

Chapter 4

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## Chapter 4

### Other Performance Measures

Vocational education at the secondary level has many objectives in addition to job preparation and job placement.<sup>49</sup> Three particularly important areas not examined by OTA are discussed in this section: academic skills, higher-order thinking skills, and postsecondary educational attainment.

#### ACADEMIC SKILLS

Many recent reports have called for elevating the basic academic skills of all students. The National Governors' Association, for example, argued that the task of vocational education is to prepare “. . . workers who are both well educated with the ability to reason and adapt, and well trained to perform specific work tasks.”<sup>50</sup> (See box 5, page 75.)

Forty-two States responding to OTA's telephone survey reported efforts to introduce academic material into the vocational curriculum. As shown in figure 4-1, 32 States are in a consortium that is developing special courses in applied mathematics, science, and communications.<sup>51</sup> Two States currently require the assessment of vocational students' academic abilities, and a consortium of southern States has been formed to advance the development of basic competencies of students enrolled in vocational programs (see box 6, page 77).

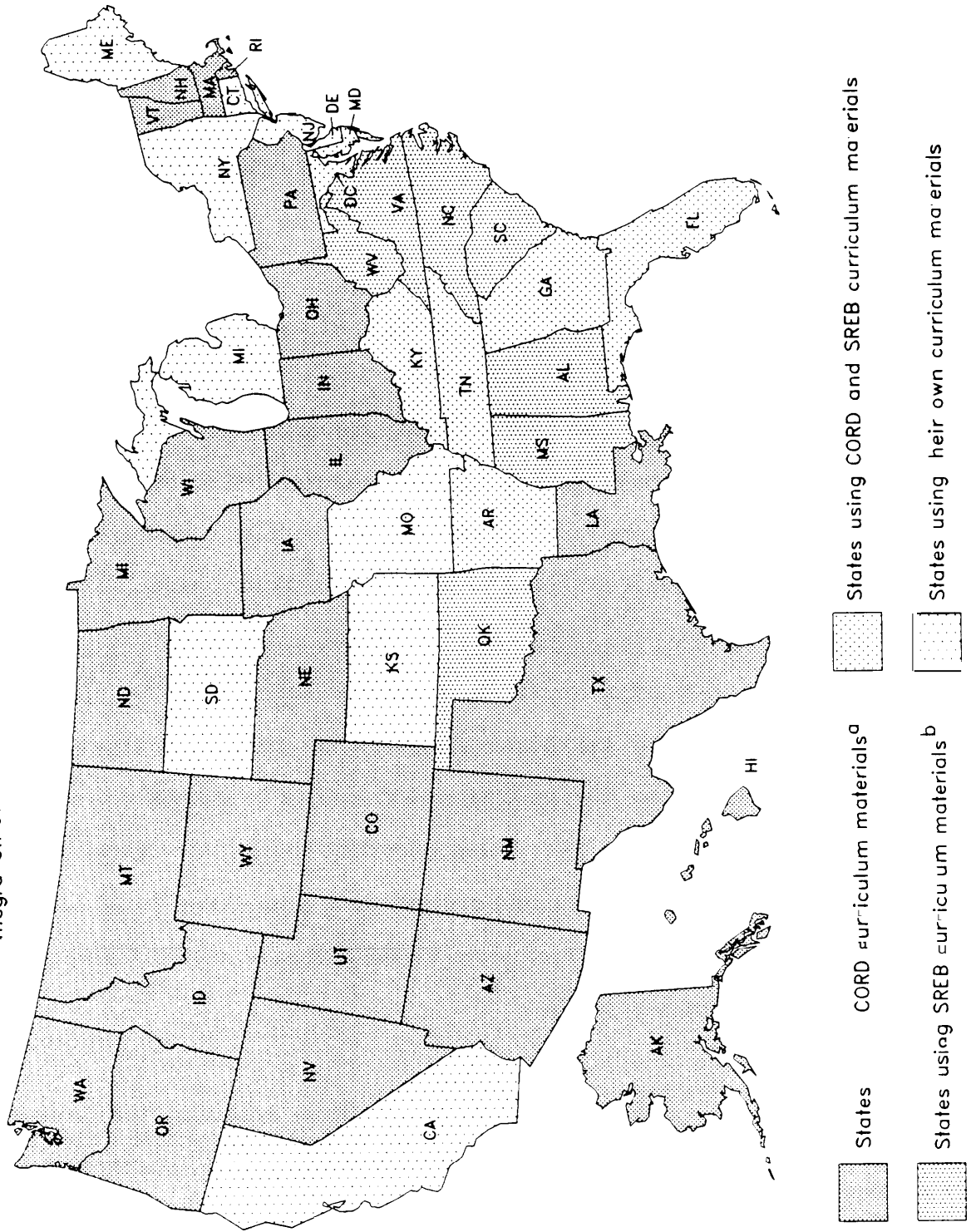
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49. For a discussion of noneconomic effects of vocational education, see Lawrence Hotchkiss and Linda Dorsten, "Effects of Tracking on Post-High School Outcomes," *Sociology of Education and Socialization*, vol. 6, Ronald Corwin (ed. ) (Greenwich, CT: JAI Press, 1987), pp. 191-219.

