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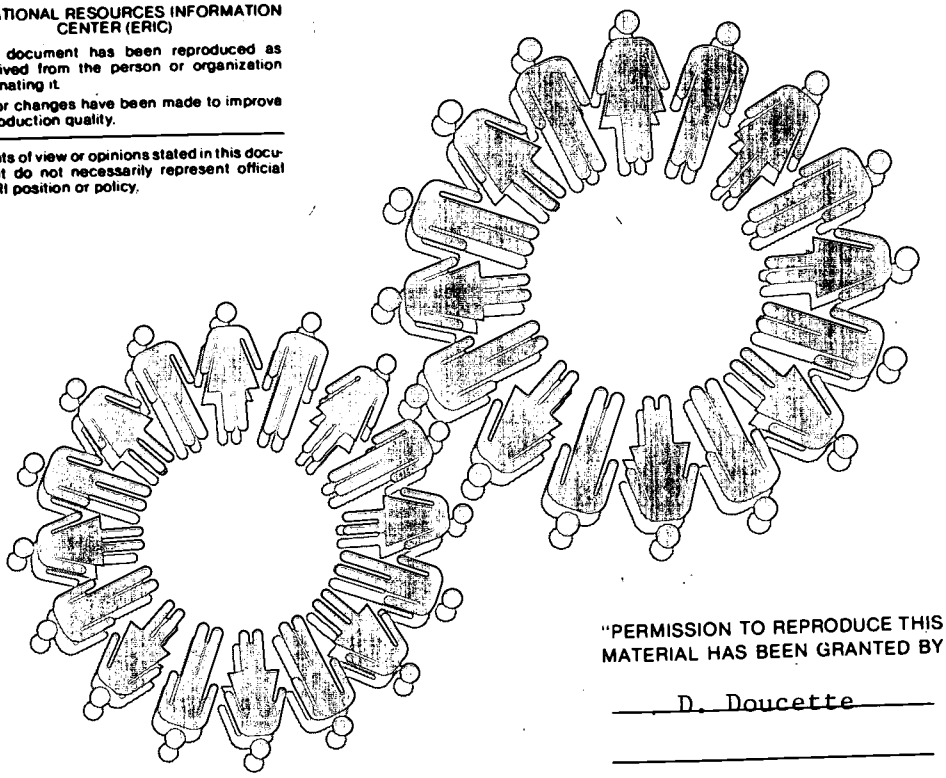
ABSTRACT

Focusing on innovations in workforce preparation and emerging practices in community colleges, this report examines tech prep programs and efforts to integrate academic and vocational education. Following an executive summary and introduction, section 1 outlines federal initiatives and other sources of support for innovation in workforce preparation. Section 2 discusses efforts in integrating academic and occupational education to enhance student achievement, focusing on combining academic and vocational content in individual courses; combining academic and occupational perspectives in multidisciplinary courses; the use of tandem courses, clusters, learning communities, and capstone courses that require students to plan and execute a project; basic skills and English-as-a-Second-Language courses in occupational contexts; and the costs and benefits of curriculum integration. Section 3 describes the community college role in curriculum integration and tech prep, examining community college activities in tech prep programs, factors limiting change in the colleges, emerging tech prep models, and successes of tech prep programs related to increased collaboration and student completion rates. The final section summarizes the benefits of these innovations and reviews the need for institutionalized support for the further development of curriculum integration and tech prep programs. Contains 41 references. (TGI)

COMMUNITY COLLEGE INNOVATIONS IN WORKFORCE PREPARATION

Curriculum Integration and Tech-Prep



League for Innovation in the Community College
National Center for Research in Vocational Education
National Council for Occupational Education

COMMUNITY COLLEGE INNOVATIONS IN WORKFORCE PREPARATION

CURRICULUM INTEGRATION AND TECH-PREP

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COMMUNITY COLLEGE INNOVATIONS IN WORKFORCE PREPARATION CURRICULUM INTEGRATION AND TECH-PREP

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ACKNOWLEDGMENTS

This monograph is the result of a collaborative effort among the National Center for Research in Vocational Education (NCRVE), the League for Innovation in the Community College, and the National Council for Occupational Education (NCOE). It began as an idea to survey the "landscape" of workforce innovations in community colleges, a landscape that has become increasingly crowded with changes and innovations in the past decade, and increasing difficult to understand. This monograph, the first of what it is hoped will be a series of collaborations, depends largely on research conducted by the National Center for Research in Vocational Education at the University of California at Berkeley, funded by the U.S. Department of Education. The National Council for Occupational Education, the organization of administrators and faculty most concerned with the occupational mission of community colleges and technical institutes, has been consistently supportive of these efforts—including forming a task force on tech-prep—because of its interest in those changes that can enhance occupational purposes.

The greatest debt of the authors in preparing this monograph is to the faculty, tech-prep coordinators, instructional deans, and other administrators involved in both the integration of academic and occupational education and tech-prep. They gave freely of their time, sharing insights into the programs they are establishing; and sent curriculum materials, work plans, and other documents to help us understand their innovations. This is, in every way, their work and a tribute to numerous individuals in community colleges involved in promising reforms.

This monograph also benefited from an initial review of its content, and a subsequent review of a draft monograph, by an advisory committee composed of administrators and faculty from League colleges and from the National Council for Occupational Education. These individuals also made helpful suggestions regarding institutions to contact about promising practices. In particular, the following individuals were especially helpful in revising the monograph: Brenda Beckman, Debra Bragg, Patricia C. Donohue, Lynn Hall, James Jacobs, W. Gary McGuire, and Peggy Tyler.

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EXECUTIVE SUMMARY

During the past fifteen years, a great surge of interest in the preparation of the work force has affected all institutions. Community colleges and technical institutes are central to innovation in preparing the work force, because many of the changes emphasize the preparation of individuals with some postsecondary education but without a baccalaureate degree. These individuals, the "backbone of our economy," are precisely those prepared by community colleges.

In this climate, innovations have multiplied faster than they can be absorbed. Furthermore, federal legislation providing support for some of these changes has been unstable and is likely to disappear into consolidated block grants. The purpose of this monograph is, therefore, to describe two innovations that have considerable support and, while subsequently enhanced by federal funding, emerged independently. They are the integration of academic and occupational education and tech-prep programs that link community colleges with secondary schools. The monograph seeks to illuminate the many forms the innovations take and to clarify their benefits to students, employers demanding higher-order skills, and community colleges themselves.

While these innovations can be viewed as ways of enhancing the quality of occupational programs, they are also ways of reshaping community colleges for all students. They help students make the transition from secondary to postsecondary education and provide a range of instructional methods for the range of competencies that students will require as employees and citizens. In the process, they give community colleges a central role in reshaping the entire educational system.

Integrating Academic and Occupational Education. Curriculum integration in community colleges takes many forms, as befits a flexible practice that can be modified to local needs and resources as well as employment conditions. In some instances, instructors infuse some academic content into an existing occupational course, often quickly and informally. More formalized ways of doing so can be developed, of course, of which Writing Across the Curriculum is probably the best known. And many institutions have developed their own applied academics courses, which take conventional academic subjects and infuse them with the material and applications from various occupations. These applied or hybrid courses, which can be found in a great variety of subject matter and occupational areas, thereby provide a context or setting for teaching higher-order competencies that go beyond abstract academic content.

A different approach to integration involves the development of multidisciplinary courses, taking the concepts and analytic methods of academic subjects—history, literature, ethics and philosophy, and the study of societies and cultures from sociology and anthropology—and applying them to technological developments, to the nature of work and its consequences, and to other employment-related issues. They usually involve the collaboration of both occupational and academic faculty and provide novel ways of examining both academic subjects and more occupational themes.

Many institutions have developed tandem courses—where individuals take a pair of courses that have been jointly developed—or even three or four courses together, usually referred to as clusters or learning communities. Such practices provide many opportunities for integrating content, incorporating higher-order or SCANS competencies, making sure that academic prerequisites are covered, exploring occupational applications, and making the interconnections of different perspectives clear to students. They can also be applied to remedial (or developmental) and ESL courses by combining remedial or ESL courses with occupational courses, enhancing the motivation of students needing basic academic skills or English instruction while providing some of the particular competencies required in particular occupations.

Tech-Prep. Tech-prep programs linking community colleges with high-school programs have become ubiquitous, often as vehicles for curriculum integration or the enhancement of secondary-level content. The most frequent changes so far include: the enhancement of the high-school curriculum, a process in which community college instructors have been crucial in clarifying the demands of postsecondary education; efforts to explain or "market" the value of tech-prep; and the development of articulation mechanisms smoothing the transition from high school to college. In addition, a few tech-prep programs have instituted other changes like special counseling, career exploration, and work-based components, illustrating the flexibility of this innovation.

In most cases, however, tech-prep has not yet made substantial changes within community colleges. The most important reason is that these programs have not been in place long enough for many tech-prep students to enter the postsecondary component—though coordinators report that they may be on the cusp of important changes because larger numbers of tech-prep students will enter community colleges in the next few years. Other barriers include the resistance of faculty and the uneven support of administrators. Finally, in some tech-prep approaches, reforms in high schools—either of vocational programs, or of programs for all

students—are more important goals than changes at the community college level.

A more systemic problem is that it is often difficult to identify individuals as "tech-prep students." Furthermore, many students in the high-school portion may benefit—by graduating from high school rather than dropping out, for example, or continuing to a four-year college rather than the community college—without enrolling in the community college that sponsors a tech-prep effort. Thus the benefits of tech-prep are often diffuse, and accrue to students and the educational "system" as a whole, not necessarily to particular community colleges. One implication is that the costs of system-building efforts like tech-prep should be borne by the system itself, through state or federal funds, rather than by individual institutions.

Both curriculum integration and tech-prep have multiple benefits. They can enhance the content of both secondary and postsecondary coursework, responding to the demands of employers for higher-order competencies. They can prepare secondary students better for the demands of postsecondary education and provide community college students with the range of competencies they will require on the job and in other walks of life. Both innovations are multi-faceted and flexible, able to incorporate a variety of goals and to reflect different local conditions.

The continued development of these innovations in workforce preparation depends on institutionalizing the changes made so far, extending them beyond the smaller numbers of trail-blazing teachers, coordinators, district administrators, volunteers, and enthusiasts who have participated in the initial stages. In turn, this will require stability in both the funding and the climate of reform that has led to these reforms. Administrative leadership is a final requirement, since few changes can be carried out by individual faculty; only administrators can provide the coordination among faculty and the institutional commitment necessary for these reforms. But the rewards can be substantial in helping community colleges fulfill their promise as innovative, teaching-oriented, learning-centered, nontraditional institutions responding to their multiple missions with flexibility and foresight.

INTRODUCTION

During the past fifteen years, a great surge of interest in the preparation of the work force has affected all educational institutions. Motivated in part by the fear of economic decline, the renewed emphasis on occupational preparation has resulted in numerous commission reports, federal and state legislation, local reforms of many kinds, and new initiatives from business and industry.

Community colleges and technical institutes are key to innovation in preparing the work force. In large part, policy makers and business leaders have focused on the middle-skilled jobs of our economy—the jobs for which community colleges prepare students. For example, one report that described in stark terms the directions this country faces, *America's Choice: High Skills or Low Wages!,* stated that:

> More than 70 percent of the jobs in America will not require a [four-year] college education by the year 2000. These jobs are the backbone of our economy, and the productivity of our workers in these jobs will make or break our economic future (p. 3).

The report's program to promote a high-skills economy then recommended a system of technical and professional certificates and associate degrees "for the majority of our students and adult workers who do not pursue a baccalaureate degree." In the innovations intended to improve the preparation of individuals for these critical jobs, community colleges and technical institutes are central.

But the downside of this renewed interest in workforce preparation is that reforms and proposals have multiplied faster than they can be absorbed. The programs and proposals that have been introduced during this period include at least the following:

- accountability measures, including performance measures required by federal legislation;
- proposals to enhance the academic competencies and "higher-order" skills of the work force, including federal initiatives to integrate academic and occupational education;
- tech-prep programs linking secondary schools with community colleges;
- school-to-work programs adding work-based learning and connecting activities to educational programs;
- the expansion of short-term job-training programs, for groups ranging from welfare recipients to displaced workers;
- contract education provided by community colleges to specific employers to upgrade certain skills of their work force;
- state-funded economic development programs, providing still other funds for firm-specific training, often with the intention of attracting business and industry to an area;
- proposals to develop skill standards, specifying the skills required in certain occupations and industries.

And, with all these changes, federal legislation that provides support for some of these innovations has not remained stable. At the moment, Congress is considering legislation to consolidate vocational education, job training, and adult education legislation, giving states greater authority over how to spend these funds. Small wonder, then, that community college administrators and instructors often complain about the "reform du jour," the sense that there have been too many reforms that come and go, overlapping in their purposes and unclear in their effects.

The purpose of this monograph, therefore, is to clarify certain innovations in workforce preparation and to highlight those emerging practices that have the most promise for community colleges. Two particular innovations will be examined—the efforts to integrate academic and vocational education, and tech-prep programs—because they have attracted a great deal of attention, and have led to practices that should continue even if federal funding for them is reduced or eliminated. The two are appropriately examined together, because tech-prep programs often include curriculum integration or have been used to fund integration activities; indeed, to some extent our separation of curriculum integration (in Section II) and tech-prep (in Section III) is artificial and violates the practice in some community colleges of combining these reforms. However, they are conceptually distinct innovations since curriculum integration can take place in community colleges without the links to high schools that define tech-prep. Conversely, as is shown in Section III, tech-prep programs have often failed to change postsecondary curricula, and have sometimes fostered curriculum integration in high schools but not necessarily at the postsecondary level. And the focus of each is different: curriculum integration emphasizes changes in curriculum and pedagogy, while tech-prep stresses relationships between secondary and postsecondary education.

While the monograph starts with these two particular reforms, over the longer run it is hoped that the joint efforts of the National Center for Research in Vocational Education, the League for Innovation in the Community College, and the National Council for Occupational Education will

continue to examine other workforce innovations. This would provide community college administrators and faculty a thorough understanding of the variety of occupational initiatives. In particular, these two reforms are examples of a more general innovation that would seek other forms of integration as well. Such examples might include integration across occupational areas, particularly in institutions where occupational programs have fragmented and proliferated; integration across community colleges, which would benefit from learning about one another and sharing their experiences in innovation; integration with business and industry and with work-based learning (the vision of the School-to-Work Opportunities Act of 1994); and integration of longer-term occupational education with shorter-term job training.[1] Over the long run, the creation of a coherent system of workforce preparation depends on institutionalizing all these forms of integration, replacing the fragmented nonsystem that exists now.

