Education and Work

Education Reform Issues

The Rationale for an Integrated System for Workforce Education Curricula

Center for Occupational Research and Development

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This document was prepared for the Integrated System for Workforce Education Curricula by Maurice Dutton, Ph.D.; Leslie Buchta; Margaret Leary; and Walter Edling, Ph.D.; Center for Occupational Research and Development. It represents an analysis of conditions that provided the driving force behind development of new approaches to curriculum development.

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Preface

Change became an increasingly prominent theme in our society as we progressed through the 1970s and 1980s, and in the 1990s it has come to dominate many of our thoughts and actions. Sociologists and futurists have described what has been and is happening in our society and have predicted the trends in such books as *Future Shock, The Third Wave, Powershift, The Aquarian Conspiracy, Megatrends, Megatrends 2000,* and *Reinventing the Corporation.*

All of the above writers deal in different ways with the forces bringing about changes not only in the United States but also in all of the world's "advanced," industrialized nations (North America, Europe, and the Pacific Rim nations). All of the writers deal with the changing values of societies, the changing basis of power and wealth within societies, and the changing nature and structure of organizations within societies.

The writers give special attention to the impact of technology (solid-state electronics, fiber optics, computers, miniaturization, and biotechnologies) and the globalization of world markets and economies. The impact of these two forces is causing major changes in the (1) nature and structure of work; (2) knowledge, skills, and levels of ability required in contemporary workforces; (3) values, expectations, and levels of commitment of employees; (4) availability of qualified employees; (5) leadership styles and organization structures of work organizations; and (6) importance of education, its content, availability, methodology, and structure in preparing all people for rewarding careers.

As we review these changes, it becomes apparent that many of them are occurring in the basic values and undergirding concepts of our societies and, thus, bringing about their transformation. Old, established values, organizational structures, and methodologies/systems are being replaced by new values, organizational structures, and methodologies/systems.

Some see these changes as threats to the economy and standard of living in the United States, while others see them as golden opportunities to expand and enhance our economy and standard of living. In fact, the more we try to hang on to the "good old days," the more we will experience a decline. To the degree to which we are able to capitalize on the changes, we will grow and prosper.

The Integrated System for Workforce Education Curricula (ISWEC) staff recognizes that the project is not only a part of, but also a positive response to, the changing conditions and needs of contemporary and future workforces. With this in mind, the research phase of the project has focused on those aspects of the changing workforce and the transformation of the education system that may provide insight into and guidance for

(1) the identification and grouping of appropriate career clusters for tomorrow's U.S. economy and (2) the design of a model for workforce education curriculum development that is adaptable to state and local needs and of potential benefit to all students.

The Rationale for an Integrated System for Workforce Education Curricula

I. The Changing Workplace

Rapid advances in technology and the globalization of markets are bringing about major changes in the nature and structure of jobs and work organizations. These, in turn, are bringing about changes in the knowledge, skills, and levels of ability required of workers in newly emerging, internationally competitive workforces.

In this section we will review (1) the rapid advances in technology and their uses by business and industry, (2) the globalization of markets and the emergence of internationally competitive workforces, (3) the emergence of high-performance companies, (4) the development of national and international skill standards, and (5) the occupational classification systems.

Rapid Advances in Technology

The years after World War II saw rapid increases in the adaptation of science (i.e., technology) to industrial and military uses. Air travel changed the time it took to bring people and products together and helped bring into being the "global village." Television added the ability to bring worldwide information and images into the living rooms of the general public.

These changes were followed by the rapid growth of high-speed computing. During the same period, the space race resulted in rapid developments in electronics and composite materials. These led to such advances as communication satellites and the miniaturization of products, which were further enhanced by the development of fiber-optic cables, fax machines, portable computers, and portable telephones. Now, corporate computer networks have been further linked through the Internet and World Wide Web. All these advances have radically increased the speed and volume of information that can be processed and instantly shared.

Advances in biotechnology have resulted in contributions in genetic engineering and DNA mapping, and the development of new drugs and general consumer products.

Technological advances have had a major impact on the way we work. For example, in high-performance companies, computers now control manufacturing processes and perform tasks previously done by humans. Thus, the manufacturing workforce has experienced a sharp and continuing decline as a percentage of the total workforce. From 50 percent, it has fallen to less than 20 percent, and is likely to fall below 10 percent.

All of the above have had major impacts on value systems, consumer choices, increases in product and service quality and timeliness, information availability, and the skills and abilities required to understand and use information and technical advances.

Globalization of Markets

Major advances in transportation and communication have led to the globalization of world markets and the recognition of the economic interdependency of nations and global regions.[1] This dependency and the free flow of information and technology across national boundaries have led to the lowering of tariffs (which protected local markets) between nations. They have also led to the formation of free-trade zones such as the European Economic Community (European Union) and the North American Free Trade Accord.[2] This trend continues to accelerate, as does the relocation of production. (Since high-production equipment and technology can move easily across national boundaries, many companies have moved their production facilities to third-world nations with labor forces qualified to operate production equipment, yet willing to work for less than their American counterpart.)

As international competition has increased, customers have begun to expect—and get—products and services of higher quality, in greater variety, more conveniently, and in a more timely manner than in the past. These, and price, have become the new measures of competitiveness.[3]

Companies successful in international competition have become sensitive to the needs and desires of their customers, have modified their production processes through total quality management approaches, and have set new requirements for frontline workers. These companies are being referred to as “high-performance” companies.

High-Performance Companies

High-performance companies have discovered that the old, hierarchical organization responds too slowly to the rapid changes required to remain competitive. As a result, they have largely done away with mid-management staff and have transferred their tasks and responsibilities to frontline workers. This has greatly changed the skills and capabilities required of the workers who must be able to understand and use technological applications, adapt rapidly to changing conditions, solve problems, communicate effectively, work in teams with different types of people, take personal responsibility for quality, and have adaptable technical skills.