50. National Governors' Association, "Draft Policy Statement on Vocational Education," unpublished manuscript, 1988.

51. This development work is being conducted through a consortium of State agencies called the Center for Occupational Research and Development (CORD), in Waco, TX.

e 4-1  
 Integration of Vocational Education Curricula



<sup>a</sup> Center for Occupational Research and Development (CORD) consortium  
<sup>b</sup> Southern Regional Education Board (SREB) consortium  
 SOURCE: OTA telephone survey, January 1989.

Many analyses point to a long-term shift toward higher-skill jobs.<sup>52</sup> It is important to note that while the rate of growth in jobs that require more advanced skills is quite high, the majority of the total number of jobs will continue to require relatively low skills. Compared coworkers who have good academic skills, workers who are deficient in basic skills will experience longer durations of unemployment and will have greater difficulty finding new jobs at their previous wage levels.<sup>53</sup>

Another factor contributing to the demand for a better educated work force is the restructuring of jobs. Many jobs that were once quite simple have become more complex.<sup>54</sup> In the insurance industry, for example, a single claims adjuster now does the work of five. The computer has eliminated many jobs, and the customer assistance clerk, claims adjuster, file clerk, messenger, and policy writer have been collapsed into a single position that demands advanced levels of communication and thought. The adjuster must be able to analyze a customer's needs and interpret and use the multiple arrays of information now available through computerized databases. Insurance companies that formerly hired high school dropouts or graduates to fill the jobs of messenger and file clerk now hire individuals with at least 2 years of college.

As technology has changed, so has the management philosophy of some organizations. For example, team work has become one strategy to handle greater

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52. See, for example, Sue E. Berryman, "The Economy and American High Schools: What Should We Teach? When? How? To Whom?" presented at the Tenth Annual Research Conference, Association for Public Policy Analysis and Management, Seattle, WA, Oct. 27-29, 1988.

53. M. Podgursky, "Job Displacement and Labor Market Adjustment: Evidence From the Displaced Worker Survey," prepared for National Academy of Sciences, Panel on Technology and Employment, 1987; P.O. Flaim and E. Sehgal, "Displaced Workers of 1979-83: How Well Have They Fared?" *Monthly Labor Review*, vol. 108, No. 6, pp. 3-16.

54. Thomas Bailey, National Center on Education and Employment, Teachers College, Columbia University, "Education and the Transformation of Markets and Technology in the Textile Industry," Technical Paper No. 2, 1988; Thomas Bailey and Thierry Noyelle, National Center on Education and Employment, Teachers College, Columbia University, "New Technology and Skill Formation: Issues and Hypotheses," Technical Paper No. 1, 1988; Thierry Noyelle, *Beyond Industrial Dualism* (Boulder, CO: Westview Press, 1987); and Thierry Noyelle, National Center on Education and Employment, Teachers College, Columbia University, "Services and the New Economy: Toward a New Labor Market segmentation," Occasional Paper No. 5, 1988.