Throughout the pages that follow, it is stressed that there are varying ways to understand the value of these two particular innovations, as well as other initiatives that will be examined in the future. On the one hand, these reforms can improve the quality of occupational programs, increasing the skills of workers in ways that should enhance their mobility over the long run and respond to the demands for a better-qualified work force. On the other hand, a broader interpretation is that they are ways of reshaping community colleges fundamentally for all students, not just for a subset who have chosen occupational programs. For example, the efforts to integrate academic and occupational education led to forms of teaching that provide a clearer context or setting for academic subjects and for developmental education. The collaboration among instructors can help "build communities" within the community college, as was called for by *Building Communities,* the 1988 report of the Commission on the Future of the Community College. And some tech-prep programs, with their emphasis on developing coherent sequences of courses from high school into the community college, have helped counter the tendency of both students and faculty to think in terms of isolated courses. As the report of one tech-prep director stated:

> This project may have come to life under the auspices of the tech-prep project, but it has opened a window on the fundamental mission of the community college, indeed of all education.

These innovations start out as ways of enhancing occupational preparation, which is only one mission of the community college; but they can end up as innovations that influence many of its missions.

There are many different approaches to both curriculum integration and tech-prep. Numerous examples are provided in order to clarify the range of practices and the variety of options. These reforms are therefore flexible enough to match the differing needs of community colleges and technical institutes as they vary in size, student composition, mission, and local labor market conditions.

Finally, while these two innovations have been enhanced by federal legislation, support for them is much deeper than federal financing. Section I outlines these different sources of support, clarifying that—whatever happens with federal legislation in the turbulent times ahead—the more fundamental reasons for curriculum integration and tech-prep will persist. The innovations should therefore outlive the federal legislation on which they currently depend. Then Section II and III describe the innovative efforts in community colleges in curriculum integration and tech-prep, respectively, while Section IV summarizes the benefits of these innovations.

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[1] These other forms of integration are presented by James Jacobs of Macomb Community College. On the integration of occupational education and job training see Grubb (1996a).

SECTION ONE
FEDERAL INITIATIVES AND OTHER SUPPORT FOR INNOVATION IN WORKFORCE PREPARATION

In their current form, both the integration of academic and occupational education and tech-prep programs have been stimulated by federal legislation—specifically, the Carl Perkins Amendments of 1990. Section 238 of these amendments stated:

> Funds made available . . . shall be used to provide vocational education in programs that . . . integrate academic and vocational education in such programs through coherent sequences of courses so that students achieve both academic and occupational competencies (p. 42).

In theory, this required community colleges (as well as secondary schools) to use their federal funds for such integration efforts. In practice, most community colleges initially made little progress in implementing this provision, partly because the idea was so unfamiliar, and most of them continued to spend federal funds for capital equipment, for remedial or developmental efforts for occupational students, and for updating courses and materials (Grubb and Stasz, 1993; Boesel, 1994). However, as is described in Section III, more recently community colleges seem to have increased the amount of experimentation with Perkins funds, and the number and variety of integration efforts have expanded substantially. In some states, state-level initiatives reinforced and interpreted federal requirements; for example, Colorado directed its community colleges to develop integration plans in late 1990; California made this a priority beginning in 1994; Ohio has been especially active in developing capstone courses (described below); Kansas has circulated a standard form for colleges to describe key practices related to integration, allowing innovations to be shared among practitioners; and New Hampshire has developed a list of core competencies for integrated courses, quite similar to the skills articulated by the much-cited Secretary's Commission on Achieving Necessary Skills (SCANS, 1991). But state enforcement has varied widely and can often be satisfied with paper compliance; most successful efforts at curriculum integration are locally developed.

Similarly, tech-prep programs have been funded with federal funds. The 1990 Amendments established a separate allocation for tech-prep programs, requiring seven "essential elements" in all programs:

- formal articulation agreements between secondary and postsecondary institutions;
- a core of required courses in math, science, communications, and technologies, including at least two years each of high school and postsecondary education;
- curriculum development appropriate to the consortium;
- in-service training for both secondary and postsecondary instructors;
- training for counselors;
- equal access for special populations;
- preparatory services to help all populations to participate in tech-prep.

In response, tech-prep consortia developed around the country, with initiatives advanced by both secondary schools and community colleges. As Section III clarifies in greater detail, most tech-prep initiatives have emphasized innovations at the high-school level, and with some important exceptions, the amount of change within community colleges is still relatively small. Nonetheless, it is stressed that the conception underlying tech-prep remains a valuable one, with substantial benefits for community colleges as well as high schools.

These two innovations have been incorporated into subsequent federal legislation, the School-to-Work Opportunities Act of 1994. This act provided funding for new school-to-work programs; but because the funding for such programs has been quite modest—$150 million for fiscal year 1995, with funding designed to vanish after five years (compared to $1.2 billion for the Carl Perkins Act and nearly $5 billion for job-training programs, for example)—this act is perhaps best interpreted as a vision for work-related education and a stimulus to experimental efforts, rather than a funding source. The act specified a three-part program incorporating an educational component, a work-based component, and "connecting activities" to ensure the consistency of the two. Furthermore, the educational component is to include a "career major," defined as "a coherent sequence of courses . . . that integrate occupational and academic learning, integrate work-based and school-based learning, and establish linkages between secondary and postsecondary education." It also requires programs to incorporate at least one year of postsecondary education. School-to-work programs should incorporate both curriculum integration and the spirit of tech-prep linking secondary and postsecondary efforts. The school-to-work vision therefore proposes three different forms of integration: the integration of academic and occupational education; the integration of secondary and postsecondary education; and—the new element in school-to-work—the integration of work-based and school-based learning.

But nothing stays the same, least of all federal legislation. Currently Congress is considering legislation to consolidate a number of vocational education, job training, and adult education bills to reduce overall funding by 25 percent, and to allow states considerable freedom in deciding how to spend the remaining funds. The specific details remain unclear because different versions of this legislation have not yet been reconciled.[2] However, it is virtually certain that both the Carl Perkins legislation and the School-to-Work Opportunities Act will be eliminated in the process of consolidation, thereby ending funds earmarked for curriculum integration and tech-prep.

Fortunately for these innovations, there have been other sources of support for the ideas of curriculum integration and tech-prep. Probably the most insistent support for a broad range of both "academic" and, more specifically, occupational skills has come from the business community. As the Committee for Economic Development (1985) declared: "Business, in general, is not interested in narrow vocationalism. It prefers a curriculum that stresses literacy and mathematical and problem-solving skills." The Commission on the Skills of the American Workforce portrayed the future starkly in the title of its widely cited report as *America's Choice: High Skills or Low Wages!* (CSAW, 1990), and went on to describe the skills needed for a "third industrial revolution" encompassing:

> ... the demonstrated ability to read, write, compute, and perform at world-class levels in general school subjects (mathematics, physical and natural sciences, technology, history, geography, politics, economics and English). Students should also have exhibited a capacity to learn, think, work effectively alone and in groups, and solve problems (p. 69).

The Secretary's Commission on Achieving Necessary Skills (SCANS) of the Department of Labor outlined *What Work Requires of Schools,* complaining that "we are failing to develop the full academic abilities of most students" (p. vi) and arguing that "tomorrow's career ladders require even the basic skills—the old 3 Rs—to take on a new meaning." Among the five competencies and three "foundation skills" advocated as part of "high-performance schools," the report illustrated the need for greater competence in the conventional academic skills such as reading, writing, mathematics, and computational skills, and "thinking skills" like decision making, problem solving, and knowing how to learn (SCANS, 1991).

This position from the business community has also been supported by community college educators themselves. A 1984 report on the economic roles of community colleges, *Putting America Back to Work*—written well before the current interest in "higher-order skills"—stressed that:

> Training for one job is not going to serve a worker all of his/her life. Foremost in any training program must be instruction that concentrates on *how to learn*; if possible, on *enjoying learning*; and on *making a commitment to learning throughout life* (p. 29).

The report went on to recommend a two-tiered system, in which the first tier includes a broad background in math, science, communications, analytical and reasoning skills, together with a second tier of more job-specific content (*Putting America Back to Work,* 1984, p. 29). In 1988, the Commission on the Future of the Community College stated "if technical education programs are too narrow, if work cannot be a broadening experience, then the students may achieve only short-term gains." The commission then went on to recommend "exploring new ways to combine technical and general studies throughout the undergraduate experience," and declared that "community college faculty should take the lead in closing the gap between the so-called 'liberal' and the 'useful' arts," particularly by developing "up-to-date programs that integrate the core curriculum and technical education" (*Building Communities,* p. 21). And in its guide to assessing institutional effectiveness, the League for Innovation in the Community College included the issues of whether students are achieving a broad general education, stating that:

> Community colleges generally consider broad, general education critical for their students. This includes proficiency in written and oral communication, computational skills, and an understanding of history, social institutions, science and technology, and the arts. Another essential skill is the ability to work cooperatively (Doucette and Hughes, 1990, p. 16-17).

Thus the idea of integrating academic and occupational education has been present in community colleges for well over a decade.

Similarly, the idea of linking secondary and postsecondary institutions to create more coherent programs—the heart of the tech-prep vision—has been

supported from many sources other than federal legislation. The idea is often associated with Dale Parnell, who stated in *The Neglected Majority* (1985):

> There is a lack of clarity in what high schools and postsecondary institutions expect of their students. Furthermore, there is poor communication between these two educational entities. Even more serious, there is a subtle but stubborn provincialism that suggests that program *articulation,* the careful building of bridges between high schools and colleges, and program *evaluation,* the careful measure of program success or failure, are extraneous to the primary mission of either group (p. 134).

But the idea of linking secondary and postsecondary programs was present much earlier than that. In 1968, Oregon recommended identifying the elements of effective articulation between high schools and community colleges, and subsequent advocacy of the idea came from the National Institute of Education in the early 1970s and from the Commission on Secondary Vocational Agenda's (1984) report, *The Unfinished Agenda* (Bragg, 1992, Chapter 2).

Support for integrating academic and occupational education and for tech-prep need not depend, therefore, on federal funding. These innovations have been widely supported by the business community seeking to upgrade the skills of those in middle-skilled jobs, and community college educators have already affirmed these innovations. The benefits to students are substantial as well, as the emerging practices described in the next two sections will demonstrate.

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[2] As of February 1996 the House and Senate versions of consolidation, with substantial differences in the ways funds would be allocated to states, has not been reconciled, though most observers expected passage of final legislation sometime during 1996.

SECTION TWO
INTEGRATING ACADEMIC AND OCCUPATIONAL EDUCATION TO ENHANCE STUDENT ACHIEVEMENT

When NCRVE first began looking at vocational education in 1991, to ask what curriculum integration might look like, large numbers of community colleges and technical institutes were found to be engaging in a few practices—especially applied academics courses (described in greater detail below)—while many fewer colleges had developed the more thorough forms of curriculum integration (Grubb and Kraskouskas, 1992). Since then, there seems to have been a substantial increase in innovation, resulting in more examples of integration and a broader variety of practices. (See Sources of Information for a description of the sources used.) Even though the extent of integration is limited in most institutions, the idea of integration is clearly "in the air," and much better established than it was five years ago.

The most important benefit of curriculum integration is, of course, the enhancement of academic and "higher-order" skills within occupational courses and programs. But the methods of combining academic and occupational content, particularly tandem courses and learning communities, also lend themselves to developmental education and English as a Second Language (ESL), creating more effective ways of teaching these important and difficult subjects. In addition, these changes generate greater attention to the quality of teaching, and thereby can become a vehicle for improving the methods of instruction. And most importantly, they become ways to think of community colleges much more flexibly, as institutions that provide a range of teaching practices to meet the range of competencies necessary in modern employment—in those institutions that pride themselves on being teaching institutions for nontraditional students.

Integration efforts have often arisen as solutions to particular problems raised by faculty or students. For example, one pairing of an English course with auto technology came about because the auto instructor realized that the low reading levels of the students made it difficult for them to read the technical manuals. Similarly, the discovery that a particular biology course was a barrier to health occupations students led to a cluster of biology, English, and math courses at LaGuardia Community College. Writing Across the Curriculum and specific applied courses (like Technical Math) have been developed to remedy specific weaknesses of students in particular academic subjects. And several colleges have paired ESL with occupational courses when they determined that particular language groups were having special difficulty. Curriculum integration is quite a malleable innovation, able to resolve several different problems and to be implemented on different scales; it is therefore a flexible approach for community colleges as problem-solving institutions.

Before describing some innovations associated with integration, a common practice should be mentioned that probably should not be considered integration. The course requirements for certificate and associate degree programs in occupational fields often specify some related academic coursework and general education requirements, overwhelmingly drawn from academic subjects. This practice often lead individuals to claim that occupational programs are "naturally integrated." However, such academic and general education requirements usually remain independent of vocational courses, and require *students* to make the links to occupational concerns or the requirements of employment. As one committee proposing multi-disciplinary learning communities commented, the existing core curriculum "does not encourage students to explore the relations between the disciplines and transfer their learning from one course to another." Indeed, most students have trouble with integrating and applying material from different disciplines, and there are particular reasons to think that community college students—whose prior academic records have often been weak, who may have been out of school for considerable periods of time, or who may be insecure about academic coursework—are likely to need substantial help with such integration.[3] Instructors often remark that occupational students take academic and general education courses only grudgingly, and that they often fail to see the relevance of general education to their occupational goals. Instead of requiring students to make the links among different subjects, the most promising approaches to curriculum integration place the responsibility for integration squarely on instructors, and create new courses and groups of courses that do so.

In this section, a number of successful practices in community colleges and technical institutes are described. There are many practices that are valuable forms of integration, and it is important to think flexibly about them. While it is also difficult to make hard and fast distinctions among the various forms, it may be useful to distinguish five kinds of efforts:

- combining academic and vocational content;
- multidisciplinary courses;
- tandem courses and clusters;
- capstone courses;
- developmental education and ESL taught as tandem courses.

A forthcoming monograph from the National Center for Research in Vocational Education by Norena Badway and Norton Grubb (1996) will provide an appendix with additional curriculum material, including syllabi and outlines of several of these promising courses.

Combining Academic and Vocational Content in Individual Courses

The most pervasive approach to integration is the infusion of particular lessons or modules into an existing course. Often this takes the form of academic material incorporated into vocational courses; for example, instructors might provide a quick review of ratios for students learning Ohm's law in an automotive or electronics program, or review proportions when studying the laws of gases in respiratory therapy. This kind of teaching or reinforcement of a particular concept is usually quick and informal.

A more extended and formalized approach to infusion is to incorporate longer modules taken from academic approaches. For example, the Introduction to Law Enforcement course at Southern Maine Vocational-Technical College added a component on the history of law enforcement; instructors at Moraine Valley Community College (Illinois) inserted modules on the history and philosophy of law enforcement into introductory courses in criminal justice. The inclusion of ethics—normally a topic within philosophy—in a variety of occupational programs is by now a standard recommendation. At Cape Cod Community College (Massachusetts), a four-week module on "Making the Connection between Algebra and the Real World" was developed to answer the frequent student question, "What do I need algebra for?" The module used newspaper articles, advertisements, and various business situations to explore math applications, doing so in collaborative exercises designed to examine the benefits of learning math as a social rather than individual activity.

