Case Studies: Three Vendors of Tests for Occupational Competencies

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Another perspective on the capacity for testing and assessment in vocational education is provided by describing three main vendors who supply states and local programs with resources for occupational testing. The vendors represent the mainstream of current practices in vocational education and one direction of future development—generic workplace skills.

The case studies include:

- the Work Keys System being developed by American College Testing (ACT);
- the Vocational-Technical Education Consortium of the States (V-TECS), which supports a system of test item banks for competency-based testing and assessment; and
- the Student Occupational Competency Achievement Testing (SOCAT) program of the National Occupational Competency Testing Institute (NOCTI).

The first assessment program is just now being developed and implemented. The latter two programs have been in operation for nearly 20 years.

WORK KEYS[1]

Origin of ACT and Work Keys

Work Keys is a system being developed by ACT for teaching and testing general workplace competencies and employability skills. The system is well along in development. When fully

[1] Joel West, Joy McClarity, Kate Ulmer Sottong, and Barry Mason, American College Testing, OTA interview, Jan. 28, 1993.

operational, as expected in early 1994, Work Keys will include the following four interrelated components for each of eight skill areas: 1) tests suitable for large-scale, high-stakes testing situations; 2) a job profiling component for analyzing the skill levels required in eight areas in real-life jobs; 3) instructional materials related to the skills assessed; and 4) a reporting service. Portions of all the components are available now.

Work Keys represents a broadening of mission for ACT, an independent, not-for-profit organization founded in 1959, which provides programs and services in the areas of college admissions, career and educational planning, financial aid, continuing education, professional certification, and licensure. ACT is best known for its testing program for college entrance. More than a million high school students take the ACT tests each year; college admissions officers use the scores in making admissions and placement decisions. In 1991, ACT decided to expand its services to encompass students bound directly for the workforce.

The Work Keys System

The broad goal of the Work Keys system, according to ACT, is to help strengthen the workplace skill competencies of all individuals who are bound for work or are already in jobs—not just vocational students. ACT hopes that schools will use Work Keys to help students see the connection between the skills acquired in school and those needed on the job.

The current design for Work Keys focuses on 12 different skills, each of which will eventually have its own separate test.[2] ACT identified these skills by surveying the literature on workplace skills and consulting with employers, teachers, and employment and training experts; the aim was to identify skills that are both measurable and teachable and that are viewed as important by employers and educators. When fully operational, Work Keys will enable test takers to evaluate their skills in a general way or compare their skill levels with those required by employers for specific jobs.

The four linked components of Work Keys can be summarized as follows:[3]

1. *Testing Component.* This will include at least 12 workplace skills tests or assessments that will be criterion-referenced and require written or other kinds of responses. The instruments will measure the level of competency demonstrated by the individual, or "how much" of the workplace skill they can demonstrate. The tests will be administered in a variety of formats such as multiple choice, constructed response, and computer adaptive. Necessary materials will range from paper and pencil to audiotapes and videotapes.
2. *Job-Profiling Component.* This component will enable a company to profile the competency or skill levels required for an employee to perform selected jobs successfully. The job profiling system was released in the fall of 1993.
3. *Instructional Support Component.* Instructional materials and accompanying reference guides will help learners and their teachers take steps to improve and broaden learner skills, so that people can obtain the jobs they want.
4. *Reporting and Recording Component.* A comprehensive recording and reporting service will provide informative reports on assessment results to students, teachers, and employers. For example, teachers may use the service to see how many of their students have strong workplace skills or evaluate instructional programs. Educators

[2] Although ACT plans to develop Work Keys tests for 12 skills, this number may change during the development process.

[3] The whole system is being implemented in phases and is currently operational for the initial skill areas; additional programs, services, and skill areas will be added over time.

and employers will be interested in comparing the test results to job profiles.

Purchasers will be able to buy and use any combination of the four components, although ACT will encourage users to view the system as a whole and to use all the parts for which they have a need.

The Work Keys Assessments

All of the Work Keys assessments aim to measure ''work-related basic skills, ' with an emphasis on workplace applications of skills rather than academic applications. In addition, all of the assessments are criterion-referenced (not norm-referenced), meaning that an examinee is evaluated on his or her performance relative to the content and level of the test items and not the performance of other test takers.

Each test will include questions across a range of levels of difficulty, from four to six depending on the assessment. For each assessment, the range of levels reflects the skills required from the lowest level likely to be assessed to just below the level at which specialized training would be required. The levels are hierarchical. For example, an examinee who scores at the fourth level on the Applied Mathematics assessment should also be able to perform well on exercises at all levels below, but not levels above. Because the tests are criterion-referenced, a specific level on one assessment does not correspond to the same level on another assessment.