workplace complexity; but team work requires skills in problem identification, conflict resolution, and project evaluation that many workers may need to acquire.<sup>55</sup>

For these reasons, many people advocate the inclusion of basic academic competencies in performance measurement. However, there are also many people who believe that the primary goal of vocational education should be mastery of occupational skills. Clearly there is some overlap. The problem is how to fine-tune the blend of job-specific and generic skills in a curriculum that may already be quite dense. While some educators and administrators believe that schools can accommodate both, there is also some evidence that too much emphasis on academic content could undermine the vocational curriculum and leave vocational students worse off than before.<sup>56</sup>

There are other reasons why OTA urges caution in the implementation of stringent academic requirements. First, many of the students enrolled in vocational education programs are there precisely because they were not successful in more academically-oriented classrooms. Adding more rigorous academic material to the vocational curriculum could frighten off the very students for whom vocational education is successful. Second, proponents of a more occupationally-oriented vocational curriculum point out that vocational graduates can support themselves through college thanks to the skills they acquired in high school. Since college-going is increasingly seen as an objective for many students who complete vocational programs in high school, it would be a mistake to weaken these students' technical occupational credentials. Third, there

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55. In fact, when management agrees to fundamental changes in the decisionmaking role of employees, productivity can improve even among a work force whose skill level was originally considered inadequate. See, for example, Murnane, op. cit., footnote 1, p. 218; Richard M. Cyert and David C. Mowery (eds.), *Technology and Employment: Innovation and Growth in the U.S. Economy* (Washington, DC: National Academy Press, 1987); and Berryman, op. cit., footnote 53.

56. See, for example, William Clune et al., Center for Policy Research in Education, Eagleton Institute of Politics, Rutgers University, "The **implementation** and Effects of High School Graduation Requirements: First Steps Toward Curricular Reform," unpublished manuscript, 1989. In an article in *Education Week* (Feb. 15, 1989, p. 5), Clune is quoted as saying that "... vocational courses were the major casualty of the increased academic **coursetaking**.... We saw evidence that the new requirements made it difficult to complete logical, and even required, sequences of vocational courses."

are reasons to be skeptical about some projections of skill requirements, as well as about statistical correlations between performance on tests of cognitive ability and job performance.<sup>57</sup>

## HIGHER-ORDER THINKING

Many educators have come to believe that knowing how to learn has become as important as what is learned.<sup>58</sup> As one researcher has argued: "We are moving into an era in which the traditional separation between working and learning is disappearing, with learning becoming increasingly integrated into a person's work life." Our aim, claims another researcher, should be to develop "expert novices" who, ". . . although they may not possess sufficient background knowledge in a new field, know how to go about gaining that knowledge."<sup>59</sup> The term most commonly associated with reasoning and problem solving is "higher-order thinking skill." This is an abstract term, difficult to define and even more difficult to observe.<sup>60</sup> But it is relevant to performance

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57. For a more thorough treatment of these issues see **Murnane**, op. cit., footnote 1, pp. 219-225. **Murnane** points out that while certain cognitive skills are important for all students, it is not entirely clear how high their skill levels must be: ". . . the best available information indicates that enhancing productivity growth will require that all students be provided with threshold levels of literacy and problem-solving skills, as measured on paper-and-pencil tests. Extremely high scores on the types of standardized tests typically used in schools to measure cognitive skills may not be necessary for productive performance in the labor force." (p. 224)

58. This attitude, too, is controversial. See **E.D. Hirsch**, "The Primal Scene of Education," *New York Review of Books*, Mar. 2, 1989, pp. 29-34.

59. See **Noyelle**, *Beyond Industrial Dualism*, op. cit., footnote 55; **Robert Glaser**, "Teaching Expert Novices," *Educational Researcher* (Washington, DC: American Educational Research Association, December 1987); and **Berryman**, op. cit., footnote 53, who lists the following components of knowing how to learn: ". . . knowing how to identify the limits of one's own knowledge, how to ask germane questions, how to penetrate poor documentation, and how to identify sources of information."