In some institutions, infusion has been used to incorporate the skills necessary for high-skills workplaces, sometimes referred to as "SCANS skills." For example, programs at Cape Cod Community College added new assignments related to "the efficient use of resources," a critical performance skill identified by SCANS. The modules require students to use criterion-based assessment in selecting nursing equipment and flowcharts to identify productive and nonproductive processes in hypothetical nursing situations, and they teach students to apply a systems approach to care-giving settings and to apply social audit techniques to resolve ethical dilemmas. As part of transforming the New Hampshire Technical Colleges into comprehensive community colleges, a statewide group of faculty, administrators, and business representatives used a process similar to the Developing a Curriculum Model (DACUM) to establish core competencies, and now incorporate instruction for each of these competencies into every course.

In other cases, infusion has been used for the purposes of career exploration. At Santa Barbara Community College (California), for example, career exploration activities are incorporated into a number of introductory courses by including assignments that require research in the Career and Transfer Centers. Counselors assist students in completing interest inventories and computer-assisted labor-market research. Following the Career Research Project guidelines, students gain not only research skills but also experience in using data for further clarification of career goals and the guidance services of career and transfer counselors (Friedlander, undated). Similar efforts have been developed in other colleges in related courses such as "Career Development" and "Experiencing Technology."

Infusion is often highly informal, but there are ways to make sure that it is widely practiced. Fayetteville Technical Community College (North Carolina) formed four teams of six faculty—from math, science, English, and social science, as well as two occupational areas—that designed 50 curriculum integration activity guides for 16 technical courses. This approach allowed the college to get innovation underway quickly, initially relying on faculty predisposed toward interdisciplinary teaching, thus involving more faculty than would have been possible using other approaches.

Still another systematic way to incorporate more academic skills into occupational programs has been to adopt cross-curriculum efforts in an entire institution. The best-known example is Writing Across the Curriculum (WAC), in which all instructors—both academic and occupational—are encouraged to incorporate more writing into their courses. Writing Across the Curriculum efforts have been implemented in several different ways. Florida has required WAC of all its community colleges, consistent with its active state role. In the majority of community colleges, however, much more informal methods are used to motivate faculty to participate, including recruitment and outreach by members of the WAC staff (usually from the English department), seminars and staff development efforts to show instructors how to incorporate writing exercises into their courses, and availability of WAC staff to provide help to individual instructors. The best WAC efforts, therefore, provide

instructors some resources to modify their course content, as well as the rationale and peer support to do so.

In a variant of WAC, also designed to enhance the teaching of writing, Kapi'olani Community College (Hawai'i) requires all students to take two writing-intensive courses. These are defined as courses that "emphasize writing as a way of learning. In a writing-intensive course, your instructor will guide you through the writing process in a specific discipline." Courses that count as writing-intensive include a variety of traditional general education courses as well as certain redesigned occupational courses, like Business/ Management Writing, Basic Nursing Concepts, Introduction to Physical Therapy, and Special Radiology Procedures.

Although Writing Across the Curriculum is by far the most common cross-curricular effort, there are a few others. Prince George's Community College (Maryland) initiated Communication Across the Curriculum, which developed materials to enable students and instructors to increase the amount and coherence of discussion—an attempt to shift to a pedagogy where students are more active and questioning. Nashville State Technical Institute (Tennessee) has adopted what might be called Humanities Across the Technologies, incorporating some of the humanities in every course to improve student outcomes in communications, the arts, math, and writing. For example, a mechanical engineering technology course now includes components in the history, art, and ethics of the field and a unit on "solving problems related to balancing academics and beginning a technical career," while other technical courses include activities "designed to enhance [student] abilities in communication, critical thinking, and problem solving." A course in Mechanical Equipment provides a good example of how many different perspectives can be incorporated into a technical course. The instructor requires students to give oral presentations, with possible topics including whether the designer of the Tacoma Narrows Bridge (which collapsed in a high wind) should be criminally prosecuted, and whether the third little pig over-engineered his house. One paper requires students to clarify what steps technicians can take to "help preserve and/or protect the environment," and other assignments require them to read Petroski's *To Err Is Human: The Role of Failure in Successful Design* and then write about the development of Gothic structures, the ambivalence of William Wordsworth toward nineteenth century technology, and Galileo's error in calculating the yield stress of cantilever beams.

A still more formalized approach to infusion and curriculum integration is the development of applied academics courses, which typically take conventional academic subjects and infuse them with applications from occupational areas. This is clearly the most common form of integration, and a perusal of course catalogs suggests that virtually every community college and technical institute has several such courses. Examples include Technical Writing, Writing for the Workplace, and Written Business Communication; Agricultural Economics or Business Economics; and Applied Math or Technical Math, sometimes further specialized as in the Technical Math for Nurses course at San Bernardino Community College (California), or Applied Math for Recording Technology at Cedar Valley College (Texas). These applied academics courses are usually locally developed; they are not the same as the Applied Academics courses—Applied Math, Applied Communications, and Principles of Technology—developed for high-school students by the Council for Occupational Research and Development (CORD) and the Agency for Instructional Technology (AIT). It was found that many community college instructors are disdainful of "off-the-shelf" courses, particularly Applied Math and Applied Communications: their concern being that the academic content is too basic, occupational applications are too trivial, and the courses fail to encourage initiative and collaboration among instructors.

An interesting version of this concept is illustrated by three colleges that offer foreign languages for particular occupational areas to address specific language needs. Monterey Peninsula College (California) offers Spanish for Medical Assistants, and Southern Arkansas University Technical College has offered Japanese, German, and Spanish for students who need to develop conversational ability for international business communication. Dona Ana Branch Community College (New Mexico) links Introduction to International Business with Spanish for the Workplace, achieving the same goal by linking two courses (described more fully below).

Applied academics courses generally adapt the content from conventional academic subjects and use practical applications taken from occupations. In many cases, these courses have been developed as a way to serve the needs of occupational students more precisely, sometimes because of the perception that standard academic courses in math or English are too general, too abstract, or too lacking in appropriate applications. Typically, applied academics courses are taught to occupational students only, reinforcing the ability of instructors to mold the content to a particular occupational area. Most such courses are locally developed, though in

Alabama, centrally developed courses in Technical English and Technical Math are used for all nondegree occupational students; the state curricula occurred as a way of imposing some quality standards and consistency on local institutions.

These hybrid courses may be taught either by academic instructors or by occupational instructors; because of fiscal limitations, they are rarely team taught. Occasional battles over who is to teach the course reveal an unavoidable conflict: whether an applied academics course should stress the more abstract, theoretical, "academic" underpinnings of the subject, including disciplinary modes of thinking, or whether it should instead stress occupational examples, "practical" information (including institutional details), and a further socialization into the values of an occupation. Often, academic instructors take the first approach while vocational instructors take the second.

Applied courses have sometimes been criticized, particularly by academic faculty, for their lack of rigor. However, this need not be the case if the course is appropriately designed. For example, Illinois Central College offers a technical math course, Calculus for Engineers, jointly designed by math and engineering faculty; Northland Community College (Minnesota) has a technical trigonometry course, while many institutions have applied math courses at the level of intermediate college algebra. To avoid charges of developing courses that are too simple, some institutions have their applied courses taught by academic faculty; for example, the food sanitation courses at Holyoke Community College (Massachusetts) and San Francisco City College (California) are taught by the biology departments.

Infusion takes many forms, therefore, from the quick and casual review of academic competencies to the more formalized approaches of Writing Across the Curriculum and applied academics courses. It is a flexible approach to integrating the curriculum, adaptable to several purposes, and accommodates a variety of informal and formal changes.

Combining Academic and Occupational Perspectives in Multidisciplinary Courses

A different approach to integrating academic and occupational education has been the development of multidisciplinary courses. The common element in these courses is the application of academic subjects and their concepts and analytic methods to technological developments, working and its consequences, and other employment-related issues. The applications may be through a variety of disciplines—history, literature, ethics, and philosophy, or the study of culture from sociological or anthropological perspectives. The multidisciplinary approach is presumed to be more compelling for occupational students than traditional single-discipline academic courses. The resulting hybrids are often courses that could be included in general education programs, though with subjects of special interest to occupational students. Like efforts at infusion, they emphasize such general skills as the ability to write clearly and to analyze problems. They differ, however, from applied academics courses, which are in many ways interdisciplinary, largely in their purposes: applied academics courses generally reinforce the related academic competencies required for employment (see Table 1), while multidisciplinary courses tend to focus on the political and social aspects of work, not necessarily required for employment but part of a broader general education.

While there are many examples of multidisciplinary courses, most fall into one of several distinct groupings:

Literature on Working Life. Some courses emphasize literature that focuses on working life such as "Working in America" at Kirkwood Community College (Iowa). This literature course uses work-related fiction and nonfiction to examine attitudes toward work; to understand the "past, present, and future of working"; to "develop [student] abilities to communicate about basic human experiences such as work"; and to "become more competent in the interpretation of stories and other symbolic expressions." This course has also spawned a reader, *Working in America,* that provides students and instructors with readings from various fictional and nonfictional sources about work, with appropriate introductions (Sessions and Wortman, 1992).[4] "Culture and Technology," a course offered at the same institution, also includes literature concerned with work, but also some readings about current ethical issues (like genetic engineering) and movies and music concerned with work.

Similarly, "Science and Technology as Themes of Literature" at Northeast State Technical Community College (Tennessee) examines various literary works, including science fiction, to explore themes surrounding technology, such as the hopes for technology, the sense of betrayal as technology fails to deliver on its promises, the problems of alienation in the workplace, the loss of the self as machines have replaced people in production, the effects of industrialization on leisure, and ethical issues. A course called "Changes and Choices: Experiencing Living in the Workplace, the Home, and the Broader Community" at Muscatine Community College (Iowa) uses short stories, novels, poetry, essays, and history to "assist occupational

Table 1

Educational Content of Occupational Preparation

Competency	Description	Methods of Instruction
Job-specific skills	Production skills used in particular work	Traditional occupation-specific courses; work-based learning, including co-op education, and on-the-job training; short-term job training
Generic skills for modern work places	Skills used in a variety of occupations: computer applications, business procedures, diagram/blueprint reading, quality assurance techniques	Occupational courses with infusion; linked courses; broadly work-related activities and materials
Related academic competencies	"SCANS skills": decision making; problem solving; communications skills; independent learning; understanding systems; organizing resources	Applied academic courses; infusions and writing across the curriculum; linked courses; learning communities
Career exploration and decision making	"Foundation skills": reading, writing, and other communications skills; appropriate mathematics, including problem solving; appropriate science and social science, including workplace applications	Introductory occupational courses; bridge programs; infusion; work-based learning; co-op education and co-op seminars; guidance and counseling
Economic, political, and social aspects of work	Understanding broad economic and political issues; historical perspectives; responsibilities of citizens and community members; traditional goals of liberal education	Infusion; multidisciplinary courses; linked courses and learning communities; revised general education programs

Source: Adapted from Badway and Grubb (forthcoming),

program students in using the humanities to make everyday decisions, to take on the challenges of change, to make major decisions, and to decide to effect change." (This course, initially designed for office technology students, was developed specifically because computers and work reorganization have changed these occupations substantially.) A more occupation-specific example is "Law through Literacy," a course for legal assistants developed at New York City Technical College.

Examining Influences of Technology on Society. Another group of courses examines the influences of technology on society. "History of Technology" at New Hampshire Vocational-Technical College, "Discoveries, Investigations, and Explorations" at Northeast State Technical Community College, and "Technology and Civilization" at County College of Morris (New Jersey) are all courses examining technical change in historical perspective, the effects on society, and the conflicts over technical change, allowing students to explore current issues surrounding technological developments. "Connecting Technology and Our Lives" at Sinclair Community College (Ohio), listed as a humanities and engineering course, examines the history

of technology (focusing on technological changes in the Dayton area) to prepare citizens who can "influence and react to rapidly changing technology." Such courses are related in spirit, if not in their origins, to the courses in Science, Technology, and Society (STS) that have proliferated in secondary schools (Yagur, 1990).

Humanities Perspective on Technology and Production. Still other courses use the perspectives of several of the humanities, including history, philosophy, and art in various forms, to explore the effects of technology and production. "Technology and Human Values" at Yavapai College (Arizona) examines the ethical issues generated by advancing technologies, as well as the influence of technology on individual and social values. "Ethical Dilemmas in Modern Society" at Southern Maine Vocational Technical Institute is a general ethics course, but within a technical college; one of its themes is the "intellectual flexibility and tolerance necessary for the workplace." "The Machine in America" at De Anza College (California) examines America's romance with technology and the interrelationship of technology and social issues.

These courses can also serve as vehicles for introducing students to radically different ways of viewing the world. A business instructor teaching a course called "Wisdom for the Workplace"—using literature and case studies from business to "teach students that the wisdom of great writers from the past is still pertinent to the solving of contemporary job-related problems"—described the process as follows (Smith, 1990):

> I have also discovered why my business-career students generally falter when faced with complex problems in their business or technical core courses, especially those that deal with human issues. The juxtaposition between the humanities—which always ask questions about life, happiness, and freedom—and the courses that fill their career programs (always focusing on the absorption of accepted processes or pragmatic applications) is so strong. [My course] is a wild mix that asks students to question first, and then to justify their opinions convincingly, rather than to simply accept (p. 10).

Most efforts to develop multidisciplinary courses have led to only one or two such courses. However, a more systematic approach is also possible. At Salt Lake Community College (Utah), faculty and administrators were concerned that many students lacked any clear purpose, and treated general education requirements as something to "get out of the way." In an effort to educate all students about their career and academic choices, the college obtained a Title III grant to revise general education. The faculty developed the view that all courses should relate to students' present and future lives, including careers, and established the following criteria for general education:

> The general education program at Salt Lake Community College has as its fundamental purpose the integration of attitudes, skills, and broad abstractions of knowledge. The program will encourage students to be active and creative agents in the life-long process of inquiry, evaluation, and decision making. All general education courses will be nonmajor classes and will provide an introductory overview with no prerequisites. They must also meet six criteria of communication, creativity, critical thinking, esthetics, social web [diversity], and substance.

As a result, every existing general education course was evaluated, with the result that few continued in their previous form, and the college added a multidisciplinary requirement for graduation. The new courses have very different conceptions than conventional general education. "Understanding History" is subtitled "What History Is and What Historians Do," and is a study of how to do (rather than merely read) history. "Electricity and Modern Living" is one of the most popular of the new general education courses, because students not only gain a historical perspective of the development and impact of electrical technology, they also conduct safety inspections, wire circuits, install GFCI receptacles, and participate in a host of other laboratory activities. Several of the general education courses have led to enrollment increases in vocational programs, as students have made historical and philosophical connections to occupations and gained personal experience in career-like activities.[5]

Most multidisciplinary courses have come from the humanities rather than the social sciences. One reason is that many of these hybrid courses have been developed with special funding from the National Endowment for the Humanities and from the NEH-supported project on "Integrating the Humanities into Occupational Programs" (Shared Vision Task Force, 1989, 1991). However, there are other obvious candidates for multidisciplinary courses related to various social sciences. These could include

courses examining public policy and political issues related to technological change and employment issues (including unemployment, discrimination, the quality of work, and other unpleasant realities of capitalism); courses examining the sociology and the psychology of work[6] (including the psychology of occupational choice for students unsure of their direction); and courses in business-government relations to examine the ethical, political, and regulatory issues surrounding employment. Almost every area of the humanities and social sciences contains issues which are related to employment and which could form the basis for several courses (Koziol and Grubb, 1995).