Six tests were released in September of 1993:

1. *Reading for Information. This* ". . . measures the examinee's ability to read and understand work-related instructions and policies. Reading selections and questions based on the actual demands of the workplace appear in the form of memos, bulletins, notices, letters, policy manuals, and governmental regulations. ' Questions on the test fall across five levels of difficulty, arranged from easiest to the most difficult, and are followed by multiple-choice questions.
2. *Listening and Writing.* This assessment measures listening and writing skills together, simulating how they are often used in the workplace. The examinee listens to audio-messages on tape, takes notes, and composes a written message. The written messages are scored in two different ways: a listening score measures accuracy and completeness of information, and a writing score addresses grammar.
3. *Applied Mathematics.* This measures the test taker's skill in setting up and solving work problems using ''mathematical reasoning skills. ' Examinees are allowed to use calculators, just as in the workplace.
4. *Applied Technology. This* paper-and-pencil, multiple-choice test measures an individual's skill in solving technological problems, covering the basic principles of mechanics, electricity, fluid dynamics, and thermodynamics as they apply to machines and equipment found in the workplace. The test emphasizes skills in identifying and analyzing relevant parts of problems, evaluating potential solutions, selecting materials and solutions, and applying methods to novel challenges and circumstances.
5. *Teamwork.* This test measures an examinee's ability to ''. . . choose behaviors and/or actions that simultaneously support team interrelationships and lead toward accomplishment of work tasks. Test takers will watch a videotape of teams of workers performing tasks and will be asked multiple-choice questions about the teamwork scenarios.
6. *Locating Information.* This multiple-choice test will measure the ability to use graphic documents to insert, locate, compare, and summarize information. The types of graphics used on the test include diagrams, blueprints, floor plans, tables, forms, graphs, and instrument gauges.

ACT plans to complete at least five additional tests in the next several years. One, *Observations,* is scheduled for release in September 1994. The others are currently in the design and early development phases.

- *Speaking.* This test will measure whether a person can convey a spoken message clearly.
- *Observation.* This test will measure a person's ''watching skills' '--the ability to learn from demonstrations.
- *Motivation.* This test will measure dependability and responsibility, and will focus on work habits that can be taught (rather than attributes of personality).
- *Learning.* This test will measure a person's skill at adjusting to changes in a job situation, such as those resulting from a new job or new technology.
- *Managing Resources. This* test will measure a person's skill in scheduling, budgeting, and allocating resources.

The Assessment Development Process

ACT is undertaking several steps to ensure that Work Keys will be responsive to the needs of employers and educators and that the assessments developed will be reliable, valid, and fair. Early in the development process, ACT created a consortium of six "charter states' with a demonstrated interest in new vocational assessments to give advice and help pilot the system.[4] No state is obliged, however, to use the Work Keys assessments once completed. Each charter state also has a Work Keys advisory panel, composed of two-thirds business and industry representatives and one-third educators. The advisory panels help ACT with the conception and development of Work Keys components, with prototype testing and pretesting, and with marketing the system. In addition, the panels are expected to help facilitate the use of the Work Keys assessments in their own states.

ACT follows a typical process of objective test development to ensure that test items and assessments meet high professional standards of reliability, content validity, and fairness. First, ''constructs, ' or definitions, are identified and developed for each skill, with the help of two representatives from each charter state. Once constructs are developed, ACT attempts to define and describe a hierarchy of content levels for each skill to provide a set of criteria for test construction.

The second step is to draft items that correspond to each level of difficulty; ACT hires item writers to help with this process. All items must be written to the specifications developed by ACT and the advisory panels, and all items are edited by ACT staff.

The third phase is "prototype testing. ' In prototype testing, the draft items are administered to small samples of students and employees. ACT determines whether the draft items appear to correspond with the expected level of difficulty and satisfy the content criteria. Based on the findings, ACT rewrites and redevelops items for each level of difficulty.

Fourth, a large number of items are written, edited, and reviewed by experts for content validity and fairness. These items are pretested on a large sample of individuals. For the multiple-choice Work Keys tests, this sample consists of over 1,600 student and employee volunteers. 'The pretest results are analyzed for consistency and reliability. High-quality items meeting all content and statistical criteria are selected to produce the final tests.

Test Administration and Reporting

The Work Keys tests are designed to be administered by teachers or guidance counselors, in accordance with procedures proscribed by ACT. Currently, all tests completed by students

[4] The six charter states are Wisconsin, Tennessee, Michigan, Iowa, Oregon, and Ohio.

are returned to ACT for scoring; local onsite scoring will be available in the future.

For each test purchased, five different types of reports will be generated by ACT and sent back to the client.

- *Chat-r Essay Report. This* report provides some general descriptive information about how various groups of examinees scored on each test. It is organized around a standard set of questions such as: ''Do the scores of males and females differ on the Reading for Information test?' For each question, a page of the report provides information about the percentages of examinees achieving different score levels in both bar and table form. The report is produced for each test administered.
- *Individual Reports.* Each of the examinees will receive a multipart report describing his or her performance on each test with suggestions of learning activities that might be undertaken to improve skills. The first part gives the examinee's scores on the assessment, a few tasks illustrating the levels of performance associated with the scores, and suggested learning activities. The second part contains the examinee's scores along with demographic and other information provided by the examinee during the testing process. The third part summarizes the information in a form suitable for attachment to job or school admission applications. The information in the report is designed to be used for course planning, career guidance, and individual goal setting.
- *Roster Report.* One copy of this report, which lists the name and four lines of information on each examinee, will be provided for each client order. The information will include assessment scores and demographic and job-related information (e.g., job-seeking and career choice information).
- *Vocational Information Reports.* This report is designed to be used in determining the career goals of a group of examinees and whether those goals match the occupational opportunities in a given region or city. It shows the percentages of examinees holding and expressing interest in particular jobs selected from a given list.
- *Local Items Report.* Clients may also include locally generated items in the Work Keys system. These questions are primarily intended to obtain information about an examinee's instructional experiences (e.g., in using calculators). This report tabulates the responses of examinees to those questions.