60. One researcher suggests that higher-order cognitive skills are those that involve the orchestration and practical use of the simpler skills — like computation in school arithmetic. See **Susan F. Chipman**, *What is Meant by "Higher-Order Cognitive Skills"* (Arlington, VA: Office of Naval Research, 1987).

Another definition uses the following characterizations of higher-order thinking: **nonalgorithmic**, meaning that the path of action is not fully specified in advance; **complex**, meaning that the total path is not mentally "visible" from any single vantage

measurement in vocational education because of the interest in moving beyond simple measures of short-run job placement and toward providing students with “. . . a job with a future — a job that provides personal growth, the chance to master new skills, and the opportunity to earn promotions.”<sup>61</sup> To the extent that these higher skills can be diagnosed and measured, they could become elements in a comprehensive system of performance measurement. At present, however, testing methods have not reached that level of sophistication, which suggests that the Federal role should be restricted to support for basic research.<sup>62</sup>

## EDUCATIONAL ATTAINMENT

Apart from what students learn in school, how far they go in school has important consequences of its own.<sup>63</sup> Finishing high school has significant advantages: between 1961 and 1981, the average earnings of full-time working men (aged 25 to 64) with 1 to 3 years of high school fell from 87 to 75 percent of the average earnings of a comparable group with 4 years of high school. Thus, it is understandable why reducing the high school dropout rate is frequently mentioned as an important objective of vocational

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point; often yielding multiple solutions, each with costs and benefits, rather than unique solutions; involving nuanced judgment and interpretation; requiring the application of multiple, sometimes conflicting, criteria; involving uncertainty — not everything bearing on the task is known; involving self-regulation of the thinking process, not regulation by others; involving imposing meaning, finding structure in apparent disorder; and being effortful.” See Lauren Resnick, *Education and Learning to Think* (Washington, DC: National Academy Press, 1987), p. 3.

The limited current base of knowledge about higher-order cognition is discussed in a recent OTA Technical Memorandum on elementary and secondary schooling for future scientists and engineers. See U.S. Congress, Office of Technology Assessment, *Elementary and Secondary Education for Science and Engineering*, OTA-TM-SET-41 (Washington, DC: U.S. Government Printing Office, December 1988), pp. 77-81.

61. The William T. Grant Commission on Work, Family and Citizenship, *The Forgotten Half: Pathways to Success for America's Youth and Young Families* (Washington, DC: 1988).

62. Four States are already either planning or implementing the assessment of higher-order thinking and problem-solving skills.

63. This discussion draws on Stern, *op. cit.*, footnote 5, pp. 10-12.

education. Indeed, the fact that so many students elect to take vocational courses in high school means that some students would have less reason to come to school if those courses were not available. While statistical studies of the effect of vocational coursework on dropout rates have been ambiguous, continued research in this area could be fruitful--and might yield new quantitative measures of program performance. Similarly, the propensity for vocational students to attend college — again, independently of their long-run labor market outcomes — warrants further study.



The Need for Basic Skills Mounting Pressure<sup>64</sup>

Future jobs will be restructured about every seven years and work and learning will be inseparable.

-David Kearns, Chief  
Executive Officer of  
Xerox Corp.

More than half of all new jobs created between 1984 — 2000 will require some education beyond high school, and almost a third will be filled by college graduates. Today, only 22 percent of all occupations require a college degree.

-Bureau of Labor  
Statistics, U.S.  
Department of Labor

The pace of technology development now is so great that life cycles for electronics products and processes already have collapsed to three to five years, and rarely will exceed five to ten years in most other industries. As a result, any set of skills also can be obsolescent in five to ten years. Continuous re-skilling must be a top national priority.

-U.S. Department of  
Commerce

Tektronix, an Oregon based manufacturer of electronic equipment, tried to shift its traditional assembly line workforce to a flexible manufacturing system four years ago. The company discovered that 20 percent of its production workers lacked rudimentary skills needed for the transition. Tektronix is solving its problem by contracting with nearby Portland Community College to run a remedial on-site program in basic math and English for its many non-English speaking assemblers. Along the way, Tektronix added courses to enhance such skills as team building, negotiating, and effective time management.