The reliance of multidisciplinary courses on special funding is testimony to the resources necessary to develop novel approaches. Every participant in multidisciplinary courses has stressed the need for staff development, since faculty must have release time to develop new materials, and many hybrid courses have required the collaboration of faculty from several disciplines. However, there is a danger to reliance on special funding: when the funding disappears, the courses may also disappear. The challenge is to institutionalize such courses, to have them become part of the normal offerings of community colleges and technical institutes supported by "regular" rather than special funds, and accepted as legitimate by students, faculty, and administrators alike.

Despite the difficulty institutions have had institutionalizing these courses, they present a promising vision. They represent a fresh approach to curriculum integration, one which creates new courses rather than modifying existing courses in minor ways. The best of them have required the collaboration of both occupational and academic faculty, providing new opportunities for faculty interaction. The difficulty institutions have had in institutionalizing these offerings is distressing, to be sure, but the current round of courses is relatively new and—with the interest in broader forms of education and higher-order skills—they may be able to establish themselves as permanent parts of the community college.

Tandem Courses, Clusters, and Learning Communities

The examples of integrated instruction given so far attempt to reshape *individual* courses. Another approach has been to develop *a series* of courses—including both academic and occupational courses—that students take simultaneously, with each course designed to complement the other. This kind of interaction among courses can happen in several different ways. Two subjects can be linked, creating tandem courses. For example, Chemeketa Community College (Oregon) has developed a Human Services Practicum coupled with Writing 121. The practicum introduces students to various human services positions and requires extensive writing from students about positions they might like, in effect forcing them to assess opportunities in human services; the writing course presents various styles of writing and enables students to work more intensively on the papers they prepare for the practicum. Waukesha County Technical College (Wisconsin) pairs Workplace Psychology with Welding to guide occupational students in understanding how race and ethnicity, safety, health, and interpersonal relationships affect the work environment. Several colleges link courses that are naturally related. Linn-Benton Community College (Oregon) pairs Business Quantitative Methods and Technical Report Writing. Similarly, physical science and engineering materials courses are linked at Southwestern Community College (Iowa), and medical terminology is linked with anatomy and physiology at the Community College of Allegheny County (Pennsylvania). Business and English are common pairings, as are business and math, and engineering technologies and math.

On a larger scale, clusters of more than two courses can be related to one another. Clusters usually include courses with some natural relationship to one another; for example, at Butte College (California), Business Ethics, Business Law, and Introduction to Business have been linked. LaGuardia Community College (New York) has developed an umbrella called the Enterprise Center for cluster courses related to business. The Introductory Business Cluster includes Introduction to Business, Composition I, and Introduction to Economics. The Advanced Business Cluster includes Principles of Management; Philosophy, Values, and Business Ethics; and Writing through Literature. The advanced cluster has also articulated four themes—the entrepreneur versus individual rights, the individual within the organization, cultural and corporate values, and the social cost of business, intended to cut across the three courses in the cluster. The choice of themes reveals purposes related both to general education—providing critical perspectives from the humanities, for example—and to broad vocational purposes like introducing students to the personal and social tensions within business.

In addition, basic math is paired with a course called "Computer Topics"—again at a relatively basic level—while the pairing of "Introduction to Business" and "Introduction to Computers" is designed "to explore the impact of computer technology on contemporary business." Other clusters at LaGuardia include the Animal Health Technology Cluster,

including "Introduction to Animal Health," a chemistry course, an English course, (designed in part to clarify the need for good writing to students), and a pairing of ESL and keyboarding for students new to this country. This last is what the instructors called a "sheltered pair" because it shelters students from the more rigorous pacing of a standard class.

Another systematic approach to clusters has emerged at San Diego City College (California), where a set of clusters called "City Blocks" are advertised as courses that fit together and make sense. The college offers two very different forms of clusters. "History of Technology in the Workplace" combines transfer-level history, English, and computer information science to focus on the theme of historical changes wrought by technological advances. Two other clusters, "Workplace Ethics" and "Communications Skills," combine occupational perspectives with liberal arts studies in philosophy and with written and oral communications. "Workplace Ethics" combines assignments, readings, cross-faculty discussions, and joint assessments between an accounting course and a philosophy course. The final examination includes a case study to be analyzed for elements of fraudulent accounting practices, after which students discuss the advice that Mills or Kant would give to an employee involved in this ethical dilemma. College officials report that the linked courses have enticed vocational students to take more academic coursework and have allowed academic students to gain knowledge of career pathways.

In several institutions, clusters have been developed to prepare students for specific careers. A new program initiated at Macomb Community College (Michigan) addresses several components of manufacturing including internal and external communication, problem solving and scheduling techniques in manufacturing, and technical competencies in machining. A related approach to simulating workplace conditions has been implemented at the College of DuPage (Illinois), where a business professor designed a flow-of-work simulation to link seven business and marketing courses. Students enrolled in these courses attend class at a common location and complete tasks which simulate the interdependence of information and production flow on the job, as well as learning the job-specific and generic technical skills necessary to operate business equipment, schedule output, and complete accounting and marketing tasks. Motivated by student complaints that there was no connection between physics courses and work requirements, faculty at Dutchess Community College (New York) developed an Integrated Production Cluster which meets daily at a local firm, linking courses in physics, chemistry, math, English, economics, reading, and computer skills.

In clusters, students take all courses simultaneously (or, less often, over two semesters). Instructors report that students within clusters are engaged in deeper ways than are most community college students. They have stronger personal relationships with other students, since they see them more frequently; they tend to work more collaboratively, and to develop study groups and other support mechanisms. (Some instructors have capitalized on this development by having students work in small groups and using other collaborative teaching techniques.) Students can refer to material from other classes, and benefit from having connections among classes clarified both by the structure of the courses and by instructors. As one student mentioned:

> The topics were interrelated between Business and Economics, and English brought it together. Also, we were all in the same class and could exchange ideas among ourselves.[7]

For their part, instructors can be more confident about what material students have already learned, and can therefore build on earlier material in other classes. The faculty at LaGuardia College report that at their regular meetings they discuss assessment, and teaching and learning methods, which suggests another mechanism for improving teaching. They also claim that students studying in pairs and clusters are more motivated and less likely to drop out. While evidence is limited, the conclusion that students in clusters have closer ties to other students is consistent with the finding that dropout rates are lower among individuals whose social connections within postsecondary institutions are stronger.[8]

Certainly, clusters may have drawbacks. Several instructors mentioned that they had insufficient time for joint planning. While acknowledging the benefits of greater student interaction, several mentioned that students form cliques and discipline problems may develop—"familiarity can become too familiar," stated one instructor. Several faculty members felt that clusters were not worth the effort necessary to coordinate instructors and to cope with discipline problems, though one faculty member who was considering leaving a cluster still acknowledged their value: "When it works, it's incredible." Evidently, clusters represent substantial departures from conventional classroom practice and place novel demands on instructors; some may be unwilling to spend the time, and some may find themselves unprepared for the cooperation clusters require.

Of course, tandem courses and clusters can become

larger groupings of courses, sometimes referred to as "learning communities" (e.g., Gabelnick, 1991; Gabelnick, MacGregor, Matthews, and Smith, 1990). Any number of disciplines can be linked within learning communities; many examples group conventional academic courses—economics and history, math and science, literature and art. Whatever the specific disciplines, the most important aspects of self-conscious learning communities are the emphasis on multidisciplinary study; the development of institutional structures (like coenrollment and team teaching) that overcome the fragmentation of conventional educational institutions the integration of skills from various disciplines and content areas; and the development of more active approaches to teaching, with seminars, discussion groups, and projects more common than conventional lectures.

Capstone Courses

Capstone courses are in many ways hybrid courses, like applied academic or multidisciplinary courses, but they serve a different role in the curriculum and have taken on new value as both occupational and academic courses move toward more authentic assessment. Capstone courses require students to plan and execute a project, similar to one in a work setting, that includes planning, finance, technical, and production skills, as well as labor, safety, environmental, and community issues. For example, Sinclair Community College has adopted sophomore-year projects in several technical fields, in one case requiring students to apply plant layout and materials-handling knowledge to a project designing manufacturing plants. At Columbus State Community College (Ohio), microcomputer operations students design and develop appropriate forms, presentations, data entry, and retrieval procedures using various media for a typical small business system; they also evaluate the hardware and software that might be appropriate. At the same institution, students in construction supervision track a project with a construction firm from the earliest phases to job completion as a way to "develop a broad understanding of the integration of the home office and field management functions." Capstone courses provide another way of integrating coursework from several disciplines by drawing on material and competencies from a variety of subject areas. By focusing on a project, this approach provides a more natural and work-like context for such integration.[9]

Basic Skills and English as a Second Language in Occupational Contexts

The forms of integrating academic and vocational education described so far are responses to the demands of employers for greater mastery of academic competencies and for broader forms of occupational education. But two-year colleges are often hampered in implementing such efforts because of their role as "second chance" institutions, open to all who want to enroll. A large and increasing number of students entering two-year colleges have left high school without mastering fundamental academic competencies and need some form of remedial education (often termed developmental education to avoid the stigma associated with remediation) and to signal more student-centered pedagogical approaches. Virtually every community college and technical institute now offers some form of basic-skills instruction. Conventional estimates of the numbers of entering students in need of basic instruction vary from 25 to 78 percent in one state system (Grubb and Kalman, 1994); and many of the colleges examined reported 60 to 70 percent of students need remediation in either math or language. In addition, given the scale of immigration since the 1960s, increasing numbers of students enter community colleges with limited knowledge of English, often specifically seeking instruction in English—particularly in English as a Second Language (ESL) courses. And if community colleges serve to link short-term job training and education (Grubb, 1996a), then the numbers of such students will only increase.

Students in need of basic skills development and ESL—who come to the community college like other students, seeking to enter the economic mainstream—often find themselves making little visible progress toward their occupational goals, faced with as much as two years of remedial courses or ESL, filling out worksheets, and doing standard arithmetic problems. Many instructors report that students (and occupational students especially) are bored with remedial courses and fail to see their relevance to occupational goals. The result is that dropout rates in remedial courses are high; students needing remediation but failing to complete the appropriate coursework are unlikely to persist or to complete their programs of study.[10]

One remedy to the problem of providing remedial instruction and ESL is to borrow the method of integrating academic and occupational content: that is, to develop remedial courses and ESL programs with an occupational emphasis, or to teach remedial and occupational subjects in tandem courses or clusters, with developmental English and

math clustered with an occupational course. These approaches teach basic academic skills (or English) while introducing students to the concepts, tasks, and job-specific skills required in occupational areas. In addition to providing some sense that remedial courses are connected to occupational purposes, these approaches exemplify the position that learning in a particular context is most effective (Collins, Brown, and Newman, 1989). Some examples include the following:

Developmental Education in the Context of Technical Occupations. "Introduction to Technology" at Yakima Community College (Washington) provides remediation in math, reading, and writing in the context of an introduction to various technical occupational specialties, including jobs in agriculture, engineering, and auto/diesel mechanics. The proposal for the course states the problem as the separation of remediation from subsequent coursework:

> Developmental students are physically remote from vocational/technological programs and faculty, [and] remain unaware of program opportunities available to them . . . this collaborative learning community will build bridges for faculty and students, and more clearly define a pathway from developmental education to vocational and technological programs.

Remediation through Introductory Technology Courses. The Basic Technology Program at Schenectady Community College (New York), designed for "students with limited math/science backgrounds or weak basic skills," includes two courses titled "Introduction to Technologies," which describe technical careers, applied math (e.g., measurement and scales), some physical processes, and some of the equipment used in technical jobs. Supporting courses include a remedial math sequence, freshman English, introduction to chemistry, and introduction to computers. At Chemeketa Community College (Oregon) a program in drafting and study skills has been devised with the collaboration of a drafting instructor and an instructor from developmental education.

Developmental Education Connected to Specific Occupational Fields. A somewhat more complex program, with a sequence of remedial courses connected to occupational instruction, is the Health Career Community developed at Springfield Technical Institute (Massachusetts), for students needing remediation who are preparing for one of 12 health programs. A series of three courses focuses on reading skills with practical applications in medical settings (including a great deal of medical vocabulary); study skills (such as note taking, outlining, and test taking) using a specially selected text on health; life skills (time management, stress management, nutrition, and self-confidence), again using examples drawn from health; and familiarization with career opportunities in health, with an attempt to convey what is required in different occupations—a kind of career exploration. Simultaneously, students can take conventional developmental courses in reading, math, and science. When they have passed the introductory courses, they can begin the regular courses of the health occupation they have chosen. The director claims higher retention rates than in the community college as a whole.

Grouped Courses and Learning Communities. LaGuardia Community College, where learning communities are probably better developed than at any other two-year college in the country, teaches all of its programs for welfare recipients through learning communities. Typically, a remedial English and a math course are combined with an introductory occupational course; one example combined English, math, and an introductory biology course that had previously been a barrier to those attempting to enter health occupations. Another example combined courses in reading, sociology, and social services for students who wanted to enter various social work positions. A cluster at Palomar College (California) called "Reading, Writing, and Wrenches" combines developmental skills courses with an occupational course teaching basic approaches to tools, materials, and technology. In such clusters, the content of the developmental courses can be changed to reinforce the specific reading, writing, and math skills necessary in a particular group of occupations. In turn, the instructor in the occupational course can count on certain prerequisites having been learned in the related developmental courses and can have specific competencies—for example, a particular kind of writing—reinforced in the other courses. In addition, such clusters generate a support group among a group of students facing similar problems in making their way through the institution and into employment.

Combined Language Skills and Technological Basics. A similar approach has been taken in several ESL courses, sometimes labeled English for Special Purposes (ESP) or Vocational English as a Second Language (VESL). At Bunker Hill Community College (Massachusetts), for example, ESL programs for nursing assistants, lab assistants, pharmacy technicians, and in electronics have been developed, based on the belief that "language training is most effective when taught in the context of skill training."

The courses aim to improve the English-language reading and writing of students, and employ reading and vocabulary drawn from the related occupation and writing assignments that mimic those that will be used on the job. In addition, they introduce students to the careers available and the basic tasks and capacities they require.