Consequently, a revolutionary change in the training of such a workforce is needed.

Skill Standards

The development of state and national skill standards means that attention is being focused on the knowledge, skills, and levels of ability of the frontline workers of the new, high-performance companies. Basic employability skills that cut across all occupations and that are of a higher level than those needed in the past are being recognized (e.g. SCANS[4]). Similarities in related jobs, the advantage of employee "cross-training," and the need for employees to change jobs more frequently all point to the need to reorganize job-classification systems around skill-related occupational clusters.

In recent years, state vocational educators[5] and workforce retraining programs have increased their collaboration with business and industry representatives to identify performance outcomes for their training programs and to focus their program assessments on these outcomes.

The report, *America's Choice: High Skills or Low Wages!* pointed out the need for changing our educational system to better prepare students for the new workforce.[6] In defining the problem, the report said that the lack of a clear standard of achievement and the lack of motivated students were two barriers to producing the highly educated workforce needed. Students going to work straight after school lack motivation "to study hard because they see little or no relationship between how well they do in school and what kind of job they can get after school." This contrasts with students in other countries, who, by age sixteen or so, must meet stringent performance requirements that have a direct impact on their employment potential.

Based on these concerns, the report recommended that a national educational performance standard, equal to the highest in other countries, should be set and met by all students by age sixteen.

Federal legislation in the early 1990s reflected these concerns. The *Goals 2000: Educate America Act* established a National Skill Standards Board to encourage, promote, and help the development and adoption of a national system of voluntary occupational skill standards.[7] The Departments of Labor and Education funded twenty-two pilot projects to develop industry-based skill standards (see Appendix A). The *School-to-Work Opportunities Act of 1994* also provides for educational programs that lead to nationally recognized skill certificates (i.e., certificates of initial and advanced mastery).

According to Secretary of Labor, Robert B. Reich, a system of national, voluntary skill standards will provide the framework needed to ensure that workers have the portable skills required by today's fast-changing economy.

> Broadly defined skill standards form the cornerstone of this Administration's workforce development system. When connected to educational standards, they

will help create a seamless system of lifelong learning opportunities with certificates of mastery and competency that are accepted and recognized by employers.

Skill standards identify the knowledge, skill and level of ability an individual needs to perform successfully in the workplace. They ensure a common, standardized system for classifying and describing the skills needed for particular occupations and the skills possessed by individual workers. Skill standards can aid communication among employers, educators, trainers and workers regarding specific skill levels and needs.[8]

National skill standards will not only aid communication among employers, educators, and workers, but will also (1) show students what they must learn and motivate them to learn, (2) provide curriculum development guidance to educators and trainers, and (3) help employers recruit and screen employees.

The study team for the report, "Industry and Education Driven Skill Standards Systems in the United States and Other Countries," reviewed the skill standards systems in six countries: Australia, Canada, Denmark, Germany, Japan, and the United Kingdom.[9] These tend to break into three categories:

1. The "initial preparation" model represented by Germany and Denmark focuses on the school-to-work transition for young people. Both nations' frameworks are school-to-work transition models, and both have long histories of involving industry in the education and training of the workforce. Both have been firm regarding the critical role of industry in establishing standards and in designing and implementing certification of skills.
2. The "craft certification" approach represented by Japan and Canada meets the needs of more mobile workers. The critical feature that ties Canada and Japan together within the skill-standards systems is the focus each has placed on the development of skill-certification systems for occupations with a substantial amount of worker mobility across crafts and trades.

   National skill standards in Japan are driven largely by government and employer organizations, and focus heavily on incumbent workers. Canada excels at establishing both a common language and portable credentials.
3. The "comprehensive" model found in the United Kingdom and Australia is the youngest, and still evolving category.

   In both countries, the traditional role of the central government prior to the 1980s could be characterized as "laissez-faire" in the arena of promotion of skill standards. During the past decade, however, there has been a dramatic shift. In these countries,

the promulgation of skill standards and certification systems is seen as central to the competitiveness of their economies.

The development of industry-driven skill-standard systems is having direct impact on the organization and structure of vocational preparation institutions, and on the traditional academic education systems.

In looking at these six countries, three important differences between them and the United States should be noted:

1. Many other countries are more advanced than the United States in supporting education and/or work-based skill-standard systems.
2. Each of the other countries provides an exit from the compulsory school examination system. This is often used to sort people, a strategy the United States has shunned.
3. The other nations have a long history of central governments supporting and promoting third-party certification of skills and knowledge gained through vocational preparation. This includes formal mechanisms to involve industry and employee representatives.

Skill standards have proven valuable in several ways. They have served as the basis for: (1) describing jobs, (2) selecting employees, (3) promoting employees, (4) developing curricula for training programs, (5) certifying employees in specific areas, and (6) providing relevant career guidance and counseling. Where common definitions have been developed and accepted, communication has been enhanced between companies, employers and employees, and trainers and employers.

The ISWEC project places a high value on the use of state and national skill standards as a significant base of information for curriculum development. The standards are coupled with traditional high academic standards to produce curricula for the high-performance workforce.

Competency-based education and the development of occupational skill standards have been a basic part of vocational/technical education for the past twenty-plus years. The primary approach has been "to develop task lists as the basic units of curriculum, instruction, and evaluation criteria…for vocational/technical education performance standards."[10] Many well-established "credentialing" systems also have been developed by professional and craft occupations for both regional and national use. These systems have been mainly used for self-regulating credentialing of "membership."[11]

The traditional organization tended to use two different approaches to skill standards and certification: the skill components approach (a list of component tasks or skill sets focused on the pieces that make up the whole) for frontline workers, and the

professional/craft approach, which focused on the ability to do the overall activities of the relevant occupations, for the professional or highly skilled technician. Thomas Bailey and Donna Merritt remark that "certification often required some form of guided experience, but was, at a minimum, based on examinations or tests that required the student to perform complex activities or solve problems that simulate the actual activities of the profession."[12]

The industrial frontline worker had to have specific skills, but was not expected to know how he or she contributed to the overall production process. In the new workforce, however, a frontline worker must be able to understand the "how" and "why" of his or her activities, as well as having specific skills. He or she must also be able to do complex activities and solve problems in the actual context of the workplace.