ACT is considering offering electronic resumes for interested individuals who take the Work Keys assessments. This resume would contain cumulative information on an individual's skill levels over time, and would be made available to prospective employers at the individual's request.

Job Profiling

The job profiling component of Work Keys will enable employers to identify the nature and level of work-related basic skills required for jobs in their companies. By following the Work Keys procedure, an employer will be able to determine the level of each of the 12 Work Keys skills required for every job profiled, Analysts trained and certified by ACT will conduct the job profiling. The profiling procedure is being developed in a joint effort with a number of companies.

Individuals who participate in Work Keys will also be able to develop their own skill profiles based on their assessment score reports. A student could then compare his or her personal profile to the job profile for their desired occupation. Both learners and employers will be able to see the extent to which an individual has the skills needed to qualify for a particular job. ACT is developing a database of job profiles (without employer identification) that can provide employers and educators with a general picture of skill requirements for different occupations.

The instructional component will consist of materials describing the Work Keys skills in greater detail and illustrating workplace applications of those skills. ACT may also offer workshops for educators and employees to discuss strategies for building the skills needed in the workplace.

Implementation of Work Keys

ACT began marketing the Work Keys system in early 1993. A number of states have decided to use or are considering use of the Work Keys system in various ways. Several states intend to use Work Keys for measuring ‘ ‘basic or more advanced academic skills” as required in the Perkins Act. Others may administer it as a pretest at the beginning of 11th grade and a post-test at the end of 12th grade to assess student gains in workplace skills. Still others may use Work Keys as a program completion examination at the end of grade 14, after the final years of an integrated secondary-postsecondary ‘‘tech-prep’ program.

VOCATIONAL-TECHNICAL EDUCATION CONSORTIUM OF THE STATES[5]

Origin and Purpose of V-TECS

V-TECS is a consortium of 23 states with the goal of promoting competency-based vocational-technical education. Since its inception in 1973, V-TECS has been a unit within the Southern Association of Colleges and Schools, the main accrediting agency in the South. Full membership in V-TECS is limited to state agencies responsible for administering the Perkins Act programs. Member agencies provide proportional support for V-TECS administrative and product development costs. Associate membership is open to . . the military services, federal, state and local governmental agencies, international entities, and other organizations. . .’ with demonstrated interest in performance-based education.[6]

V-TECS aims to accomplish its goal of promoting competency-based education through cooperative research and development (R&D) efforts in four main areas: 1) analyzing jobs; 2) organizing job-related information; 3) developing components for assessing student achievement; and 4) designing, developing, and/or acquiring instructional materials that link teaching with the skills required for jobs.

These four efforts are interrelated, with the first effort, occupational analysis, providing the foundation for the other three. The founders of V-TECS felt that the improvement of curricula for vocational-technical education should begin with occupational analysis—ascertaining the specific tasks and duties performed by workers in certain jobs and building a curriculum around them. The task of developing the occupational analysis was divided among participating states, with each state taking responsibility for certain occupations and sharing their findings with other members.

Assessment did not become a major focus of V-TECS until 1986, when banks of test items for states or other V-TECS members to use in constructing their own competency-based tests were developed to respond to the growing interest in better assessment and credentialing for vocational students.[7] As with curriculum, V-TEJCS members felt that assessment should be based on what students would be required to do in the occupations for which they were trained. Thus, every test item selected for the banks is tied to a specific task or duty in a specific job area.

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[5] Information in this case study is based on Brenda Hattaway, assistant director, V-TECS, OTA interview, Jan. 12, 1993.

[6] The technical training commands of the Army, Air Force, Navy, and Marine Corps are associate members and support V-TECS through such means as sharing task lists with member states. Other federal agencies, such as the Bureau of Prisons and the International Labor Affairs Division of the U.S. Department of Labor, are associate members.

[7] According to Hattaway (op. cit., footnote 5), the main purpose of the tests has been to improve instruction.

Paralleling its four R&D efforts, V-TECS offers four main products and services:

1. *Analytical Tools.* First developed in 1973, these are called "catalogs" and exist for over 200 job areas.[8] For each job area, the catalog consists of lists of the duties and tasks involved, along with the tools, equipment, and work aids needed to perform them, Finally, for each of the duties and tasks there is a list of performance objectives and the steps that the worker must take in performing them.[9]
2. *Instructional Tools. These,* too, are organized by job area. For each job area, they include instructional worksheets, lists of instructional resources and activities, lists of enabling competencies, and lists of related academic skills. Development of instructional tools began in 1984, and they now exist for 66 job areas.
3. *Assessment Tools.* V-TECS has also developed or acquired banks of test items. Each of the test items is criterion-referenced to a specific duty and task. A test item bank is available for 35 of V-TECSs job areas. The banks include both written (matching or multiple-choice) and performance-based items.
4. *V-TECS DIRECT.* This is a software package designed for storing and retrieving the V-TECS materials that make up the other three components. As of fall 1992, catalogs and instructional tools for about 70 occupations were available on disk. All test item banks have been available on disk from their initial release.