An approach called "technology-specific ESL" has been developed at the Applied Technology Center operated by Everett and Edmonds Community Colleges (Washington). ESL instructors are first taught about electronics; then, in consultation with industry supervisors and managers from local high-tech firms, teach limited English-proficient employees of these firms "the reading, writing, and speaking skills necessary to participate in the problem solving and collaboration required in high technology firms" and to pass the certification tests required by federal contracts. Black Hawk College (Illinois) has developed a machine tool curriculum for new Indochinese students, with vocational instructors and staff bilingual in Laotian and Vietnamese collaborating.

Language Acquisition and Occupational Course Clusters. Concerned about attrition among students with limited English who were required to spend long amounts of time in learning labs, Mt. San Antonio College (California) and Massachusetts Bay Community College designed clusters to combine occupational content and language acquisition. At the latter college, an Introduction to Business course exploring career opportunities and skill requirements is combined with Contemporary Economics and an ESL course providing special attention to business-related terminology. At Mt. San Antonio, word processing and business vocabulary were added to the ESL course, along with an internship to provide some on-the-job experience. At Orange Coast College (California), faculty became aware of the difficulty Vietnamese students were having with workplace communications skills and the reading of technical manuals. The college paired an ESL course with machine technology and subsequently extended the approach to health occupations, computer information systems, and airline-travel careers.

Bridge Programs. Bridge programs, designed to facilitate the return to formal education for particular groups—older adults, individuals from particular language groups such as Spanish speakers, or those with inadequate preparation—often provide preparation in the form of clusters. Indian River Community College (Florida) offers a two-option bridge program, including one or two full semesters of linked courses in applied philosophy, principles of academic success, applied physics, applied math, and applied communications. Students choose between occupational courses in manufacturing and in business technology. High-school students who need academic reinforcement are "invited and recruited" to participate in the bridge program, and are organized into "production teams" for activities, group projects, and attendance. In a few cases the same goals are met within single courses; for example, "Worker Effectiveness Training" (Southwest Community College, Minnesota), "Workplace Readiness" (Broome Community College, New York), and "The World of Work" (Community College of Philadelphia, Pennsylvania) offer oral and written communication, math, keyboarding, and career planning, all in some occupational context.

In each of these cases, the integration of academic instruction and occupational content involves teaching basic skills (or English) within courses that draw reading, vocabulary, writing exercises, and other applications from a broad occupational area. Each also provides what might be termed career exploration—an introduction to the specific jobs within the occupation and to the concepts, practices, and demands in these positions. The courses, or the longer sequence of the Health Career Community at Springfield Technical Community College, prepare students to enter "regular" occupational programs. Their vocational purpose is clear—in contrast to most remedial programs, which prepare students to pass basic skills tests but fail to link remediation to any future ambitions of students. The claims that this approach increases retention, consistent with the complaints of instructors in conventional remedial programs that their students are unmotivated and fail to see the connection to vocational goals, suggest real promise for this particular form of "contextualized" instruction.

As a by-product of these various forms of integration, several colleges have combined departments so that academic and occupational departments report to one dean. In one case, academic and occupational faculty were relocated so that they were physically closer to one another. These are obviously mechanisms intended to increase interaction in the hope that more collaboration will follow; but they cannot force integration where no common purposes exist.

Benefits of Curriculum Integration

The benefits of the integration of academic and occupational education appear to be substantial, and it is worth summarizing them to see the variety of benefits that are possible from integration. The most important is probably the effects integration can have on the fundamental academic

competencies and higher-order capacities (or "SCANS skills") necessary for occupational preparation over the long run, especially in a world of changing requirements and escalating skill demands. These are capacities that are best taught with a mix of academic and occupational content, appropriately integrated so that students can see how general abilities are necessary in specific occupations.

Another benefit to students is related to career choice. Many integrated programs have incorporated modules that can be considered career exploration, sometimes as part of an applied communications course, sometimes in multi-disciplinary courses, and sometimes in introductory courses like "Introduction to Business" or "Introduction to Health Careers" linked to developmental courses. As ways of responding to the uncertainty of many community college students about their occupational futures, incorporating career information into courses is a powerful approach since it integrates career information with job-specific skills and contextualizes information about occupational options.

Still another benefit stresses the nonvocational purposes of education. A persistent stream of commentary has urged that occupational programs include the moral and humanistic elements of a broad education. As the Commission on the Future of Community Colleges noted:

> We also acknowledge that the utility of education and the dignity of vocation have important value, not just for those enrolled in general and transfer studies. Only by placing emphasis on both can all students help in the building of community . . . Students in technical studies should be helped to discover the meaning of work. They should put their special skills in historical, social, and ethical perspective. Those in traditional arts and sciences programs should, in turn, understand that work is the means by which we validate formal education *(Building Communities,* p. 20-21*)*.

Such a view lends particularly strong support to the multidisciplinary and linked courses described above.

Another less obvious benefit—particularly important in teaching-oriented institutions like community colleges—is that efforts to integrate academic and occupational instruction can improve teaching practices. Integrated approaches provide examples of learning in context—in this case, the important context of an occupation—that can enhance motivation; they are more consistent with the project- and activity-based approaches of the best vocational instruction, and are more student centered when they use issues and themes of interest to occupational students. Many integrated courses and programs include statements of purpose indicating that they are moving away from the straightforward transmission of facts and figures, towards a form of teaching in which students are more active in constructing meaning and interpreting issues of importance to them. For example, the cross-cutting themes used in LaGuardia's Advanced Business Cluster, the greater use of collaborative teaching methods in pairs and clusters, and the introduction of occupational examples and projects in applied academics courses are all cases of more active teaching than is conventionally the case. In contrast to complaints among occupational students about the "irrelevance" of conventional academic courses, instructors in integrated approaches report higher levels of motivation, because students can more easily see the applicability of academic material. These approaches to teaching are consistent with the current view that learning in context is a superior method, compared to the conventional practice of teaching reading, writing, math, or science as abstract bodies of skills and facts disconnected from their applications. These methods are also consistent with good practice in adult education and the widely cited recommendations of the Secretary's Commission on Achieving Necessary Skills (SCANS, 1991) "that teachers and schools must begin early to help students see the relationships between what they study and its applications in real-world contexts;" that "the most effective way of teaching skills is in context" (p. 19).

One way to summarize the benefits for students is to see how the various forms of integrating academic and vocational education work together to provide students with the variety of competencies they need. Table 1 (on page 8) lists these competencies, taken from the demands of employers, from the evident needs of students searching for meaningful careers, and from the desire to prepare responsible citizens. The range of competencies necessary is quite formidable, and goes well beyond the job-specific skills of occupational education and the academic skills of academic education. But in a community college that has adopted the innovative practices of curriculum integration, the range of instructional methods is formidable, too. In this vision, the community college is not just a random collection of courses, where individuals mill around hoping that the courses they take will prepare them for the future. Instead, the community college becomes a more focused institution in which a variety of institutional methods is used to help students develop in a variety of ways.

There are still other institutional benefits to the efforts to integrate academic and occupational education. One is the collaboration among faculty that integration encourages. As a dean responsible for a remedial learning community commented:

> It has brought instructors together in a new way. They have to coplan the program. Assignments are structured so that they build upon one another. The content has been developed to correspond with other work being done. That builds a [synergistic] effect. We get more accomplished and make better progress. The instructors love it. It pulls them away from the isolation they've experienced. They didn't all like it going into the planning, but all have ended up being real fans of the program.

A final institutional advantage of integrating academic and occupational education is its potential role in creating community within colleges. As the community college has developed, it has added new purposes: occupational education in addition to the early "academic" emphasis on transfer; remedial or developmental programs; community service courses of various kinds; customized training and other firm-specific instruction; noncredit adult education in some states and regions; and sometimes short-term training for Job Training Partnership Act (JTPA) clients and welfare recipients. Most community colleges have responded to these responsibilities by adding new divisions. Too often, communication among the various divisions is quite poor.[11] As a result, the community college often appears to be an archipelago of independent islands, each serving one mission but with limited communication among them. But this obviously need not be the case. The examples of community colleges that regularly support curriculum integration, learning communities, and collaborative approaches to teaching indicate that a college can establish an atmosphere where faculty regularly work with one another. In this way, curriculum integration can help bridge the distinct "islands" of activity within the community college—one of the most powerful ways of achieving a goal of the Commission on the Future of the Community College, which argued throughout its report on *Building Communities* that community colleges should be not only community-serving institutions but also internally cohesive communities.

The benefits of curriculum integration are powerful, not only for students but also for community colleges themselves. They work not only by changing the curriculum and how it is taught, but also by improving collaboration among faculty and by changing the culture of an institution. The results are postsecondary institutions that are coherent learning communities—motivating students and teaching them in the most effective ways, providing a broad education for occupational students, and preparing flexible individuals able to change as employment and labor markets require.

Costs of Curriculum Integration

To be sure, the integration of academic and occupational education does not come without cost. Uniformly, the colleges that have reshaped programs along these lines report that such efforts require release time for instructors to plan such innovations and collaborate with peers. When (rarely) such courses are team taught, they require increased staffing. Above all, they require leadership and commitment from administrators to support instructors who want to engage in course integration and to encourage (or even push) those who may initially be reluctant to innovate. Indeed, the colleges that have the greatest number of integration efforts—places like LaGuardia Community College with its commitment to clusters, or other institutions like Salt Lake City Community College with its wide array of applied courses—tend to have administrators who are particularly committed to these changes, and who use the institution's resources and staff development effort to encourage integration.

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[3] Cross (1976, Chapter 5) has argued that nontraditional students in community colleges (including many occupational students) are more likely to be field independent, and therefore to have trouble applying a concept from one area to another. It is important to note that students in even the best four-year colleges are likely to need guidance in integrating materials from different courses. The movement for interdisciplinary courses within four-year colleges, the efforts to teach from case studies, and the movement to adopt capstone courses reflect the difficulty all students have with fragmented courses.

[4] On sources for incorporating the literature about work, see also Koziol (1992), and Koziol and Grubb (1995).

[5] Personal communication, Elwood Zaugg, dean of vocational education, Salt Lake Community College, July 13, 1995.

[6] South Seattle Community College (Washington) does offer a

course in "The Psychology of the Workplace," described by the division chair as "not really integrated" but still more responsive to the needs of occupational students than is the conventional psychology course.

[7] This quote is taken from flyers advertising the business cluster to all students. The flyers promote the clusters in similar terms: "Clusters help you learn better by showing you how ideas connect across different courses. Students in clusters tend to do better in their courses."

[8] One ESL instructor reported that the pass rate in the ESL/ keyboarding pair was 90 percent, compared to 70 percent in nonpaired ESL. Those associated with clusters in LaGuardia Community College contend that the pass rate is higher for cluster students than for noncluster students in the same English courses (85 percent versus 70 percent), and that students in the business cluster have higher retention rates by 10 to 24 percentage points from the first year to the second. (Of course, self-selection of highly motivated students into clusters may be responsible.) In Tinto's (1987) model, which dominates the empirical literature on persistence, academic integration—the participation of students in the social life of the institution—is crucial to decisions about continuing. Clusters facilitate social integration, which is otherwise difficult for students in community college because so many of them are part,time and have substantial noneducational demands.

[9] Capstone courses appear to be the community college equivalent of senior projects in high schools, described in Tsuzuki (1995).

[10] The data about remedial courses in community colleges are not very good, and it is generally impossible to compare completion rates in remedial courses and "college-level" courses. However, instructors uniformly report completion rates in remedial courses to be low (Grubb and Kalman, 1994). Evidence from Miami-Dade Community College indicates that only 26 percent of students testing below standard levels completed all appropriate remedial courses, with the proportion falling as the number of subjects in which a student is deficient increases; see Losak and Morris (1985), reprinted in Grubb and Kalman (1994), and more recent results in Morris (1994)

[11] The authors know of no systematic analysis of the organizational independence of community college missions. However, in addition to the clear split between academic and occupational faculty, splits between remedial or developmental faculty and the rest of the institution (Grubb, Kalman, Castello, Brown, and Bradby, 1991), and between customized training and the rest of the institution (Lynch, Palmer, and Grubb, 1991) have been identified in earlier studies. The programs serving JTPA and welfare clients are often distinct from regular courses (Grubb, Brown, Kaufman, and Lederer, 1990); and credit and noncredit courses are often organized in different divisions.

SECTION THREE
THE COMMUNITY COLLEGE ROLE IN TECH-PREP

Of the many workforce innovations mentioned in the introduction, few have generated as much interest as tech-prep. Often linked to Dale Parnell's 1985 proposal to link high schools and community colleges for the "neglected majority" of students not bound for four-year colleges, tech-prep has been supported by federal funding since 1990, with consortia of high schools and community colleges virtually blanketing the country.

But—like the integration of academic and occupational education, which has been used to describe everything from existing general education requirements to elaborate learning communities—the term "tech-prep" has covered an incredibly wide range of practices. Some institutions use the term to describe their efforts to improve occupational preparation in any way, including bringing programs up to date. Others have made tech-prep virtually synonymous with curriculum integration, ignoring any efforts to link secondary and postsecondary institutions. Still others have initiated planning processes involving secondary and postsecondary instructors and called them tech-prep even in the absence of other changes. Some have instituted programs for students to begin planning their educational and occupational careers early in high school with the help of community college counselors, otherwise leaving both the secondary and the postsecondary curriculum unchanged. A variety of tech-prep "models" have emerged—including the tech-prep associate degree (TPAD) model stressing the completion of the degree; "integrated tech-prep" concentrating on curriculum integration; "work-based tech-prep" stressing the work-based learning for school-to-work programs; the "tech-prep baccalaureate degree" (or 2+2+2); "pretech-prep" stressing articulation in middle and elementary schools; and adult tech-prep or bridge programs (Bragg, 1995). With all these proposals, it is often difficult to remember what tech-prep was supposed to accomplish.

When Dale Parnell (1985) proposed tech-prep, he stressed the importance of creating a smoother transition between high school and community college, particularly for those individuals who would otherwise not think of postsecondary education. Similarly, the Perkins Amendments of 1990 emphasized articulation agreements between secondary and postsecondary institutions, a 2 + 2 curriculum bridging the two, and joint staff development for secondary and postsecondary instructors. For the purposes of this chapter, then, the essential kernel of tech-prep is viewed as being the collaboration of secondary and postsecondary institutions around occupational preparation.

While most investigations of tech-prep have started with the role of high schools—a logical starting point, since students in tech-prep programs begin in high school—this section focuses on what community colleges and technical institutes have done. This is a postsecondary view of what is often, as will be evident, a program emphasizing secondary-level reform. To do this, community college tech-prep coordinators of 34 tech-prep consortia, that in various ways had been nominated as relatively active or exemplary in some way, were interviewed. (See Sources of Information for additional detail.) The view of postsecondary developments in tech-prep presented here has been formed by the *best* efforts around the country rather than *average* efforts.

It is stressed that the positive conclusions about tech-prep programs that were reached as a result of these interviews are based on their characteristics and the links forged between secondary and postsecondary institutions. These programs are too new to have generated much statistical evidence about their success at the local level—though a number of state evaluations are starting to appear (Bragg, forthcoming, 1996). And, as is stressed below, the evaluation of tech-prep programs is a potentially difficult task because their benefits may take so many different forms, difficult to capture in the usual procedure of tracking students.