Frontline workers must now be able to combine their skills in complex activities, solve problems, relate new decisions to other activities and prior decisions, work in teams, and understand and support the values and culture of their organization. Skill standards, like those for professionals and autonomous craft workers, must reflect these complex, context-embedded activities.

The skill-standards projects funded by the U.S. Departments of Labor and Education are focused on meeting these specifications, and their occupational content is a prime source of information upon which to base educational curricula. The ISWEC project draws heavily upon these projects and numerous other state and local initiatives that are collecting skill standards information.

Occupational Classification Systems and Their Purpose

Occupational classification systems serve to identify and classify job titles, occupational areas, career majors representing groups of occupations, and career clusters representing groups of majors as well as providing a way of relating skills to individual jobs, occupations, majors, and clusters.

The U.S. government uses various classification systems, developed for different purposes, including: (1) statistical reporting about current and past conditions of the labor market, (2) projections and forecasts of future labor market needs, (3) job requirements for hiring and promotion by employers, (4) credentialing worker qualifications for specific jobs or specialty areas, (5) developing training programs and materials for specific jobs or specialty areas, and (6) career education/guidance and counseling.

The ISWEC project is creating a skills-based occupational classification system that focuses on developing curricula for training and credentialing workers. It will also provide useful information for career guidance and counseling.

The NOICC Master Crosswalk[13] is a computerized database showing relationships among five major occupational and educational classification systems used by the federal government. The Master Crosswalk begins with the *Dictionary of Occupational Titles* (*DOT*), which is the common denominator linking all federal classification systems. Through the Master Crosswalk, data classified according to each of the federal classification systems can be related to data classified according to one or all the other systems. The National Crosswalk Service Center (NCSC) is a technical resource center of the National Occupational Information Coordinating Committee (NOICC) and State Occupational Information Coordinating Committees (SOICC). NCSC maintains the NOICC Master Crosswalk and provides a range of products and services based on it and other federal occupational and labor-market information resources. NCSC is operated by the Iowa SOICC, under a grant from NOICC.

In cooperation with federal agencies and the NOICC, the National Crosswalk Service Center oversees modifications of the Master Crosswalk, provides technical assistance to its users, and provides information upon request. NCSC also serves as a repository of computerized occupational and educational information resources, including the following:

- NOICC Master Crosswalks
- Bureau of Labor Statistics (BLS) Crosswalks
- BLS National Industry/Occupation Projections Matrix
- *Dictionary of Occupational Titles* (*DOT*) Manual
- *Standard Occupational Classification* (*SOC*) Manual
- *Classification of Instructional Programs* (*CIP*) Manual
- Standard Industrial Classification (SIC)
- Occupational Employment Statistics (OES) Survey Dictionaries
- Standard Occupational Classification (SOC) Career Profiles
- *Occupational Outlook Handbook*
- Military Occupational and Training Data

Any occupational classification system must be useful to both those concerned with the worker production and those preparing employees for the workforce. Many systems have been developed from the demand-side perspective (e.g., *Dictionary of Occupational Titles*, Bureau of Labor Statistics National Industries/Occupations Matrix, and the Standard Industrial Classification). Others have been developed from the supply perspective (e.g., Classification of Instructional Programs and Standard Occupational Classification Career Profiles). It is critical that those involved in both the demand and supply side use common descriptors and communicate openly with each other. Until such

time as a common system is developed and generally accepted, cross-walking the systems is critical.

Alternative Approaches to Clustering

The National Skill Standards Board (NSSB) commissioned sixteen papers to advise on ways to develop "broad clusters of major occupations." (See Appendix B for a listing.)

Robert Sheets lists three alternative approaches in a background paper entitled "Developing Occupational Skill Clusters."[14] They are:

1. Cross-Functional Skills/Worker Attribute Approach. This approach clusters occupations by cross-functional skills or general worker attributes and assumes that occupations get their integrity through the commonality of underlying general skills. Widely recognized classifications to be used in this approach include: the General Educational Development (GED) or "Data, People, Things" scales used in the *Dictionary of Occupational Titles*; the skills defined in SCANS; and the Workplace Basics compiled by the American Society for Training and Development.
2. Work Performed/Occupational Approach. This approach clusters occupations by work done in relation to some standard and is based on the assumption that occupations obtain their integrity through the commonality of similar job duties or functions and generalized work activities, as well as occupation-related knowledge, skills, and levels of ability. The industry in which these duties and skills are applied is of secondary concern.

   This approach could involve modifying existing occupational classification systems including the *Dictionary of Occupational Titles*, the Standard Occupational Classification (SOC), and the Occupational Employment Statistics (OES) program.
3. Industry-Based Occupational Approach. This approach clusters occupations by major industry groups and then into industry-based occupational clusters according to underlying similarity in roles and functions performed within the industry. This approach could involve some combination of industry and occupational classification systems, with industry being the initial consideration. The Standard Industrial Classification (SIC) system could be used to determine the industry groups, and could be combined with some type of occupational classification to determine the industry-based occupational clusters.

The most widely accepted approach for defining occupational clusters is the Work Performed/Occupational Approach; however, the Worker Attribute Approach has received much attention in recent years and has begun to challenge the more traditional Occupational Approach. The Industry-Based Occupational Approach is relied upon the least.

Section 508 of Section V in *Goals 2000* defines the term *skill standard* as "a standard that specifies the level of knowledge and competence required to successfully perform work-related functions within an occupational cluster."[15] Under this definition, skills are derived from an analysis of occupations, and occupations are grouped by common work characteristics or skills rather than general skill statements or worker attributes.