Development Process for V-TECS Catalogs and Instructional Tools

V-TECS follows a multistage process in developing all of its catalogs and instructional tools. First, the consortium determines the priorities for job analyses,[10] new product development, and revisions by collecting statistical information from such sources as the U.S. Department of Labor and surveying the needs of member states.

Second, V-TECS identifies competency-based curriculum materials and other materials for each job area that it plans to analyze. These materials help V-TECS develop task lists and lists of tools, equipment, and work aids. V-TECS refines the lists by identifying a target population of workers in the particular occupational domain being analyzed. A sample of this population is interviewed and observed. The tasks are then organized under duty statements.

The task and duty lists and the tools, equipment, and work aids lists are then sent to a larger sample of the target population in survey form. Surveyed workers are asked whether they perform the tasks listed on the V-TECS lists and whether they use the tools, equipment, and aids listed, V-TECS analyzes the survey data to determine the percentage of incumbent workers that performs each task and uses the various tools, equipment, and work aids. Based on these percentages, final lists are developed.

V-TECS has recently taken steps to improve the development of task lists, so that they will be truly national in scope. In prior years the lists were validated by surveying people in only a few states. However, V-TECS has expanded its surveys to include industry people in many states.

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[8] V-TECS estimates that its catalogs cover at least 90 percent of the vocational education program areas that exist in the nation.

[9] According to the *V-TECS Technical Reference Handbook:* "... each 'task' is a statement of measurable behavior which describes a meaningful unit of work having a definite beginning and ending point. A 'duty' is a broad descriptor under which similar tasks are organ ized. ' The performance objectives consist of a list or description of the conditions under which a task is performed, a description of the task to be performed, and a performance standard. This standard is "... an observable or measurable standard of performance deemed appropriate for successful completion of the task by incumbent workers.

[10] A job area may include one or more Dictionary of Occupational Title (DOT) job classifications.

Third, V-TECS selects a group of workers to serve on a writing team; the team is responsible for specifying performance standards and identifying the steps involved in performing each individual task in a duty area. Following this phase, subject matter experts are asked to identify the cognitive knowledge, psychomotor skills, and work-related behaviors that are critical to the performance of each of the tasks. The "enabling competencies" and "related academic skills' that eventually appear in the instructional tools are derived from these knowledge, skills, and behaviors.

The V-TECS Item Banks

All test items in the V-TECS banks are developed by member states in accordance with a standard V-TECS development model. Eleven states have contributed to the development of test item banks so far, with the V-TECS central office monitoring quality. If a member state wishes to have its own state-developed test item bank labeled as a V-TECS item bank, it must document that it has gone through the standard V-TECS development process. V-TECS staff also review and edit the state-developed test item banks, on occasion sending them back to the states for further editing. [11]

The V-TECS process for developing test items includes several steps:

. *Validating Task Lists, Performance Objectives, and Performance Steps. The* first step in developing test item banks is to review the continued validity of the task lists, performance standards, and performance steps contained in the catalog of the job area for which the test is to be developed. This is accomplished by having five to eight workers from different-sized companies and employers who are experts in the job area review the lists and make minor changes as they see appropriate.

- *Writing Test Items.* V-TECS selects a [earn of test item writers. The team must include instructors with recent work experience, the state technical coordinator or project director, workers from the domain area, and a V-TECS central office representative, when available. After receiving special training, the writing teams develop both written and performance items by reviewing the completed task analyses and using V-TECS guidelines to ensure that test items match the tasks.
- *Reviewing and Editing Test Items. The* test items are reviewed by four groups of experts and revised if necessary. The four groups include the writing team, test item construction experts, subject matter experts, and a sample of workers. V-TECS central office staff review the test items to make sure they match the duties and tasks of each of the occupations and to make sure they are formatted correctly. V-TECS staff then edit the test items and compile the test item blink.
- *Field Testing of Item Bank.* All test items are field tested in schools to check whether the items are clear, reliable, and free of sexual or racial bias and whether the directions are clear. Test administrators are asked to provide feedback on any difficulties encountered during the field test. Item response data from field testing are scored and analyzed for item difficulty, item discrimination, and distracter response. [12] These three forms of analysis help ensure that test items discrimi-

[11] States also have the option of sharing their state. developed item banks without having them labeled as V-TECS item banks. In this case, V-TECS will help make the banks available to other states, clarifying that these materials may not have been developed according to the standard V-TECS process.

[12] Multlp]e-choice questions are typically constructed to include three distractor responses, which are plausible alternatives to the correct answer. There is (rely one correct response. Test takers' responses to these distractors are analyzed in the course of test construction to check on the qua] ity of the questions and answers provided.

nate between examinees who have received instruction in the area being tested and examinees who have received no such instruction.

- *Editing and Completing Final Item Bank.* The item bank is revised based on the field test results.

This process of ongoing, multistage review by workers, V-TECS staff, and other experts helps to ensure the content validity of the items—that they are tied directly to real occupational tasks and duties.

As mentioned above, the banks include both written and performance items. The written tests measure knowledge and skills, with the emphasis on knowledge. There are two categories of written items: those that measure the examinee's ability to recall information, and those that test the examinees's ability to analyze information. V-TECS supplies the correct answer for the written items.

The performance items also measure both knowledge and skills but emphasize skills. Some items focus on the process the student uses, others focus on the product that results from the performance, and some measure both process and product.