-Fortune Magazine,  
Apr. 11, 1988

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64. The following text is quoted from U.S. Department of Education, 'U.S. Department of Commerce, and U.S. Department of Labor, *Building a Quality Workforce* (Washington, DC: U.S. Department of Labor, July 1988).

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Research done at Indiana University has found that some 70 percent of the reading material in a cross section of jobs nationally is now between 9th grade and 12th grade difficulty (some 15 percent is even higher) — and it is likely that the job and social requirements for literacy will increase even more in the years ahead.

-Business Council for  
Effective Literacy  
Newsletter, April 1988

Experts both in and out of government agree that the competitive global marketplace, increased domestic competition due to deregulation, the pace of technology development, shorter product life cycles, and new flexible production processes all require more adaptable, more highly educated entry workers in order for our country to remain competitive.

-Building a Quality  
Workforce, U.S.  
Department of  
Education, U.S.  
Department of  
Commerce, and U.S.  
Department of Labor,  
1988

## Box 6

### Academic Material in the Vocational Curriculum: State Efforts

The Southern Regional Education Board (SREB) is a consortium of 13 States working toward introducing academic mathematics and science material into the vocational education curriculum.<sup>65</sup> The stated purpose of SREB's to:

"... advance, apply, and evaluate approaches that will strengthen the development of the basic competencies — communication, science, mathematics, critical thinking, and problem solving — of students enrolled in vocational programs."<sup>66</sup>

Educators at 33 sites in consortium States are implementing a variety of strategies including:

- having vocational students take higher-level communications, mathematics, and science courses;
- increasing the amount of emphasis and instructional time in vocational courses

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65. The participating States are: Alabama, Arkansas, Florida, Georgia, Kentucky, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, and West Virginia.

66. James E. Bottoms, "The Relationship Between Vocational and Academic Education," prepared for Policy Studies Associates, Inc., Washington, DC, November 1988.

(continued)

devoted to basic competencies that underlie the occupational field of study;

- providing remediation to students in need;
- providing staff development to vocational teachers on how to incorporate instruction in basic academic subjects.

An evaluation plan draws information from multiple indicators of program effects, including results from the National Assessment of Educational Progress (NAEP) tests in mathematics, science, and reading; transcript analysis; student opinions; completer and employer follow up information; and classroom observations designed to measure the emphasis being placed on academic competencies. Correlations will be conducted to determine the relationships among vocational education experience (e.g., curriculum, instruction, counseling), NAEP scores, and students' post-high school employment. Student test scores will be compared both with other students of similar background (e.g., sex, race, type of vocational program, parent education), and also with the national NAEP sample. An added feature is that this system provides the ability to analyze changes over time. NAEP was administered to a group of students in May 1988 and analysis of the results is under way.

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Preliminary analyses conducted by the Ohio State University and reported in an memorandum to SREB members, reveal that:

. . . completing a general mathematics course added about three points to a student% NAEP mathematics score. On the other hand, completing a pre-algebra course resulted in a 9-point increase; Algebra 1, a 12-point increase; and geometry, a 14 point increase. Further, the average NAEP mathematics score for students who said that their vocational teachers often stressed mathematics was 9 points higher than the average score of students who said that their vocational teachers seldom or never stressed mathematics.

The NAEP results also provide some insight for improving the science achievement of vocational completers. For example, students in pilot sites that provided vocational completers with lab-based science courses scored approximately 20 points higher than those students from pilot sites where science courses were predominantly textbook — and information — centered.

The director of SREB recommends that NAEP be used nationwide to assess the academic competence of vocational students. However, he does not see the need to use the results of NAEP to determine funding at the Federal level, since he believes that the impact of publicizing the test results at the State and local levels will provide the needed incentives for improvement.

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67. James E. Bottoms, memorandum to State and Local Pilot Site Coordinators of the Southern Regional Education Board, Jan. 10, 1989.