From a curriculum-design viewpoint, general worker attributes can be part of the basic core since all students need to develop these attributes. In the ISWEC design, commonality of occupational skills defines the career clusters and majors.

Certification

Certification of worker qualifications is strongly embedded in labor-union apprenticeship programs and in many of the professions. However, the last decade has seen the beginning of a major national movement to develop portable credentials for secondary and postsecondary students based on specific verifiable academic and workplace-oriented knowledge, skills, and levels of ability.

There is movement toward developing Certificates of Initial Mastery and Certificates of Advanced Mastery, concepts popularized in the report *America's Choice: High Skills or Low Wages!* that recommended a comprehensive system of technical education certifications and associate degrees to be created for the majority of students and adult workers who do not pursue a baccalaureate degree.

The ISWEC project goals include developing portable credentials for secondary and postsecondary students and developing curricula that will incorporate progressive sets of skills compatible with and adaptable to the various certificates being considered. The project does not directly address mandatory certification required for employment (sometimes called Level III or high-stakes certification). However, the possible need for such certification is recognized and groundwork for it is laid in the assessment strategy.

II. The Transformation of the Education System

The basic purpose of public education is to prepare students with the knowledge, skills, and attitudes they need to be successful in our society. As our society experiences major changes, so do our public schools.

This section will focus on systemic change, redesigning occupational curricula, and assessment as it relates to the ISWEC project.

Systemic Change

As one of its objectives, the Integrated System for Workforce Education Curricula encourages the development of systemic change, which involves a restructuring of the academic environment and its leadership. As an element of ISWEC's goals, systemic change will effect quality education and career preparation for all students, the incorporation of applied learning into curricula, an emphasis on lifelong learning, and a total quality approach to educational leadership involving the input of all stakeholders affected by the educational system.

Everyone agrees that all students deserve a quality education, but there is widespread disagreement about the educational methods that serve students best. For the past several years, the American educational system has been in a state of upheaval, as educators have wrestled with the question of how to educate a student population that is larger and more diverse in terms of race, ethnicity, gender, and language than in the past. In addition, national tests have indicated that our students are not demonstrating competency in mathematics, science, and communication. To become high-performance achievers in the workforce, they must obtain a strong academic foundation in all three of these areas. Finally, the workplace of the future will require individuals with advanced skills—skills students cannot learn by participating in a traditional, general-track curriculum.

Unfortunately, the traditional American education system often focuses on high-performing and special-needs students, leaving "average" students to fend for themselves. Thus, this "neglected majority" of students, is not provided with an education that meets their needs.[16] These students receive little attention from their teachers and often perform poorly because of low expectations placed on them by the educational system and because they are not taught in ways that suit their learning styles.[17] This forgotten group includes those students not planning to attend college, as well as many of the students enrolled in traditional vocational programs. Because of their choices, the educational system affords them second-class treatment that only reinforces their decisions to merely survive until they graduate.

Rather than disregarding students who don't fit the college-bound or special-needs categories, the system should strive to meet their needs by providing them with education and training that will prepare them for the workplace and the real world. Counselors and teachers must have high expectations of all students, regardless of the type of education they choose, and commend them for choosing a path that leads to their goals—whether those goals involve college or a career. Career-awareness and exploration activities are invaluable in helping students make career choices, and must begin in kindergarten or elementary school.

Students involved in a general-track education constantly wonder, "Why do I have to learn this?" They see little use in real life for what they are learning. This is because they are presented with information without being shown how to use it. A successful occupational curriculum must demonstrate for students the *applications* of knowledge: how the knowledge is used in the world. Applying concepts and information in a workplace context exposes students to potential careers by showing them how academic concepts are used on the job. Although students can easily learn some of this through texts, videos, labs, and activities, some students are also offered firsthand experiences through plant tours, mentoring arrangements, and internships.[18] These on-site experiences take application a step further by helping students see the way the workplace really operates.

Because of the constantly changing global marketplace and emerging technologies, American employers need workers who can continually update their training and knowledge. The most valuable commodity a future worker can possess is *information literacy*, or the ability to access, evaluate, and use information from a variety of sources.[19] Information leading to the use of knowledge is the element critical to the success of organizations in the global economy—as well as of workers seeking job security.[20] Indeed, information literacy is the basic skill adults need to survive in the workplace, since no secondary or postsecondary education can provide tomorrow's workers with all the skills they need for life. As Kenneth Razak remarks, "Inexorably, people continue to move into the work force with educational deficiencies."[21] Students who prepare early to become lifelong learners will be successful in tomorrow's workforce.

Institutions undergoing change can benefit greatly from Deming's model of continuous improvement, in which all members are committed to and involved in the change process.[22] As all teachers, counselors, principals, and other administrators become involved in an educational-reform effort, change can continually occur at all levels.

For those ready to transform and improve American education, systemic change is an evolving, long-term process. The Integrated System for Workforce Education Curricula supports systemic change by promoting quality education and career preparation for all students, disseminating information on applied instruction and lifelong learning, and encouraging restructuring and continuous improvement for organizations.

Redesigning the Occupational Curriculum

The major element of the Integrated System for Workforce Education Curricula's efforts involves the redesigning of an occupational curriculum. Two problems hinder the establishment of a quality occupational education system: adherence to theoretical, abstract teaching methods that fail to consider varying learning styles, and a lack of

partnership among the disciplines and levels of the educational process. As a result of these problems, occupational education is affected in the following ways:

- The student who learns best in a "hands-on," application-based manner has difficulty in learning through accepted abstract, theoretical methods.
- Students fail to see the connections among the elements of education.
- Fewer non-university-bound students are motivated to continue education at the postsecondary level, or they are misguided in choosing a life's work.
- Secondary coursework is often duplicated at the postsecondary level.
- The importance of academic and occupational skill standards is not communicated to educators.
- Students are not prepared or encouraged to become lifelong learners who can update their skills as technology changes.