Each performance item comes with a description of the task that the student must perform. An evaluator observes student performance using the checklist, checking off actions that the examinee completes successfully.

V-TECS does not supply explicit guidelines on what a successful completion of a task or piece of a task should be like. To understand what is expected of an examinee, the evaluators must refer to the ''performance objectives and standards' for each task; which are contained in the V-TECS Analytical Tools. Agencies administering the test can decide on a minimum level of performance required in order to 'pass. ' Scoring is thus performed by the user rather than a testing organization, as in the case of Work Keys.

Use and Availability of Test Item Banks

V-TECS test item banks are used by states for a variety of purposes, including evaluating schools and programs and certifying program or course completion for individual students. Private companies also use some of the V-TECS materials, but not as extensively as schools. Entities using a V-TECS item bank select a number of items from it for each competency to be assessed, and combine them into a test or assessment for use in classrooms.

V-TECS does not maintain records on the number of states, schools, or school districts using its materials, nor does the organization maintain information on which states are using test item banks to meet Perkins Act evaluation requirements. These types of records would be difficult to maintain because the materials are so easily shared.

The V-TECS materials are widely available. Members receive two copies of all V-TECS materials. Nonmember states can purchase the material at a higher cost. In fact, V-TECS materials, including the test item banks, can be purchased by any entity. The only form of marketing V-TECS does is through exhibiting their materials at national conferences. For example, they exhibit at the annual meetings of the American Vocational Association and at the American Society for Training and Development.

The V-TECS organization provides technical assistance to members and other users of its materials. Based on requests from people in member states, V-TECS conducts workshops on such topics as how to write and review items and how to interpret student performances and products. The organization also offers workshops on competency-based vocational education at the request of a state agency or a group of schools.

In addition, V-TECS sponsors periodic national conferences on competency-based assessment and performance standards for vocational technical education. At least once a year, V-TECS holds a workshop for its technical coordinators-

the state agency employees from member states who oversee development of V-TECS material in their state, promote V-TECS materials, and work with the state educators and business people.

The Future of V-TECS

V-TECS is considering whether it should offer a testing service that would actually construct tests for states. In addition, the organization is continuing its efforts to ''fill in the gaps' in its current titles. For example, in 1991 V-TECS began identifying related academic skills, a process that it plans to continue for all occupations. Another priority is developing test items for all job areas addressed in V-TECS materials.

NATIONAL OCCUPATIONAL COMPETENCY TESTING INSTITUTE[13]

Overview of NOCTI and the SOCAT Testing Program

NOCTI was created in the early 1970s as a national, not-for-profit educational corporation. All U.S. states and territories are members, although voting privileges are reserved for states that have purchased $100 of NOCTI goods and services during the past year. States are represented through a consortium of vocational education officials. These officials are appointed by state departments of education, state-approved teacher education institutions, and other agencies sanctioned by the NOCTI Board of Trustees. Member states play a role in developing and marketing tests.

The original mission of NOCTI was to develop examinations to assess the occupational competencies of vocational education teachers, an area where there was a paucity of assessment instruments. Today NOCTI is the nation's primary provider of vocational teacher competency exams, offering 60 specific Teacher Occupational Competency Testing (TOCT) examinations.

In the late 1970s, several trends converged to convince the NOCTI board that there was a need for competency tests for vocational students. First, many people felt that competency-based testing would help to improve vocational education and demonstrate its value to employers and the public. There was also emerging interest in developing national standards for vocational student certification.

Responding to these trends, NOCTI formed a consortium of states to develop a system of Student Occupational Competency Achievement Testing (SOCAT) examinations. Since 1978, NOCTI, working with its member states, has overseen the development of 71 SOCAT tests. Each test is tied to a specific occupation, including many of the same occupations covered by the teacher tests. Most of the occupations covered fall within one of the traditional vocational education program areas of business, agriculture, home economics, trade and industry, technical and communications, marketing and distribution, or health.

Using the same methodology, NOCTI also develops Industrial Occupational Competency Testing (IOCT) examinations for specific companies. Industries use the IOCT to conduct preemployment testing, identify in-house training needs, design specific training programs, certify skills, promote employees, and carry out other purposes. Other customers of NOCTI are the U.S. Job Corps and the military.

Somewhat over 50 percent of NOCTI's total revenues come from the IOCT tests for industry. Less than 15 percent of total revenues comes from the student tests (SOCATs), because NOCTI tries to keep the cost of SOCAT tests affordable for schools. The remaining 35 percent or so of revenues comes from the teacher tests and special projects.

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[13] The information in this case study is based on OTA interviews with Scott whitener, president/chief executive officer, NOCTI, and Evelyn Wells, assessment specialist, NOCTI, January and February 1993.

The SOCAT and TOCT Tests

SOCAT test items are based on core competencies considered to be critical for job readiness. These cornpetencies are derived from analysis of the specific tasks performed in a particular job for which the test is being developed. The content of the SOCAT and the TOCT are basically the same for the same job, except for the level of competency. The student tests measure the skills and knowledge expected of a‘ ‘job-ready’ entry-level worker, whereas the TOCT tests measure the skills and knowledge expected of an “experienced’ worker. The tests are designed to be used at both the secondary and postsecondary levels.