From the 34 exemplary tech-prep programs examined, there is both bad news and good news. The bad news is that tech-prep has so far stimulated very few changes in community colleges; most of the substantial reforms so far have taken place at the high-school level. But the good news is that the changes that have taken place appear to be valuable, benefiting students and educational institutions in various ways—though often in ways that are diffuse and difficult to measure. And—*if* there can be stability in tech-prep programs in the years ahead—the best of them may be just on the verge of making substantial changes at the postsecondary level. Tech-prep programs also provide important roles for community colleges in improving the educational "system" as a whole, even though many of the benefits accrue to students who may not show up in community colleges, and to high schools rather than postsecondary institutions. The implications for future policy and funding are substantial.

Community College Activities in Tech-Prep

As others have noted (Hershey, Silverberg, and Owen, 1994; Dornsife et al., 1993), the most substantial changes in most tech-prep programs have been in high schools, partly because tech-prep programs are so new that it has made sense

to concentrate on the education level where students have been initially enrolled. This observation about the early emphasis extends to the participation of postsecondary personnel as well: most of the activities of postsecondary coordinators, instructors, and other administrators have so far concentrated on changes that most directly influence the high-school component. In rough order of frequency in the 34 programs examined, the activities of community college personnel have included the following:[12]

Collaboration. The most frequent collaboration between secondary and postsecondary instructors has been the process of specifying competencies necessary in postsecondary courses, laying the foundation for articulating secondary and postsecondary courses. Typically this has led to the upgrading of secondary courses. This kind of collaboration allows community college faculty to play an active role in upgrading the content of high-school courses, particularly the math courses required for technical occupations and the English courses emphasizing communication skills; less frequently, the content of science courses—for example, those required for health occupations or applied physics courses appropriate for a variety of technical occupations—have been strengthened. In theory, these activities prepare students to enter community colleges better able to do college-level work, or less likely to need remedial (or developmental) education. (There have so far been so few tech-prep students entering community colleges that it is difficult to be sure whether levels of preparation have improved.) These efforts are consistent with those elsewhere in secondary education to eliminate "general track" courses in favor of more rigorous alternatives, to suffuse vocational programs with more academic content, and to increase standards in general.

The collaboration of community college and secondary-school faculty in tech-prep is similar to efforts by the American Association for Higher Education and other groups to have schools and colleges collaborate (Wilbur and Lambert, 1995). While many of these collaborations provide specific programs and services for students, a large number involve postsecondary faculty in particular academic disciplines working with their secondary peers to improve high-school courses. These discipline-specific collaborative efforts, designed to prepare college-bound students for the kinds of analytic and interpretive approaches required in college, have sometimes helped high-school teachers to concentrate less on facts and formulas and more on deeper disciplinary perspectives. The participation of community college faculty from occupational areas has the potential to clarify for high-school students and teachers the most common difficulties that students face as they enter community colleges and prepare for employment. In part, community college instructors can help articulate the demands of the workplace and the importance of key competencies, both academic and nonacademic. Often changes are made in high-school courses so that they stress occupational applications and contextualized instruction, a change that allows students to transfer knowledge from one course to another.

Staff Development. The most common activity (though one that is less time consuming than faculty collaboration) is variously described as staff development, awareness, or marketing, by which is meant explaining what tech-prep is and "selling" it to community college faculty, as well as to other potential participants like administrators and employers. The meetings, informal presentations, seminars, workshops, and planning sessions absorb the greatest efforts of tech-prep coordinators; indeed, they seem to be never ending, partly because there is always a round of new faculty, or individuals who have not yet been convinced, or changes in the conception of what tech-prep is. Another way to explain the constant need for "selling" this innovation is that the most basic changes it envisions—the close linking of high schools and postsecondary institutions, the collaboration of faculty in several ways, and the creation of coherent *programs* instead of independent *courses*—are so different from the common practices of independent institutions, independent faculty, and independent courses. Like curriculum integration, tech-prep has the potential for truly substantial change in how education operates. This message is not quickly learned.

Articulation. Articulation agreements have been at the heart of most exemplary tech-prep programs, and often success is counted by the number of agreements with a variety of local high schools. Articulation agreements take many forms, and the benefits to students vary. Some community colleges give college credit for courses taken during high school, or for courses taken at the community college during the high-school year; this allows the period of time necessary for completing a certificate or associate degree to be shorter. Others give students advanced standing, or waive certain prerequisites, but insist that courses taken in tech-prep programs not shorten the time to a credential. In still other cases, students can move directly into college-level courses and avoid the need for remediation; for this group the benefits of tech-prep may be substantial since most community colleges find high proportions of recent high-school graduates needing remedial education—but the benefits are especially difficult to measure because they take the form of remediation prevented rather than credits earned or advanced standing attained. All these forms of collaboration help community colleges define their requirements to high schools, though they do so in ways that

have less influence on the high-school curriculum than do the collaborative efforts of faculty.

Much less often, some colleges offer financial incentives to students who move on to the community college, though only a few waive fees or provide scholarships to tech-prep students. Because most tech-prep programs have not been operating long enough for many students to enter community colleges, it is unclear how effective financial incentives are.

Curriculum. The curricular changes in tech-prep programs have so far been confined largely to high schools, where a variety of new courses have been created—partly in response to the process of specifying the competencies necessary for entry into community colleges. The courses range from the applied academics courses, created by the Center for Occupational Research and Development (CORD) and consisting of applied curriculum materials that teachers can use "off the shelf;" to locally developed courses that integrate academic and vocational content; to the development of career pathways or majors that generate coherent programs of academic and vocational courses for high-school students. (It should be noted that the CORD courses are widely used in high schools but generally rejected by community college instructors as too low-level and poorly integrated with occupational content.) The focus of curriculum changes has been both to upgrade the content of high-school programs, as well as to integrate academic and vocational education (see Grubb, 1995a, for changes at the secondary level) and to stimulate a move to teaching methods that are more applied, more project centered and active.

Other Activities. A very few tech-prep programs have started special counseling for tech-prep students in high schools to help them see the value of completing high school and entering postsecondary education. One assigned a community college instructor to the high school as an advisor and instructor of a career assessment workshop. Some have started elements that are forms of career exploration, to get students thinking earlier and more deeply about their occupational interests and goals; one program has even begun career workshops for seventh graders and courses about technical careers for ninth-grade girls, as well as workshops on career decision making for high-school students. One added a curriculum in "job savvy," teaching students such capacities as punctuality, conflict resolution, and team building, based on their observations that "when students went out into the workplace to learn, they didn't necessarily know what to do there."

Another small group of tech-prep programs have implemented work-based components, such as internships and co-op placements. This practice foreshadows the widespread belief that tech-prep will be subsumed in school-to-work programs linking school-based learning with work-based learning, as well as secondary and postsecondary education. It also reflects the tremendous potential of work-based learning and associated "connecting activities" like co-op seminars (Grubb and Badway, 1995) as vehicles for integrating academic content and clarifying the importance on the job of both basic and higher-order competencies. So far, however, tech-prep coordinators acknowledge that they have had neither the time nor the funds to do much about work-based placements.

Although small in number, these efforts to begin incorporating linkages to earlier years of schooling, to guidance and counseling, and to work-based activities illustrate the value of tech-prep. They start schools and colleges thinking hard about other connections that might be valuable. Unexpectedly, what began as a systematic approach to get more of the "neglected majority" or "forgotten half" of high-school students to consider postsecondary options has ended up as a process to rethink schooling more generally.

Factors Limiting Change in Community Colleges

In all the changes noted in high schools, the participation of community colleges is crucial. Access to postsecondary education provides the goal that motivates these changes; the participation of community college faculty in setting competencies and upgrading courses provides the specific pressures to upgrade high-school courses and programs. But for all the changes encouraged by community college participation in tech-prep programs, there have so far been almost no changes within community colleges themselves as a result of tech-prep—not in curriculum, in teaching methods, in the students who have entered, or in ancillary services like guidance and counseling. Tech-prep coordinators uniformly report that "we have had very little curriculum change at the community college level," or "tech-prep hasn't had any direct impact on the community college . . . we're not expecting much change." The reasons are varied, and understanding them is critical to defining what tech-prep programs might be expected to accomplish within community colleges.

Most tech-prep programs have not been in place long enough for any high-school students to have moved into postsecondary institutions. Apart from those early innovators that started 2+2 programs in the 1980s, most states initiated their programs in late 1991. Most tech-prep consortia received an initial planning grant for 1991-92, theoretically allowing them to enroll the first students in the fall of 1992. However, in practice it took much more time to put programs in place; in most cases the first students entered the eleventh

grade of tech-prep in the fall of 1993, and graduated from high school in spring 1995. This means they enrolled in community colleges for the first time in the fall of 1995—and information about their numbers and activities is still limited, particularly since tech-prep directors were interviewed in October-December 1995. More frequently, tech-prep grants were delayed, planning took longer than expected, or a different direction was taken after a few years. As a result, only a small minority of tech-prep programs—only four of the 34 examined—now have students enrolled at the postsecondary level. It is simply too early for the community college portion of tech-prep to come online, and both faculty and administrators are reluctant to change their programs in advance of the need.

However, a number of tech-prep coordinators report that they are on the cusp of important changes. As one coordinator described it, "Systemic change will take place once a critical mass of students hits the community college." The stimulus for these changes, they feel, will be a larger number of students better prepared for college work and more accustomed to active and applied approaches to learning. One example of a new community college course—Technical Physics, developed as an extension of Principles of Technology used in high schools—emerged precisely because of the need to develop curriculum better suited to a new wave of tech-prep students. If tech-prep programs remain stable—if funding for them is maintained and coordinators can continue the processes of marketing and staff development—then curriculum changes at the community college level analogous to those that have already started to take place in high schools will follow.

More troublesome barriers to change in community colleges have been the resistance of faculty to change curriculum and the lack of understanding of applied teaching. As one tech-prep coordinator reported, "Community colleges appear more reluctant to change than high schools." The reform pressures have not been as insistent in community colleges as they have been in high schools, where there has been constant pressure for reform at least since 1983, with the publication of *A Nation at Risk*. Tech-prep, as a vocationally related reform, has low-status in the eyes of academic faculty, and there is also some feeling that it is a fad, one of the "reforms du jour" that can be ignored because it will quickly pass. Some coordinators mentioned the dislike of creating courses especially for occupational and tech-prep students:

> It is very difficult to get postsecondary people interested in application issues. They say that by giving applied courses, we are essentially setting tech-prep students aside from other students, and we shouldn't be doing that.

So not all community college faculty welcome the curricular and pedagogical changes that tech-prep is bringing. And occasionally, external attempts to mandate changes in course content have raised the sensitive issue of academic freedom. Furthermore, changes that involve development of course clusters or team teaching run into the strictures of established faculty loads, particularly if unsupported by adequate release time or compensation. The willingness of faculty to make changes in pedagogical methods developed long ago, and honed by years of experience, may be considerably limited unless adequate time, monetary incentives, and essential staff development are made available.

Where tech-prep programs have been successful in getting faculty involved, two groups have been especially active. The first includes occupational instructors who, because of close ties with business and industry, have a good understanding of the skills needed in the workplace and the advantages of better preparation in a broad range of both academic and occupational skills. For them, tech-prep is a reform that might directly enhance their programs, and they have been more active in defining competencies and structuring articulation agreements. The second group includes academic instructors interested in pedagogical innovations, including the more student-centered, project-based, and applied methods associated with curriculum integration. But this leaves a large number of faculty unmoved by the potential of tech-prep.

Similarly, the support of administrators has been uneven. While some tech-prep coordinators describe outstanding administrative leadership, others report indifference for some of the same reasons faculty are reluctant to participate: administrators see tech-prep as irrelevant,[13] low-status, evanescent, or as something more concerned with high schools than community colleges. Indeed, the institutional indifference is illustrated precisely by one simple fact: of the 34 exemplary tech-prep programs examined, very few have devoted institutional funds to support tech-prep—as distinct from external grant funding. Institutional fiscal support is crucial in part because many faculty will not budge without institutional commitment. Lack of general-fund support is especially frightening to tech-prep coordinators in a period of shifting federal policy.

A final and more systemic barrier to change in community colleges is the inability to define and track tech-prep students—to count them, to know what they do when they leave high school, to follow them into and through the community college. This occurs simply because the information systems necessary to follow students from one institution to another are not yet in place: "we're still working on this" is a common response. Although some programs

have added a box on community college enrollment forms where students can identify if they have been through a tech-prep program in high school—this process is rife with error.

In some cases, high schools have not established clear tech-prep programs. Sometimes, students may be advised to take a particular combination of courses to prepare them for postsecondary options, but there are no counseling or tracking mechanisms to make sure that certain students do so. In these conditions it is impossible to say who is a tech-prep student even in the high-school component, and the idea of tracking students into postsecondary programs is pointless. In addition, some tech-prep programs do not want to identify a group of students designated "tech-prep" from those who are "college prep" or bound for four-year colleges, or to distinguish tech-prep students bound for community colleges from "preemployment" students aiming for employment right after high school. Such distinctions, useful as they may be for developing coherent programs and following students, also smack of tracking and unequal access to educational resources. As a result, many high schools have changed their courses but not specified who takes them; as one coordinator reported:

> There is no consistent definition of tech-prep, no standard way to say, "I now apply [to the community college] as tech-prep." There are tech-prep courses but not tech-prep students. The local schools want to avoid tracking in any way.

In practice, then, some programs identify tech-prep students as those who enroll in any tech-prep courses or any other tech-prep activity (like career counseling). Only a few—the ones described below as following the "classic" model—have well-defined cohorts of tech-prep students.

The inability to define and to track tech-prep students is not merely an administrative inconvenience or a problem for would-be evaluators. If community colleges cannot point to substantial numbers of students who enter through tech-prep, then it is hard to justify administrators allocating resources to tech-prep, or faculty changing their courses, or counselors developing special services for tech-prep students. In an institution like the community college, driven by enrollments and funded largely on a per-student basis, the inability to count certain kinds of students may mean "there's no there there"—from the community college vantage, there is no evidence that tech-prep has done anything for the institution. The benefits to the institution are completely unclear.

Furthermore, even if it is possible to identify and track tech-prep students, they may pursue many different routes after high school, and a community college will "capture" only some of them. The experiences of the four colleges in this analysis that have enrolled their first identifiable tech-prep students is illustrative. One college in Ohio reported that 85 percent of the first group of tech-prep graduates from high school enrolled in the community college, partly because the college had treated them as community college students since eleventh grade; two went to four-year colleges, one got married and started a family, and several went to work in tooling and machining. But two other community colleges reported respectively that 50 percent and 23 percent of the first high-school graduates attended the community college. And, at the other extreme, only one of the first ten tech-prep graduates in yet another Ohio program entered the local technical college; seven went to a four-year college and two into the military. In other programs, tech-prep coordinators report that students change their program areas:

> What's happening is that students who choose tech-prep might continue at the college, but in a program area different from the one they started in high school.