In seeking solutions to these problems, ISWEC proposes to revamp the occupational curriculum framework. The revised curriculum framework will incorporate contextual learning, curriculum integration, seamless design, inclusion of skill standards, competency assessment, and opportunities to exit and reenter programs. These are proven elements for bringing about change and improvement.

Howard Gardner, Professor of Education at Harvard University, challenged traditional pedagogical methods in his 1983 book, *Frames of Mind: The Theory of Multiple Intelligences*. According to Gardner, intelligence is not a single, measurable capacity but a multitude of capacities corresponding to certain aptitudes. It can be divided into linguistic, logical/mathematical, musical, spatial, kinesthetic, interpersonal, and intrapersonal capacities.[23] We learn according to the types of intelligence we possess, and not always through traditional means.

For some years now, contextual learning has been recognized as a leading alternative to the accepted but failing abstract methodologies. Traditional teaching methods have asked students to memorize unrelated bits of information without ever understanding how they connect to the real world. Unfortunately, many students just can't see why concepts work; others actively reject information for which they see no need; others memorize answers without developing problem-solving skills. If these students are to obtain a quality education, they must be *taught* in a manner that suits the way they *learn*.

Contextual learning occurs as students process information in ways that are meaningful to them. Students involved in contextual learning are more likely to understand the usefulness of information in their lives and their future occupations. The following are five recognized forms of contextual learning:

- *Relating:* learning in the context of life experiences.

- *Transferring:* learning in the context of existing knowledge—using and building upon what a student already knows.
- *Applying:* learning in the context of how the knowledge and information can be used.
- *Experiencing:* learning in the context of exploration, discovery, and invention.
- *Cooperating:* learning in the context of sharing, responding, and communicating with other learners.[24]

Contextual learning enables students to associate what they are learning with information they have already mastered, and to recognize the connections among the elements of education. Rather than forcing students to memorize and repeat abstract ideas, teachers using contextual learning concepts show students how information applies to the real world. Contextual learning theory emphasizes that learning can occur in a multitude of environments. Thus, some students can learn the application of abstract concepts at a worksite as well as in a classroom.

Researchers have discovered that student interest in almost every area of a curriculum improves dramatically as students are shown how to connect the information to experience and to other knowledge. Finally, contextual learning methods ensure that students will want to continue learning—making connections, enjoying discovery, and using knowledge—long after their secondary or postsecondary education has ended. It is imperative that students, especially those seeking technical occupations, become confident with the learning process, since many of them will return to the classroom to update knowledge as technology changes.

The concept of *integration* complements contextual learning theory goals, and is another element of a quality occupational curriculum. Although the term can be applied in different ways, all forms of integration unify aspects of a curriculum, enabling students to synthesize components of their education into a meaningful whole.

Horizontal integration, or "integrating across the curriculum," involves incorporating both academic and vocational subject matter into a meaningful whole.[25] One example of horizontal integration can be found in *team teaching*, which occurs when teams of academic and vocational instructors share time in the classroom. Teamed teachers benefit from seeing each other's instructional methods, and students observing the teachers begin to understand the connections between traditionally unrelated disciplines.

Vertical integration occurs as secondary and postsecondary programs of study are designed in concert to avoid postsecondary repetition of subject matter mastered at the secondary level. Given a clear path from secondary to postsecondary education, students are more likely to pursue at least an associate's degree.

Effective vertical integration efforts require the cooperation and commitment of both the secondary and postsecondary faculty. W. Henry Con and James Hardy describe articulation as a goal institutions should strive for:

> As a goal, [articulation] is the creation of an educational system without artificial divisions, so that the whole educational period becomes one unbroken flow, which varies in speed for each individual, and which eliminates loss of credit, delays, and unnecessary duplication of effort.[26]

Originally a framework for a Tech Prep curriculum, a seamless model is a logical guide for any school-to-work program. A seamless curriculum usually begins at the elementary or middle school level, during which students learn about careers and prepare to select a high school career cluster. The second phase sets the stage for curriculum integration by introducing ninth and tenth grade students to a core containing a rigorous foundation of applied academics and/or contextual learning. This core blends needed employability and academic skills with occupational skills, and may also connect to worksite learning experiences. The third phase, which involves students in selecting a career major, establishes areas of knowledge applicable to a number of related occupations.

The fourth and final phase of a seamless curriculum happens at the thirteenth and fourteenth grades (and possibly beyond) as students continue with the integrated curriculum at a community college or university. In this phase, students build on their previous learning experiences, gain advanced skills, and enter or continue worksite learning experiences in their chosen career fields. After completing associate's degree or certificate programs, these students may go directly to work or continue to baccalaureate degrees.

Standards-Driven

No education, no matter how thorough, can prepare students for the world or the workplace unless they develop the skills they need to function as mature adults and valuable employees. A complete occupational curriculum must account for, and incorporate, both academic and occupational skill standards. Academic, employability, and occupational skill standards can ensure that students obtain the education they need.

Academic standards, measured by a variety of established and newer assessment tools, represent those skills students should master through basic K12 academic education. SCANS and other employability standards emphasize competency in personal qualities and thinking ability as well as in academics. [27]

The adoption of employability standards can help students transfer knowledge from school to work and understand the ways their education translates into usable skills, including creativity, problem-solving ability, and reasoning capacity.[28] Technical skill

standards translate employers' expectations into a curriculum that can really make students work-ready.

Finally, a quality occupational curriculum must provide multiple exit and reentry points for all students. Many may choose to go directly to work after high school, and to attend community college at a later time. Others will continue with school and obtain baccalaureate degrees, building on their technical foundation. The curriculum must be structured to accommodate these and other learners at various stages of program involvement.