The SOCAT tests have two components, a written part and a performance part. Both parts are tied to the knowledge and competencies required of job-ready entry-level workers in a given occupation. NOCTI encourages states to use both the written and performance components, because it feels that the written test alone gives an incomplete picture of a student’s skills and knowledge. The written tests are multiple choice and are designed to assess whether a student understands and can apply the information needed to perform various tasks. The performance tests require a student to perform various tasks that an individual must be able to do to be considered job-ready. The instructions for doing the performance tests call for having evaluators/administrators from industry judge the quality of both the performance process and the resulting product.

NOCTI also supplies a third test of thinking ability, if requested by the schools. This Test of Cognitive Skills was developed by CTB/McGraw-Hill and is marketed by them. The test measures capabilities of analyzing patterns or sequences of letters, figures, and numbers; recognizing relationships and classifying objects and concepts according to common attributes; recalling previously presented information; and reasoning logically. The items on this test are not tied directly to the SOCAT tests, but are scored by NOCTI and reported back to users as part of the SOCAT score report.

A major difference from V-TECS is that the SOCAT tests are fixed and secure. V-TECS is an item bank. The SOCATs are fixed in that the items are preselected by NOCTI and are the same for all test takers. Clients return completed tests to NOCTI for scoring and do not receive any information about the correct answers. In this respect, the SOCATs are similar to standardized academic tests.

Test Development Process

The process for developing the TOCT and SOCAT tests begins with the analysis of occupational tasks. For each job or occupation addressed, NOCTI assembles a test development team. The team consists of secondary and postsecondary vocational educators from at least two states and industry representatives who are highly competent workers familiar with the tasks required in a given occupation. NOCTI selects some of the industry representatives; state educational agencies select the remaining industry representatives and all of the educators.

These teams then proceed to identify the specific tasks involved in performing the target job or occupation in question by following the DACUM (Developing a Curriculum) process or reviewing existing task lists and merging them into one. Generally, the DACUM method is used only when high-quality task lists do not already exist for an occupation. After prioritizing the tasks, the team members determine which items are best evaluated through a performance exam and which are best done through a written exam. The actual test items are then written either by the team members or subject matter specialists hired for the task.

Once written, the items are reviewed by NOCTI’s in-house testing experts. A bias review is conducted and reading experts ensure that the reading level of the exam matches the level required for the occupation in question. This is

accomplished by comparing the test items with actual written materials that workers use on the job.

The draft exam is then pilot- and field-tested in a two-stage process. Teachers or schools first volunteer to administer the test in a small number of schools; NOCTI monitors the administration to make sure the test is operationally sound and that time limits and other administrative features are appropriate. Then, the exam is field tested on a larger scale in at least two states. Through this testing, NOCTI seeks to learn whether the items are free of colloquialisms or regional biases, whether the test items actually match the skills required for the job, whether the time limits are appropriate, and whether the tasks are up to date. This process helps to ensure the validity of the test.

NOCTI also conducts an item analysis to determine which items are not good discriminators among the students—that is, are too easy or too hard for them to answer. Suspect items are reviewed by a subject matter or test expert and possibly revised. Once final refinements and revisions are made, the test is ready to be sold nationally.

SOCAT tests are reviewed annually by NOCTI. After each annual administration, NOCTI asks for feedback from industry representatives, teachers, and students involved in the testing. The feedback is cataloged, and if there is significant criticism of a test, NOCTI reinstitutes a committee of industry representatives and educators to review the test and determine whether revision is necessary.

The technical quality of the test is addressed at several points in the development process. Content validity is achieved by having real workers develop task lists and provide feedback on test content after they are administered. (NOCTI does not check for predictive validity, although the organization would like to do so if more resources were available.)

NOCTI calculates reliability statistics for the written tests using the Kuder-Richardson method for determining the internal consistency of test items. Furthermore, as explained in greater detail below, NOCTI has developed scoring guidelines for the evaluators/administrators of the performance tests.

Use of SOCAT Tests

SOCAT test services maybe purchased by any educational agency, including state agencies or individual schools. In 1992, the SOCAT test was administered to 9,015 secondary and postsecondary students in 24 states, with the number per state ranging from 1 in Delaware to 3,435 in Pennsylvania. It is estimated that about one-half of the states using SOCAT tests administer all three components: the written, performance, and cognitive skills tests.

This number of secondary and postsecondary students taking the SOCAT tests is not large in relation to the size of vocational education. In 1992, there were about 720,000 high school seniors who took four credits or more of vocational education in their high school careers and therefore can be considered to be "vocational students."[14]

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14 This estimate was obtained as follows. The number of high school seniors in the 199 I -92 school year was 2.4 million. It is reasonable to assume that the number of seniors was about the same in the 1992-93 school year, since the increase in overall high school enrollments between 1991-92 and 1992-93 was less than 2 percent. It is also reasonable to assume that 30 percent of these 1992 seniors were "vocational students. " This is the percentage of 1987 high school seniors who took four credits or more of vocational education courses by the time of graduation, and this has been a fairly stable number since the high school class of 1982. A reasonable estimate of the total number of high school seniors who might have taken vocational tests in the 1992-93 school year is therefore 720,000. U.S. Department of Education, Office of Educational Research and Improvement, National Center for Educational Statistics, *Digest of Education Statistics, /993* (Washington, DC: U.S. Government Printing Office, 1993), tables 2 and 44; and U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics, *Vocational Education in the United States, 1969-1990* (Washington, DC: U.S. Government Printing office, April 1992), table 13.