Given all the possibilities and the contingencies that high-school graduates face—the choice of many different four-year and two-year colleges, even within a limited geographical area; the possibility of geographical mobility; the possibility of changing areas of interest; the options of entering the military or, for women, starting families; the increasing tendency to "stop out" and work or play before entering college—the likelihood that a community college will enroll a graduate from a tech-prep program may be slim indeed.

But these alternatives—and the experiences of the programs with low numbers of students enrolling at the community college—are not necessarily failures. If these efforts have stimulated greater interest in schooling among students who would otherwise be turned off, if they have resulted in more active and more engaging teaching, if they have caused students to explore their occupational options more carefully and to understand the potential value of postsecondary education, if students enter postsecondary education less in need of remediation—then these tech-prep programs have been successful even if the numbers enrolled in the participating community colleges are low. In this case the benefits to students and the educational "system" as a whole are substantial, even though there are few direct benefits to the community college itself and few community college enrollments. The disjunction between the benefits in general and the benefits that accrue directly to the community college creates problems, to be sure—among

other things, it reduces the pressure to make changes in the postsecondary curriculum itself—but it should not be interpreted as a lack of benefit.

Emerging Tech-Prep Models

While it is still too early to see many changes in community colleges, many coordinators think that larger numbers of tech-prep students are likely to enter community colleges in the next few years, forcing additional changes at the postsecondary level. They are therefore planning certain kinds of changes, and in their efforts can be distinguished three models or approaches to tech-prep that seem to dominate their thinking.[14] These "models" should be understood as rough descriptions of what programs are attempting; the practices in different programs overlap a great deal, and the distinctions among the three approaches are not hard and fast. Nonetheless, it is useful to articulate them because they clarify the varied ambitions of different programs. Roughly speaking, slightly more than one quarter of the 34 programs examined followed what will be called the "classic" model, which includes changes at both the secondary and the postsecondary levels; about one third followed the model of upgrading secondary vocational education; and slightly more than one third followed the model of secondary curriculum reform. These figures illustrate that there are significant numbers of tech-prep programs using each approach; but the specific percentages should not be overemphasized because assigning a particular tech-prep program to a particular "model" is somewhat inexact, and because the sample of programs was chosen primarily to describe exemplary efforts.

The "Classic" Model. The "classic model" seems to be most consistent with the original vision of Dale Parnell (1985), with his emphasis on the middle quartiles of high schools, the middle range of occupations, higher standards for both levels, and continuity of learning between the secondary and postsecondary levels. Many of the programs following this approach are in Ohio, because that state has adopted a statewide plan embracing many of these elements; it is also consistent with Oregon's state plans, which call for a two-track approach with a "college-prep" track and several "tech-prep" tracks emphasizing one of six different broad occupational areas. This approach concentrates more or less explicitly on the middle 50 percent of high-school students, acknowledging that the top students will go to four-year colleges and the bottom quartile are unlikely to participate in any postsecondary education at all—or are simply too difficult to motivate to higher levels of performance. Indeed, one coordinator stated that their initial efforts to include low-performing students foundered:

> We did have one high school send us their highest-risk students, and we found we were just not set up to deal with such a high-risk population. We found that when the high-risk kids come in such a group they put too much pressure on each other to fail.

Many of these programs, therefore, have entrance requirements—for example, in one case, requiring that students have passed state proficiency tests, have a C average in algebra, a C average in biology (for health occupations students), and be computer literate—and those that do not still target their recruitment efforts at the middle 50 percent. Because these programs are clear about which students they want to enroll, they tend to designate their students as tech-prep students, distinguished from the rest of the high-school population, and for this reason tracking and evaluation are easier than for other approaches.

The changes at the high-school level include upgrading the curriculum, defining the courses most appropriate for students preparing for postsecondary occupational programs, and using more applied and integrated teaching—all with the cooperation of community college faculty, who specify the preparation appropriate for doing advanced work at the community college level. These programs contain an understanding, explicit or implied, that students will continue in a related program in a community college or some other postsecondary institution. Finally, because these programs anticipate a well-defined group of tech-prep students will enter the community college as a cohort, there is a greater commitment to changing the curriculum and teaching at the postsecondary level as well, incorporating the various forms of integration mentioned earlier in this monograph. Typically, this approach does not designate other special services for tech-prep students at the postsecondary level, because these students should be integrated into the mainstream of the community college; but there is a greater recognition that tech-prep or 2+2 programs require reforms at both levels.

Upgrading Secondary Vocational Education. This approach, like the classic model, tends to exclude high-school students likely bound for four-year colleges. It focuses on students in vocational areas only, and tries to raise the standards of such programs through greater demands, a different sequencing of courses, incorporating more math, and introducing more contextual or applied teaching. One of its effects may be to replace the general track, followed by students who are neither college nor vocational bound, with a more rigorous program of applied courses that have an occupational flavor or applications—even though such a program may not be vocational in the traditional sense of preparing for specific, entry-level jobs.

Unlike the classic model, there is no clear understanding that students will continue in a community college, and therefore less interest in tracking tech-prep students—though high-school students should be better prepared for postsecondary alternatives because the curriculum is more rigorous (especially when general track courses are eliminated) and courses more coherently sequenced. Because the emphasis of this model is on the improvement of postsecondary vocational education, there is much less emphasis on change in the community college, and less participation of community college faculty except in specifying competencies and standards.

Reforming the Secondary Curriculum. The third model, unlike the previous two, focuses on almost all students in a high school including those who might be considered college-prep. The emphasis is on reforming the high-school curriculum for all students, often by developing career majors or pathways that create more coherent sequences of courses, where every student elects one pathway or another. Because this approach intends to reform the high school for all students, there is generally a disinclination to track students, or to label some students "tech-prep" while others remain "college preparatory" or "employment bound," therefore designating and tracking tech-prep students is difficult. The purpose of connections to postsecondary institutions is to stress that all students, when they graduate, have the options of continuing their education, going into employment, or combining further schooling and employment (as an increasing proportion of students do anyway)—a broader set of goals than either college preparatory or traditional vocational programs have had. This allows students to engage in "parallel career planning" where they can envision both postsecondary education and back-up employment (Heebner, 1995). As one student described this approach:

> This is my last year, and I'm going to get my cosmetology license. After I get my license, I'll just go to college for business. If one doesn't work out, I'll go to the other.

Several of the programs that have been examples of the second model, improving secondary vocational education, appear to be shifting to the third model, stressing the reform of the entire high school. Such a development is consistent with recommendations that an occupational focus and the integration of academic and occupational education can be the stimulus for general high-school reform, even if it starts with vocational programs (e.g., Grubb, 1995a). Students may be better prepared for postsecondary education, and more of them will qualify for employment or further education after high school.

In the model of reforming the secondary curriculum, the inability to identify certain students as tech-prep makes it difficult to track students entering a particular community college as tech-prep students. For this reason, and because this approach emphasizes the reform of the high-school curriculum, there is not much identifiable change at the community college level—and certainly little interest in curricular or pedagogical change. To be sure, as in the model of upgrading secondary vocational education, students entering community colleges should be better prepared and need less remediation, and some of them may be recruited to community colleges by articulation agreements between the career pathway they have chosen in high school and a particular community college occupational program. There are, then, benefits for community colleges. As one tech-prep coordinator summarized the benefits of the program:

> I have seen an increase in self-esteem and self-confidence. Tech-prep students are more focused, have more concrete goals, their high-school performance is improved—and it is much easier to transition to the community college if they decide to get an associate's degree. I haven't seen as [many] drop out: our community college freshmen at least finish the term.

But the benefits to the community college are less direct, and they certainly are more difficult to evaluate because high-school students are likely to end up in a large variety of institutions and jobs after high school.

One purpose of clarifying these three models, rough as they are, is to emphasize once again that many tech-prep programs have important goals that have little to do with reform at the community college level. The models of upgrading secondary vocational education and of reforming the entire secondary curriculum may require the participation of community college instructors, but they may not see the need to reshape the community college itself. And the benefits for community colleges as a whole from improving the high school curriculum and increasing the awareness of occupational choices and postsecondary alternatives may be substantial, but they may be indirect and diffuse: particularly given the inability or reluctance to label and track tech-prep students, a participating community college may not see an increase in the numbers of identifiable tech-prep students.

System Building and the Future of Tech-Prep

Almost without exception, tech-prep coordinators are highly enthusiastic about the potential of tech-prep. This is

practically a job requirement. Nevertheless, the potential benefits of tech-prep appear to be substantial and take several different forms.

Collaboration and Articulation. The collaboration between community college and secondary instructors has helped to increase the rigor of high-school programs, and to ensure that high-school students are better prepared for the kind of demands they will face in postsecondary education and the world of work. Articulation agreements have smoothed the transition to community college, allowing some students to start at a more advanced level and some colleges to develop more sophisticated programs. While few tech-prep students have yet entered community colleges, many tech-prep coordinators predict that a wave of students—better prepared, accustomed to more active and student-centered teaching—will force postsecondary instructors to change their teaching methods.

Student Completion Rates. The development of applied courses and more active teaching methods in high schools has helped to engage a number of students—precisely those students (often, the middle 50 percent or the "forgotten half") who have been turned off by the conventional college-preparatory curriculum and standard didactic teaching methods. Tech-prep has been a vehicle for other components—for example, career exploration and work-based learning at the high-school level—that provide other kinds of learning opportunities, and may in the future lead to more community college students who have clear ideas about their goals rather than coming to postsecondary programs unsure of themselves and needing to "experiment" to find some sense of direction (Grubb, 1996b, Chapter 2). This in turn should reduce the "milling around" that takes place while such students clarify their purposes.

By reducing the need for remediation, serving to accelerate progress through the community college, and enhancing students' sense of direction, these programs may increase the completion rates of incoming tech-prep students—and such improvements are particularly important for the disadvantaged students whose completion rates are especially low. Indeed, some tech-prep programs—those following the "classic" approach and those following the tech-prep associate degree model (Bragg, 1995)—explicitly stress to students that completion of the associate degree is the goal, not merely enrollment in postsecondary education. In turn, increased rates of completion will benefit students because the economic value of associate degrees is substantially higher than either certificates or credits earned without any credential (Grubb, 1995; Grubb 1996b, Chapter 3).

Revisiting Basic Educational Purposes. Tech-prep has served as a vehicle for forcing institutions and faculty to think about the basic purposes of education. As one coordinator said:

> I don't know that anything has really changed [at the community college], but I do know that through tech-prep many issues that needed to be addressed are finally getting addressed, e.g., teaching and learning issues. We are also asking ourselves such questions as: What is "college ready"? What is integration?

Another reported, even though "we aren't making as much progress as I had hoped . . . some faculty are starting to think about more learning-centered ways of teaching—we're doing workshops on distance learning and encouraging faculty to adopt teaching strategies different from the traditional lecture." The most concrete form this kind of investigation has taken is the effort to develop coherent programs spanning the high-school and postsecondary years, drawing on the collaboration of secondary and postsecondary faculty. As one coordinator commented, "We need to provide more opportunity for students to move through a planned educational experience," and another coordinator involved in delineating career pathways declared that "we must get students out of the process of just picking courses." And the larger issues—who does education now benefit, who should it benefit, what are the alternatives to the standard college preparation "track," how might educational institutions work together, what approaches to teaching are most effective—have also been a central part of many discussions initiated by tech-prep.

At the same time, virtually all tech-prep coordinators in community colleges are nervous about the future of their programs. They rely heavily on external funding from the federal government, since their institutions have (with a few exceptions) not yet shouldered the costs of tech-prep. The elimination of tech-prep funding in its current form, as Congress moves toward consolidating vocational funding, threatens the very existence of these programs. Almost universally, community college coordinators envision that tech-prep will be subsumed under school-to-work programs, but this too creates its own uncertainty: while some tech-prep programs are part of local and state school-to-work planning groups, others are not. One coordinator reported that "the school-to-work people are a totally different group—the two groups don't talk." The tendency to see school-to-work as a new reform rather than an extension of curriculum integration and tech-prep, the politics around a different decision-making group, and the battles over funds that arise from including proponents of work-based learning all make the transition to school-to-work quite precarious.

Moreover, because so few tech-prep students have

entered community colleges yet, the benefits are still invisible to faculty and administrators alike; there are very few tangible benefits to community colleges that tech-prep coordinators can point to, even after five years of federal funding and endless amounts of publicity and "marketing." The benefits to high schools and high-school students are again all too invisible.

Over the long run an equally serious problem with tech-prep is the apparent disjunction between the responsibilities of community colleges and the pattern of benefits. Crude as it may be, the evidence from a few institutions that only a few students entering a tech-prep program in high school will continue in the same program in the local community college is consistent with everything else known about the ways in which students change their minds, develop other plans as they progress, and move around geographically. The problem is exacerbated by the large numbers of tech-prep programs that cannot or will not identify students as "tech-prep," or that have adopted models that merely stress high-school improvement. The participation of a particular community college is obviously crucial to the success of each local tech-prep program, but the benefits are diffuse. High-school programs may become more coherent, and some high-school students are more likely to graduate and continue to postsecondary education, but some will end up in four-year colleges, or other community colleges, or employment, or the military. It may never be clearly in the interests of the local community college to fund its participation in tech-prep if it looks solely at the benefits to its own students and its own instructors.

The underlying problem is that the costs of system building—of linking different educational institutions like high schools and community colleges—have to be borne by the system itself, by state or federal governments with specific funding, rather than by individual institutions with their general-purpose funds. This has been, of course, the point of federal funding for tech-prep under the Carl Perkins Amendments of 1990, and it will continue to be a legitimate function of state funding under consolidation. The future of tech-prep may depend on recognizing this point, and persuading state governments that they have a critical responsibility to continue funding the costs of system building to create coherent occupational education and job-training systems.

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[12] These findings are consistent with the national survey of tech-prep coordinators in Bragg, Layton, and Hammons, 1994.

[13] A frequently mentioned source of resistance to tech-prep comes from a basic misunderstanding of who community college students are. One mantra among community college administrators is "the average age of our students is 29," implying that tech-prep programs concentrating on students entering from high school will serve only trivial numbers of community college students. However, the average age of 29 masks two different populations: older students, who tend to be part time, and full-time students who tend to be much younger. As a result the median age of all students is 25, the median age of full-time students is 21, and the modal age appears to be 19; see the 1992-93 NPSAS data in Tuma (1993) and Cohen and Brawer (1989, p. 32). These younger students, more or less right out of high school, are the targets of most tech-prep programs, and they are crucial to overall enrollments, to the daytime programs that full-time faculty teach, and to the core programs of the institution.

[14] These three are consistent with the three approaches described by Hershey, Silverberg, and Owens (1994), p. 134 ff.