In light of the benefits of these proven curricular elements, the Integrated System for Workforce Education Curricula will incorporate contextual learning, integration, seamless design, skill standards, and program exit and reentry opportunities to effect change and improvement in occupational education. All of these principles have proven beneficial in isolation; however, no occupational curriculum has simultaneously accounted for differences in learning styles, skill standards, and the need for seamless curricula. By assimilating all of these principles, the Integrated System for Workforce Education Curricula's nationwide model should result in higher levels of student achievement; transportability of technical programs from one area of the state or country to another; an accelerated pace at which new curricula are developed, adapted, implemented, tested, and revised; a broader understanding of career majors with increased options for students; and appropriate assessment strategies.

Assessment

Performance-based instruction has always been central to vocational/technical education. However, the past few years have seen a major interest in and application of this approach by the academic community as well. In fact, performance-based instruction provides much of the impetus for the educational standards movement that is sweeping the country. Performance-based instruction focuses on the demonstration of proficiency by the learner. The addition of specified standards to the demonstration provides the basis for assessing the degree of achievement.

It is evident that standardized tests (multiple choice and short answer) are inadequate to measure the more complex, higher-order thinking and problem-solving processes. Consequently, variations in assessment techniques are receiving increased attention.

Alternatives to traditional multiple-choice, standardized achievement tests are called variously 'direct assessment,' 'authentic assessment,' 'performance assessment,' or simply 'alternative assessments.' Examples include journals, demonstrations, exhibitions, and portfolios.

According to Blaine Wortham, proponents of alternative assessment think students' learning "can be better assessed by examining and judging a student's actual (or simulated) performance on significant, relevant tasks."[29]

Joan Herman, Pamela Aschbacher, and Lynn Winters say alternative assessment, authentic assessment, and performance-based assessment force students to "generate rather than choose a response. Performance assessment…requires students to actively accomplish complex and significant tasks, while bringing to bear prior knowledge, recent learning, and relevant skills to solve realistic or authentic problems."[30]

Further, Herman, Aschbacher, and Winters list the following common characteristics of alternative assessment, which:

- Ask students to perform, create, produce, or do something.
- Tap higher-level thinking and problem-solving skills.
- Use tasks that represent meaningful instructional activities.
- Invoke real-world applications.
- Are scored by people using human judgment.
- Require new instructional and assessment roles for teachers.[31]

John Wirt, in his discussion of using the traditional job-competency model for setting job standards, identifies two major problems: It results in standards that reflect average rather than superior performance, and it focuses on routine, rather than complex, uncertain aspects of job performance.[32]

The shift in workforce expectations requires complex, higher-order thinking and problem solving. Wirt says research findings indicate that experts think differently from those less expert. Experts are able to obtain and use new knowledge and apply it to a variety of problems and settings. They also consciously monitor their time, their thinking, and their problem-solving abilities, acquiring new knowledge from social interaction and networks of workers and organizing it into readily accessible blocks. Wirt says that these aspects of expert performance can all be assessed.

The studies on expert performance parallel and reinforce the contextual, integrated, holistic approach to curriculum and indicate the need for using multiple assessment techniques over extended periods of time.

In synthesizing the examples he studied in defining complex performance, Wirt noted many common characteristics. They are:

- "…presenting subjects with realistically situated problems that call for complex and well-reasoned responses. This suggests that assessment of complex performance requires asking candidates to perform tasks that are extended and involve many steps.
- …the frequency with which concrete instances, vignettes, or stories of performance are employed to communicate standards embodying complex skills to others.
- …the number of standards adopted…is not in the hundreds, as with the job competency model, but half a dozen or so. The description of complexity apparently requires the opposite of what one might expect: a small number of standards rather than a large number. Furthermore, the primary content of these standards is expressed as a framework of concepts in texts presenting a vision of performance rather than as an abbreviated list of skills or behaviors."[33]

Curriculum and assessment must be intricately interwoven from the start of the design phase, through implementation and continuation, to complete certification and periodic review of the total curriculum. To create effective assessment tasks, learning outcomes must first have been established for the curriculum. Then activities must be designed that allow students to show that they have achieved those outcomes. Criteria by which achievement will be evaluated must also be determined.[34]

Assessment that is integrated into the curriculum as part of the ongoing teaching and learning process is described as "embedded assessment" and supplements or replaces traditional techniques. Wirt asserts that assessment reform has become a part of the education-reform movement for two reasons: First, teachers resist setting a high priority on developing students' abilities in thinking and doing, particularly when existing tests that hold the teacher accountable for student learning do not measure those skills. Second, teachers can learn to teach these more complex skills by being involved in the design and conduct of performance assessments built directly around the skills.[35]

Herman, Aschbacher, and Winters describe embedded assessment as transparent, ongoing, and natural, suggesting that assessment tools and criteria be woven into the curriculum so the student can see them and realize they are part of the learning process. They also suggest that public discussion of work quality and criteria help students understand what is expected before they have completed their work. [36]

Wirt describes curriculum-embedded assessment in the context of student portfolios and curriculum-embedded projects. Portfolios are basically containers for examples and records of student performance, and may contain audio and visual as well as print examples. Portfolios are put together by students with help from their teachers, and are assessed by the teachers. The contents of the portfolios vary, but should include samples of classroom work, presentations, and records of completed projects. The portfolio contents help students see their progression through school, and help teachers explain that

progression to students and others, including prospective employers. Portfolios can show broader aspects of student learning than conventional tests, since they can represent more of the context of what was taught to the student. Involving teachers in the assessment of portfolios enables them to understand and articulate broader student learning goals. Curriculum-embedded projects might involve, for example, all facets of a scientific investigation, the dramatization of a text, the writing of a research paper, or the designing of a device or process to solve a specific problem. Such projects provide opportunities for multiple examples of embedded assessment.