In some cases, the written SOCAT test is administered as a pretest, and the written and performance tests are used as post-tests to measure the occupational competency gains of students who exit a program, as specified in the Perkins Act. Although NOCTI has traditionally discouraged the use of the written test alone, in 1992 the organization began making the written test available for pretesting because of accelerated interest in using it to fulfill Perkins requirements. NOCTI believes that when the written test is used as a pretest and both the written and performance tests are used as post-tests, valuable information about competency gains can be generated.

In other states, students who do well on the SOCAT test receive special recognition certificates or credentials from the state. These awards are in addition to the SOCAT certificate, regularly provided by NOCTI for each test taker, which carries a printed report of the student's scores on the back. Both the state-issued certificate and the SOCAT certificate are intended for use in student portfolios for interviewing with prospective employers.

In other cases, successful completion of a job-ready SOCAT test may be used to receive advanced standing in college or university programs.

In order to use the SOCAT tests, teachers must ensure that they are teaching the skills and knowledge that the tests measure. Since SOCAT tests are secure, NOCTI regularly provides schools with support materials and test specimen sets to help facilitate test selection.[15]

Sometimes NOCTI helps states to determine whether there is a fit between the SOCAT tests and their state vocational curriculum. For example, NOCTI is currently comparing how the revised task lists developed by a specific state match the SOCAT tasks. In most cases, however, states are responsible for determining whether the tests are compatible with their vocational programs.

Administration of the SOCATs

Member states that use SOCAT tests receive test booklets, test manuals, and videotapes demonstrating the procedures for administering the written and performance examinations. Users can also contact NOCTI for additional technical assistance; NOCTI has a test center in every state with a knowledgeable staff person who can answer questions about the SOCAT tests. In the words of the NOCTI president: "When a school or a state administers the SOCAT tests, they have the whole organization behind them. '

The SOCAT tests are designed to be administered by local personnel at local school sites. Any teacher, guidance counselor, or test administrator can administer the written multiple-choice test and the cognitive skills test. However, as mentioned above, NOCTI recommends that a ''. . . journey worker, trades person. or business representative with technical expertise in the occupation should administer the performance test. '

After test administration, a school sends the test results back to NOCTI for machine-scoring. Within 2 weeks of receipt, NOCTI ships two types of reports to the user, individual student reports and teacher reports.

Each test taker receives a student report printed on the back of a certificate, which includes separate scores for the cognitive skills, written, and performance tests. Scores from the cognitive skills and written tests are presented as the percentage of questions answered correctly. Scores from the performance test are presented as the percentage of possible points earned. The student receives an overall percentage score and subscores for different duty areas or tasks. For example, the Electronic Technology written test contains subscores for "schematic symbols, ' ''safety, '' ''soldering, ' ''components, ' 'power

[15] In those situations where the SOCAT tests do not match what is being taught, the NOCTI president contends that the problem is with the curriculum, because SO CAT tests are built around the skills, knowledge, and competencies identified by industry as being necessary.

supplies, ' and other subjects. The student's written test scores are also compared, by percent, to the scores of other students in the same class, school, and state and with the whole nation.

For the performance tests, students receive ratings for both their performance on individual tasks and the product(s) they produce. The ratings span a scale of 1 through 5, with 1 and 2 unsatisfactory, and 3 through 5 satisfactory. The performance task report lists all of the tasks performed with a single number rating next to each task.

NOCTI has recently developed explicit guidelines and criteria that examiners can use to assign process and product ratings to the test takers' performances. For example, if the student is asked to clean a car assembly, NOCTI now supplies guidelines on how clean the rotor must be for the student to receive a certain score. These guidelines, which are intended to provide inter-rater reliability, are currently available for about one-half of the performance tests. For the remainder of the tests, the evaluator must use subjective judgment to rate student performance.

Teachers receive a class report consisting of a composite of the student reports analyzed by class, school, state, and the nation, along with standard deviations and standard error rates.

Future Priorities

NOCTI is currently developing SOCAT tests for additional occupational areas and plans to continue such expansion. One of the biggest challenges is keeping the existing tests up to date in view of the tremendous changes occurring in industry and in occupational skill requirements.

FINDINGS

The testing products of these three organizations are distinctly different from each other and represent the range of testing practices in vocational education reasonably well. Work Keys is the newest of the three systems and is at one end of the range. V-TECS and the SOCAT tests fit the mold of competency-based testing for job-specific skills, in that both written tests and performance exercises are included, and the skills assessed are job specific. Work Keys is focused on generic workplace skills and is similar to a conventional standardized academic test in the methods of test development that are being employed, the strict procedures of test administration that must be followed, and the closed-ended nature of most of the test items. The SOCAT tests fall in the middle of the range. Like Work Keys, each test consists of a fixed set of items and must be administered according to standardized procedures in order for the resulting test scores to be comparable among test takers. Unlike Work Keys, each test item is directly related to specific work tasks in a particular job area. Work Keys tests employ multiple items to measure one competence that is generally related to all job areas.