SECTION FOUR
REQUIREMENTS FOR THE FUTURE

Both workforce innovations profiled—the integration of academic and occupational education, and tech-prep programs linking community colleges with high schools—have now reached the point where some assessments are possible. Both have generated substantial amounts of change, though there is obviously variation in how much change has taken place. Some community colleges have been relatively active in promoting curriculum integration, adopting several different kinds of applied courses, or revamping their general education program to incorporate more work-related multidisciplinary courses, or adopting a series of tandem courses and learning communities. In other cases, such efforts remain idiosyncratic, the responsibility of one or two committed faculty. Tech-prep programs have achieved widespread visibility and some real changes within high schools through the collaboration of community college faculty, though the changes within community colleges themselves are as yet limited.

Both these innovations have proven to be multifaceted, flexible enough to incorporate a variety of somewhat different goals. While improved preparation of a more sophisticated work force remains the principal goal of both, the enhancement of remedial education (or its prevention, in the case of tech-prep), the inclusion of different forms of career education, the incorporation of liberal education into occupational programs, and the inclusion of work-based learning are all possible as well. Both curriculum integration and tech-prep are consistent with the larger vision of school-to-work programs incorporating work-based learning, and many participants look forward to the day when the "three integrations" envisioned in the School-to-Work Opportunities Act—of academic and vocational education, of secondary and postsecondary institutions, and of school-based and work-based learning—will replace the current nonsystem of isolated courses and independent practices.

At the same time, the initial development of these innovations has depended heavily on enthusiasts, on volunteers, on innovators, and on those committed to reforming occupational education, including those academic instructors interested in new ways of teaching. The innovations described may well have exhausted the stock of such supporters in community colleges; progress from here on may depend on converting the uncommitted, encouraging the timid, and proselytizing those who would prefer to continue in old patterns.

The further development of both curriculum integration and tech-prep will require institutionalizing support for these changes, replacing their current status as relatively peripheral innovations out of the mainstream of what community colleges do with a new status in which they are a central part of college business.

Changing the Culture

The vision underlying these practices—their basic purposes, potential benefits, and general methods—should be part of the culture of community colleges. The endless "marketing" and staff development that tech-prep coordinators undertake, as faculty come and go and others need to be further persuaded, is testimony to the novelty of these ideas. (NCRVE workshops about curriculum integration, described briefly in the Source of Information, are similar experiences—continuously explaining the idea to faculty who have only the merest glimmer of what collaboration might accomplish, including some who are actively hostile to integration.) Moreover, students usually have to be educated about these novel practices: for example, institutions adopting tandem courses and learning communities usually have to work hard to get students to enroll, and applied and active instruction also requires some adjustment by students accustomed to lectures and passive learning. In contrast, those practices that are fully institutionalized—for example, the conception of what a "course" is, the basic structure and purposes of a community college, the role of departments and faculty senates—need not be explained over and over because all members of the institution understand them. Paradoxically, these workforce innovations will be truly institutionalized when they are not viewed as innovations at all—when instead they have become part of the normal practice of community colleges and technical institutes.

The abilities to implement such programs should be normal qualifications of faculty and administrators. Curriculum integration requires forms of collaboration with other faculty that are presently rare, and approaches to teaching that are also still uncommon. Tech-prep requires working with high schools that have different cultures and practices, and is not one of the abilities that community college instructors have learned in their preparation, either in the academy or in business and industry. The appropriate preparation of faculty and administrators is particularly difficult in community colleges, because in most states there are no specific teacher- preparation programs as there are in K-12 education that might incorporate such abilities. However, two examples were discovered where local schools of education teach courses in applied learning for community

college and high- school instructors; other opportunities for such preparation include the early period of teaching—sometimes referred to as "induction"—and staff development activities.

Institutional Commitment

The institutional commitment to these practices should be so widespread that community colleges look for further opportunities to practice them. In the community colleges that have embraced curriculum integration, for example, collaboration becomes quite common, and potential problems—occupational areas with rapidly changing demands, or developmental education, or programs for welfare recipients—are routinely addressed through learning communities. When community colleges become entrepreneurial and problem-solving institutions, then these workplace innovations add to the repertoire of conventional solutions—rather than being exotic changes that continue to be unusual and irregular. In turn, such institutional commitment implies that the procedures of the institution—the scheduling of classes, the procedures for registration, the course and program-approval processes, the methods for determining credit and transferability, the myriad organizational details that frustrate so many innovations—are changed to accommodate these practices.

The funding of these innovations should come from the general funding of community colleges, rather than being external and categorical funding that is volatile, "outside," and subject to political whim. The difficulty that faculty report in getting funding for collaboration, despite the earmarking of federal funds for curriculum integration and the worries among tech-prep coordinators about the future of funding, are cases where reliance on special-purpose grant funds undermines the widespread adoption of these practices. The tendency of multidisciplinary courses and tandem courses to disappear once special-purpose funding evaporates is a similar indication of how fragile changes are that are supported with external funds.

In particular, the incorporation of funding for curriculum innovation into the "normal" resources of community colleges and the continued funding of "system-building" activities like tech-prep are dependent in part on state and federal legislatures. Some of these changes are not within the power of individual community colleges. Yet some are, and will be indicators of institutional commitment to the changes that have to be made if tech-prep is to be a lasting reality.

Stability and Administrative Leadership

There are at least two requirements for these workforce innovations to be adopted that are wholly within the control of individual institutions. *Stability* is crucial to these innovations. As one tech-prep coordinator remarked:

> I view our efforts as a long-term cultural change activity. We can do all the articulation and integration we want, but we must do it for a very long time to see it actually benefit anyone. You must attack the basic skills issue from a lot of different levels.

The processes of getting faculty to understand the benefits of these innovations, of establishing relationships with high schools in the region, and of developing integrated curricula are all time consuming. The reluctance that some tech-prep coordinators report on the part of faculty who see tech-prep and integration as passing fads, as the "reform du jour," comes from the feeling that these reforms will soon be abandoned. Similarly, the anxiety of tech-prep coordinators about the future of their programs reflects the worry that long years of work, just about to pay off as tech-prep students begin entering community colleges, will be undone if funding is discontinued. The ability to get larger numbers of faculty to support these innovations in workforce preparation depends on community colleges sustaining their commitment to reform.

Administrative leadership is the other critical requirement. Only a few of these changes can be carried out by faculty working alone. For changes that affect more than a single course, coordination among faculty and institutional commitment that only administrators can provide are essential—to encourage faculty to participate, to coordinate the schedules necessary for multidisciplinary courses and learning communities, and to develop the teams of faculty and administrators necessary to work with high schools. Over and over, tech-prep coordinators related the importance of administrative support. Lack of support—for example an instructional dean described as a "weak link," or turnover in administration—was cited as a serious problem in some cases, while others reported the benefits of administrative support. As one coordinator reported:

> I've met with such problems as faculty opposition, getting the message out, and just a basic lack of involvement from others. So leadership in the college is very important; otherwise you just meet with brick walls.

Support from administrators includes financial support, of course, but the other crucial requirement is leadership in promoting innovation in teaching. Community colleges pride themselves on being teaching institutions, and the small classes (rather than lecture-size classes) and absence of research responsibilities allow instructors to concentrate on teaching. But coordinators for curriculum integration and tech-prep also report that, left to themselves, a few faculty members will innovate but many more will not. Old patterns are hard to break, disciplinary allegiances are barriers to collaborative work (especially between academic and occupational faculty), and the institutional rewards for doing so are uncertain. The challenge is to create a *climate* in which teaching is encouraged and a *culture* in which instructors know that innovation is expected, encouraged, and rewarded. This takes more than financial support; it requires administrators to serve as instructional leaders that cajole and even pressure faculty to innovate, in which they use all the mechanisms at their disposal—hiring procedures, promotion practices, staff development, discretionary funding, the bully pulpit of faculty meetings and institutional priorities—to create an institutional commitment to innovation in teaching.

The rewards can be substantial. The innovations described in this monograph promise to improve the preparation of the labor force, to respond to the demands of employers and others that prospective workers be well prepared in academic as well as technical skills, in SCANS competencies as well as the three Rs—and that is a worthy goal all by itself. But curriculum integration and tech-prep are innovations that go beyond benefits to employers, prospective workers, and the vocational mission of the community college. They offer innovations in teaching that can benefit academic instruction and developmental education (and ESL) as well as occupational education. They provide methods of collaboration—among community college faculty, between community college instructors and high-school teachers—that generate benefits of many different kinds, including that of "building community." They give the community college a greater role in the larger "system" of education, and in so doing they can help ensure that students coming to community colleges are better prepared and more certain of their goals. And they help community colleges fulfill their promise as innovative, teaching- oriented, nontraditional institutions responding to their multiple missions with flexibility and foresight.

SOURCES OF INFORMATION

The National Center for Research in Vocational Education began examining the integration of academic and vocational education in 1991 as part of the overall program to examine innovations in vocational education generally, and those supported by the Carl Perkins Amendments of 1990 specifically. This work began with a postcard survey of deans of instruction at 295 community colleges, drawn at random from the list of the American Association of Community Colleges; 168 responded, and 121 claimed to be engaged in some form of integration. Eileen Kraskouskas then interviewed 45 of these institutions during 1991 and 1992, concentrating on those with initial or particularly interesting descriptions. Four institutions were visited. This research resulted in an NCRVE monograph (Grubb and Kraskouskas, 1992) and a brief article in the American Vocational Association's journal (Grubb and Kraskouskas, 1993). This work also formed the basis for a series of presentations at meetings of groups such as the National Council for Occupational Education, the American Association of Community Colleges, and workshops at various community colleges.

Norton Grubb was asked to conduct research on curriculum integration for the National Assessment of Vocational Education. This involved developing questionnaires for high schools and community colleges to report on the kinds of integration activities they were engaged in during 1992. The resulting monograph (Grubb and Stasz, 1993, incorporated into Boesel, 1994a) clarified that there was increasing interest in curriculum integration, though it was still low, much lower than in secondary schools; and it was principally confined to specifying general education requirements, the development of applied academics courses, and offering Writing Across the Curriculum. Curriculum integration was also more frequent in states that had developed specific initiatives and technical assistance, and in large, well-funded institutions. Based on what had been learned from earlier research and from workshops, however, it also appeared that the answers to these questionnaires were often exaggerated: in many cases it looked like community colleges reported practices under development, or practices that they wanted to develop, rather than examples of curriculum integration already in place.

In 1994, interest in curriculum integration began to increase. Several additional states began to develop initiatives to require that local colleges use their Perkins funds for integration, leading to an increased demand for NCRVE workshops related to curriculum integration. In response, Norena Badway together with Norton Grubb began investigating more recent developments. Initially, Badway contacted 291 community colleges by mail, following the procedures that Kraskouskas had used in 1991-92; 82 percent of these (244 colleges) responded. Of those responding, 98 percent reported some form of integration, including 49 percent that mentioned applied academic courses. Subsequently, curriculum deans and instructors from 115 colleges were interviewed—the ones that, based on responses to questionnaires, seemed to be more active in this area. Badway also collected curriculum materials and visited three colleges. Like the earlier work by Kraskouskas, this process resulted not in a census of curriculum integration—that is often quite useless, as the NAVE questionnaires reveal—but in a relatively thorough collection of the range of practices that exist, together with better information about the content of such efforts and supporting material like course descriptions, reading lists, and project descriptions. A subsequent NCRVE monograph will describe the results of this survey in more detail and will include a compendium of supporting materials (Badway and Grubb, 1996).

A final source of information about curriculum integration comes from the workshops and presentations carried out for community colleges by Grubb, Kraskouskas, and Badway. Within the past two years NCRVE has presented about 35 such workshops to individual community colleges and consortia of colleges in particular regions. These are, of course, primarily forms of technical assistance, not mechanisms of information gathering; but the comments of participants often reveal the kinds of efforts community colleges are making and what problems they face most often. They have therefore helped the investigators develop a sense of what is going on around the country—often difficult to do given the range and variety of community colleges, and the lack of systematic channels of information.

From its inception, NCRVE has emphasized research on tech-prep, partly because of requirements that the center examine the kinds of practices funded by federal resources. An early publication by Bragg (1992) provided a guide to implementing tech-prep, stressing the need for developing high-quality programs; similarly Dornsife (1992) stressed the many possibilities for tech-prep beyond simply articulating secondary and postsecondary programs, based on information about what programs were then doing. As was true for the integration of academic and vocational education, NCRVE was asked to analyze the development of tech-prep for the National Assessment of Vocational Education, based on evidence as of 1992; the resulting monograph (Dornsife et al., 1992, incorporated in Boesel,

1994b), clarified (not surprisingly) that while there are growing numbers of tech-prep programs, most were in the very early stages; postsecondary institutions in particular were still in the midst of planning, marketing, and other process-oriented activities. Subsequent publications by Bragg and colleagues (Bragg, Layton, and Hammons, 1994; Bragg, Kirby, Puckett, Trinkle, and Watkins, 1994) further examined developing tech-prep practices, including "best practice" programs, and Bragg and Layton (1995) stressed the roles that community colleges can play in tech-prep. Finally, Mathematica Policy Research has undertaken the official evaluation of tech-prep sponsored by the U.S. Department of Education, and has completed several descriptive reports (e.g., Hershey, Silverberg, and Owens, 1994; Silverberg and Hershey, 1994).

Many of these reports emphasized the activities in high schools—because that was where the most activity has taken place—or the processes and procedures that tech-prep programs initiated. It is difficult in this literature to find much analysis of what community colleges themselves have done (or not done), and why, and what benefits might flow from their efforts. Therefore Kraskouskas and Bell began to undertake a survey specifically for the purpose of determining the community college role in tech-prep, and the changes within community colleges. In order to avoid the problems caused by surveying large numbers of institutions with relatively little change, they initially assembled recommendations of community colleges that were relatively advanced in their tech-prep programs from several sources: the Mathematica group; Debra Bragg, Carolyn Dornsife, Gerry Hayward, and Darryl Clowes, reflecting their extensive research for NCRVE; Tom Owens of the Northwest Laboratory for Research and Development, who was not only a member of the Mathematica research team but is also knowledgeable about the many tech-prep programs in the northwest region; James McKenney of the American Association of Community Colleges, who has taken a special interest in workforce developments; the U.S. Department of Education, which has had a program of awards for exemplary tech-prep sites; and an advisory committee for this project, consisting of occupational deans and tech-prep coordinators from various colleges of the League for Innovation in the Community College and the National Council on Occupational Education. The result was a list of 50 specific community colleges nominated by one or more of these sources.

Kraskouskas and Bell then interviewed the tech-prep coordinator at the community colleges during September-December 1995, specifically about the role of community college faculty and administrators and about the changes within community colleges. In all they were able to collect information from 34 of the 50; some were difficult to contact, and because there were many nominations in Illinois and Ohio, only some of the colleges nominated in those states were interviewed. It is stressed that—unlike the surveys undertaken for NAVE and NCRVE—these results therefore reflect *exemplary* rather than *average* practices. If there have been relatively few changes at the community colleges in our sample, there are much fewer in the average community college.

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