The ISWEC project places emphasis on embedded assessment, especially when addressing high-performance worker skills. Traditional end-of-unit or episodic assessments (what Wirt calls "on-demand" assessments) will still be used in many situations; however, the evolving purpose of on-demand methods should be toward evaluating the overall effectiveness of a program rather than individual student progress. It is crucial that the characteristics being measured by embedded and on-demand assessment methods be consistent with one another; otherwise, program success indicators might not be consistent with student success criteria. This need for consistency is not trivial, since many states have in place on-demand tests that are used to judge schools and programs. To a great extent, these existing blanket testing programs do not reflect current views on high-performance work, but rather focus on basic skills and traditional views of student success.

Required certification for job entry is often referred to as "high-stakes" assessment, requiring stringent validity, security, and maintenance levels for the instruments and procedures used. This project does not directly provide for high-stakes assessment; nevertheless, assessments of students and programs must be consistent with anticipated certification procedures. It would be as unacceptable for students to face requirements for which their educational programs prepared them poorly as it would to judge *programs* against criteria differing from those used to judge *student* success.

The ISWEC project seeks to define assessment strategies that address individual student success as well as strategies that can be used to assess the overall success of programs by **sampling collective student success** at appropriate points. High-stakes assessment will not be directly addressed; however, such needs will be anticipated, and appropriate groundwork will be done. Assessment systems must be planned and designed from the beginning to meet the scrutiny and expectations of high-stake situations.

Since complex performance is multidimensional, it is important that the assessment criteria used be directly related to and appropriate for each trait or dimension being assessed. Herman, Aschbacher, and Winters state that, for judgment purposes, sample criteria should have four common elements:

- One or more traits or dimensions that serve as the basis for judging student response
- Definitions and examples to clarify the meaning of each trait or dimension
- A scale of values (or a counting system) on which to rate each dimension
- Standards of excellence for specified performance levels accompanied by models or examples of each level.[37]

These four elements relate closely to the information provided by the occupational skill-standards projects and the academics-standards projects.

John Wirt's research reveals that "with sufficient training and means of moderating judgments in place, the variations in human judgment need not be a significant source of variation for decisions made in systems of performance assessment."[38] Further, getting a large number of people in the assessment and judging process usually evens out differences in judgments, because they learn more closely what the performance standards are. This may initially reduce the statistical reliability of scoring, but will pay off long-term by ensuring that the judgments within the system are more comparable. It also helps the judges/teachers/practitioners learn ways to teach complex skills more effectively.

III. Summary and a Call for Action

All of the industrialized nations of the world are experiencing major changes in their societies, including higher requirements for their work organizations and workforces. To remain competitive in the international market and maintain its standard of living, the United States must transform its educational system to prepare workers for the new, high-performance workforce.

The rapid advances in technology and the globalization of markets are drastically changing the way goods and services are produced and distributed. High-performance businesses and industries able to adapt quickly and take advantage of the new technologies are emerging, thereby moving into position to capture and dominate the international markets.

These high-performance companies have discovered that the old, hierarchical organization responds too slowly to the rapid changes required. As a result, they have largely eliminated middle management staff and transferred their tasks and responsibilities to the frontline workers. This, in turn, has greatly changed the skills and capabilities required of the high-performance workforce.

The old, industrialized companies required workers who showed up on time, tolerated repetitive tasks, complied with standardized policies and procedures, and demonstrated good work ethics, and a few who had some narrow, specialized skill. These criteria are no

longer adequate for the worker in the new high-performance company. The new high-performance workers must be able to understand and use technological applications, adapt rapidly to changing conditions, solve problems, communicate effectively, work in teams with different types of people, take personal responsibility for the quality of product or service being produced, and have technical skills that can be adapted to rapidly changing conditions.

It has become obvious that the knowledge, skills, and level of ability of the new high-performance workforce require a drastically different type of training than did the old, industrialized workforce. Systemic change is required in the educational system to provide quality education for all students and to prepare all students for rewarding careers. Reform movements that are beginning to transform the schools include the development of national academic and workforce standards that focus on higher-order thinking skills, problem solving, and the application of knowledge in real-world situations. Curricula that are contextual, holistic and integrated, and that provide a seamless continuum of progressive learning opportunities are being designed.

Performance-based assessment that incorporates academic and occupational standards must be embedded in curricula appropriate to complex, multidimensional performance that occurs over a period of time.

The national efforts to develop an occupational classification system with clusters based on common knowledge, skills, and abilities of workers and to develop portable skills certificates for students in secondary and postsecondary career programs are an integral part of reform efforts. Ways must be found to link all these variables in a coherent system.

The Integrated System for Workforce Education Curricula (ISWEC) project is a major response to this challenge.

IV. Project Goals

It is intended that the following be incorporated into and become an integral part of the Integrated System for Workforce Education Curricula project:

1. The definition of a process and the development of a comprehensive list of career clusters and majors and related occupations based on a set of common competencies related to actual work to be performed.
2. The definition of a process plus prototype materials applying the process to at least three career clusters with a related career major and occupation for each.

3. The development of a series of career maps to guide learners in the selection of appropriate pathways as well as secondary and postsecondary learning experiences appropriate to their chosen career cluster and major.
4. The development of sample strategies for comprehensive and authentic assessment within each prototype.
5. The development of a menu of project-based and contextual learning activities and experiences spanning grades nine through fourteen that incorporate relevant cognitive, technical, and workplace-readiness skills required in a high-performance environment.

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[33] Wirt, 10-11.

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Appendix A

Skill Standards Directory

Following is a list of the twenty-two pilot skill-standard projects funded by the Departments of Education and Labor. Almost all of these projects have now completed development of skill standards for clusters of occupations and have either published their standards or are in the final stages of development and validation of the standards. For copies of skill standards for any of these occupational clusters, contact the grantee directly.