Both V-TECS and NOCTI utilize structured methods of job analysis to develop their competency-based materials. Work Keys employs a separate system of job profiling to ascertain the relevance of each general competence to a particular job or group of jobs. V-TECS is different from NOCTI's SOCATs and Work Keys in that it is more a system of resources for competency testing and assessment than a test. V-TECS provides state members of the consortium and local programs within those states with a number of so called "test item banks,' from which they construct their own tests reflecting their own local priorities, rather than providing them with tests that are secure and consist of a fixed set of items. Each test item bank is specific to a job area or occupation. Both the NOCTI and V-TECS products include both short answer, written test items, and some performance exercises; however, in both cases the written tests and the performance items are packaged separately and the written components generally predominate.

V-TECS, therefore, does not sell tests but rather models good practices of competency testing and makes testing resources available to

its 23 member states and local programs within those states for them to follow and use in constructing their own tests.

No firm conclusions can be drawn about the validity and reliability of decisions made at the state and local levels using the tests or testing resources produced by these three vendor organizations simply on the basis of the kinds of tests they produce or the methods of test development they follow. Work Keys will have the most data of the three vendors from pilot tests showing the reliability of their instruments. On the other hand, research reviews have found that competency tests of the kind produced by V-TECS and NOCTI are significant y correlated with scores on work sample and hands-on performance tests.[16] It is important to point out, however, that the skills measured by Work Keys are intended to be general across jobs, and the skills measured by V-TECS and the SOCATs are specific.

The extent to which the testing resources produced by these three vendor organizations are currently being used in vocational education differ substantially. The most concrete estimates are for the SOCAT tests, since they must be returned to NOCTI for scoring. The numbers of SOCAT test takers are not large. In fact, NOCTI reports that SOCATs were taken by 9,015 secondary and postsecondary students in 1992. In comparison, the number of high school seniors who were vocational students was about 720,000 in 1992.

The Work Keys system is much newer and no firm estimates of the number of test takers are available yet. At least two states have adopted parts of the Work Keys system, and more are considering the possibilities. Because Work Keys is so different from the SOCAT and V-TECS products in the skills tested and the methods of testing, the effects of Work Keys on testing in vocational education could be substantial, if a significant number of states decide to adopt it. The requirements of the 1990 amendments for performance standards are an important source of states' interest in purchasing Work Keys, as indicated in the interviews conducted by OTA in producing this chapter.

In the state survey conducted by OTA, described in chapter 3, state personnel frequently reported that substantial efforts are devoted to adapting, redeveloping, and/or expanding the competency lists and testing resources produced by V-TECS. The V-TECS materials are used in various ways in these efforts, along with competency lists and competency tests (or test items) from many other sources. The reason commonly given as to why these efforts to adapt and revise materials obtained from elsewhere are necessary is that neither the V-TECS materials nor the materials available from other sources adequately reflect the priorities among different areas of knowledge and skills that are most important in the state or local program area.

How much genuine need exists for this reinvention and adaptation of materials developed elsewhere and how much of it is unnecessary duplication of effort is impossible to say from the data available to OTA. Local priorities among different areas of knowledge and skill undoubtedly differ from state and national priorities, and processes of reinvention have frequently been found to be essential for the thorough implementation of innovations. "To understand is to invent' is perhaps the clearest way of expressing this frequent finding in studies of implementation.[17] On the other hand, questions can be raised

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16 Alexandra K. Wigdor and Bert F. Green, Jr. (eds.), *Performance Assessment for the Workplace*, vol. I (Washington, DC: National Academy Press, 199 I), ch. 8; and J.E. Hunter, "Causal Analysis, Cognitive Ability, Job Knowledge, Job Performance, and Supervisor Ratings," S. Lundy et al. (eds.), *Performance Measure and Theory* (Hillsdale, NJ: Lawrence Erlbaum, 1983); R.R. Reilly, "The Validity and Fairness of Alternatives to Cognitive Tests," *Policy Issues in Employment Testing* (Boston, MA: Kluwer Academic Publishers, 1993).

17 Paul Berman and Milbrey Wallin McLaughlin, *Federal Programs Supporting Educational Change, Vol. IV: The Findings in Review*, prepared for the U.S. Office of Education, Department of Health, Education, and Welfare, R- 1589/4-HEW (Santa Monica, CA. Rand Corp., April 1975).

about the consequences of this process of reinvention for the comparability of assessment results from place to place and just how necessary and useful it is.

The main conclusion, though, is that the influence of the products of these three vendors of vocational tests on testing and assessment practices in vocational education is limited, at least in relation to all states and all students enrolled in vocational education. V-TECS appears to have the greatest influence through its deliberate strategy of modeling good competency testing and assessment practices for states and local programs to follow, and providing them with competency lists and test item banks to be used as resources in developing their own programs of testing and assessment. However, only 23 states are members of the V-TECS consortium and test item banks are available for only 35 of the over 200 occupational areas in which competency lists are available. V-TECS sells its testing materials to any state or anyone who wishes to buy them. While NOCTI as an organization has many other clients and customers for its testing products, the number of students currently taking their SOCAT test is very limited. Work Keys is too new to know how extensive its impact will actually be, but at least two states (Ohio and Tennessee) have adopted portions of it for statewide use and many more are considering its use.

It is also important to point out that some individual states, such as Oklahoma, which has an extensive program of test development and distribution, also provide competency tests and resources for testing to other states in various ways. The three vendors described here are the most visible vendors of testing resources in vocational education but not necessarily the only such source.