and Nakata, 1991). The best preparation for college therefore entails more than taking prerequisite

courses. It also includes qualifying for high-wage jobs, so that it is possible to spend fewer hours on the job while working one's way through college. Thus consideration for students' practical as well as intellectual interests may induce academic teachers in high school to collaborate with their vocational and technical colleagues in developing the new integrated curriculum.

The two kinds of options -- integrated curriculum and structured work experience -- can positively reinforce each other. It is not unusual for tech-prep programs and vocational academies to provide co-op placements in jobs related to the program's curricular focus, e.g., health careers or electronics. School-based enterprise can also be used to support an integrated academic/vocational curriculum, as in a proposed production line at Minuteman Tech in Lexington, Massachusetts, where MIT's Lincoln Laboratory and local electronics companies are helping to develop a new curriculum in manufacturing technology. School-supervised work experience reinforces and extends what students learn in classes. Such work also takes on more meaning for students when it is part of an integrated curriculum.

If the new kinds of curriculum take hold in more high schools, and if they are combined with structured work experience, then it will be possible for all students to have the benefit of rigorous academic instruction and practical vocational education at the same time. Ideally, every high school student would be able to choose among several possible curricular specialities, some of which would organize the core academic curriculum around a particular occupational theme, and would provide related part-time employment during the school year and summer. Some students might enter related full-time employment after completing the program. Others might go on to college, equipped with skills that enable them to support themselves efficiently along the way. Some of those who go to college might continue in the same career line; others might not. The point, as the vocational academies have demonstrated, is that this kind of curriculum can make sense to students, whatever their postsecondary plans may be. Further expansion and improvement of these programs will take money and commitment. Additional resources could usefully be spent on developing lists of exemplary programs, writing technical assistance guides, formulating industrywide standards of competence in specific occupations, creating new curricula at the local level, and providing released time for teachers and others to implement new programs.

Building a real connection between school and work will also require vision. Now, more than ever before, individuals are working and learning at the same time. The fraction of students in high school and college who hold paid jobs during the school year has risen steadily during the past several decades, growing to a clear majority. Although most students' jobs are unconnected to their studies, there are programs that do tie school and work together. Meanwhile, in the workplace itself, technological change and international competition are requiring more employees to keep learning while they work. Programs that combine school and work for young people thus emulate the learning-intensive workplaces of today and tomorrow, extracting educational benefits from students' jobs and giving an opportunity to practice learning through work. This kind of work experience is most meaningful when attached to a course of study that combines academic and vocational content. Whether these programs expand will depend on the strength and clarity of vision shared by educators and employers who see the potential of work for promoting human development.

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