Industry	Grantee
Industrial Launderers	Institute of Industrial Launderers 1730 M. Street, NW Washington, DC 20036 202/296-6744 Project Director: Geoffrey Northey
Tourism, Travel, and Hospitality	Council on Hotel, Restaurant, and Institutional Education 1220 17th Street, NW Washington, DC 20036-3097 202/331-5990 Project Director: Doug Adair
Metalworking	National Tool and Machining Association 9300 Livingston Road Fort Washington, MD 20744 301/248-6200 Project Director: William Ruxton
Electronics	American Electronics Association 5201 Great Americana Parkway Santa Clara, CA 95054 408/987-4200 Project Director: Cheryl Fields Tyler
Electrical Construction	National Electrical Contractors 3 Bethesda Metro Center Bethesda, MD 20814 301/657-3110 Project Director: Charles Kelly
Retail Trade	National Retail Federation 701 Pennsylvania Avenue, NW Washington, DC 20004 202/783-7971 Project Director: Robert Hall
Health and Science Technology	Far West Laboratory 730 Harrison Street San Francisco, CA 94107-1242 415/565-3070 fax 415/565-3012 Project Director: Sri Ananda

Industry	Grantee
Electronics	Electronics Industries Foundation 919 18th Street Washington, DC 20006 202/955-5814 fax 202/955-5837 Project Director: Irwin Kaplan
Computer-Aided Drafting	Foundation for Industrial Modernization (FIM) 1331 Pennsylvania Avenue, NW Suite 1500, North Tower Washington, DC 20004-1703 202/662-8970 fax 202/637-3182 Project Director: Jane Beardsworth
Air Conditioning, Refrigeration, and Power	Southern Association of Colleges and Schools V-TECS (Vocational Technical Education Consortium of States) 1866 Southern Lane Decatur, GA 30033-4097 800/248-7701 fax 404/679-4556 Project Director: Victor Harville
Biotechnical Sciences	Education Development Center (EDC) 55 Chapel Street Newton, MA 02160 617/969-7100 fax 617/244-3436 Project Director: Judith Leff
Printing	The Graphic Arts Technical Foundation 4615 Forbee Avenue Pittsburgh, PA 15213-3796 412/621-6941 fax 412/621-3049 Project Director: John Burgess
Automotive, Auto Body, and Truck Technicians	National Automotive Technician Education Foundation 13505 Dulles Technology Drive Hernon, VA 22071 703/713-3800 fax 703/713-0727 Project Director: Pat Linquist
Human Services Occupations	Human Services Research Institute/EDC 2336 Massachusetts Avenue Cambridge, MA 02140 617/876-0426 Project Director: Valerie Bradley
Heavy Highway/Utility Construction and Environmental Remediation and Demolition	Laborers—AGC Education and Training Fund 37 Deerfield Road/P.O. Box 37 Pomfret Center, CT 06259 203/974-0800 Project Director: James Warren
Chemical Process Industries	American Chemical Society/EDC 1155 16th Street, NW Washington, DC 20036 202/872-8374 Project Director: Kenneth Chapman

Industry	Grantee
Hazardous Materials Management Technician	Center for Occupational Research and Development P.O. Box 21689 Waco, TX 76702-1689 817/772-8756 Project Director: Jim Johnson
Photonics Technician	Center for Occupational Research and Development P.O. Box 21689 Waco, TX 76702-1689 817/772-8756 Project Director: Darrell Hull
Agriscience/Biotechnology (agriculture, agriscience, agribusiness, and natural resources)	National FFA Foundation 5632 Mount Vernon Memorial Highway, Box 15160 Alexandria, VA 22309 703/360-3600 Project Director: Bernard L. Staller
Forest/Wood Products Production and Manufacturing	Foundation for Industrial Modernization (FIM) 1331 Pennsylvania Avenue, NW Suite 1500, North Tower Washington, DC 20004-1703 202/662-8970 fax 202/637-3182 Project Director: Jane Beardsworth
Food Marketing Industry (supermarket industry)	National Grocers' Association 1825 Samuel Morse Drive Reston, VA 22090 703/437-5300 Project Director: James Williams
Welding Occupations	American Welding Society 550 Northwest LeJeune Road Miami, FL 33126 305/443-9353 Project Director: Nelson Wall

Appendix B

Concept Papers

The following is a listing of the sixteen papers commissioned by the National Skill Standards Board to advise on ways to develop "broad clusters of major occupations."

1. "An Industry-Based Occupational Approach to Defining Occupational/Skill Clusters" by Robert G. Sheets
2. "Issues for Designing a System of Skill Standards and Certification for the American Workforce: On What Basis Should Occupational/Skill/Industry Clusters Be Organized?" by Robert W. Glover
3. "Two Chasms the Occupational Classification Must Bridge" by Linda S. Gottfredson
4. "Developing Occupational/Skill Clusters" by Eunice N. Askov
5. "On Occupational Clusters or Early Thoughts on Organizing the Work of the National Skill Standards Board" by Marc Tucker
6. "Recommendations for Developing Occupational/Skill Clusters" by Valerie McIntyre Sherwood
7. "The Development of Occupational/Skill Clusters: Issues and Recommendations" by John P. Campbell
8. "The Development of Knowledge and Skill Oriented Occupational Clusters" by J.W. Cunningham
9. "Developing Occupational Skill Clusters" by Daniel Flaming
10. "Methodologies, Objectives, and Issues Involved in Identifying Occupational Clusters Using Skills-Based Data" by Robert J. Harvey
11. "Clustering Occupations: A Need-Based Approach" by Edward L. Levine
12. "The Development of Occupational/Skill Clusters for Goals 2000: Suggested Approaches and Key Issues" by Kenneth Pearlman
13. "Toward the Definition of New Occupational/Skill Clusters for the United States" by David W. Stevens
14. "Developing Occupational/Skill Clusters" by Ronald D. McCage
15. "Observations Regarding the Development of Occupational/Skill Clusters" by Ronald D. McCage
16. "How Many Skill Standards? A Clustering Scheme for Occupations and Industries" by Arnold Packer

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