DOCUMENT RESUME

ED 412 364 CE 074 884

AUTHOR McCage, Ronald D.; Olson, Chris M.
TITLE Observations Regarding a Revised Standard Occupational Classification System Using a Skills Based Concept.
PUB DATE 1995-03-00
NOTE 66p.
PUB TYPE Opinion Papers (120)
EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Adult Education; Classification; Cluster Grouping; *Job Analysis; *Job Skills; Models; *Occupational Clusters; *Occupational Information; Occupations; Postsecondary Education; Secondary Education; Vertical Organization; Vocational Education
IDENTIFIERS *Dictionary of Occupational Titles; *Standard Industrial Classification

ABSTRACT

A study focused on defining what is needed to build an occupational classification system using a skills-based concept. A thorough analysis was conducted of all existing classification systems and the new Dictionary of Occupational Titles (DOT) content model so recommendations made regarding the revisions of the Standard Occupational Classification (SOC) System would be in concert with the evolving DOT Content Model. The study borrowed heavily from "Observations Regarding the Development of Occupational/Skills Clusters" (McCage 1990). Indiana was used as a scenario to illustrate how labor market information is used to drive program and curricular decisions. The systems reviewed included the following: SOC; Occupational Employment Survey (OES); Classification of Instructional Programs (CIP); DOT; NOICC [National Occupational Information Coordinating Committee] Master Crosswalk; and Prototype Skills-Based Job Family Matrix. The study recommended that SOC become the system or framework for consolidating the OES survey-based matrix, OES survey occupational codes and titles, and the current census code. Elements in each of these could be condensed around the OES matrix titles to build one system with 3-4 levels of specification for some 600-700 occupational clusters organized under 12-14 major occupational families. The Prototype Skills-Based Job Family Matrix would be a good place to start for building an hierarchical framework for the SOC and DOT. (Contains 42 references.) (YLB)

OBSERVATIONS REGARDING A REVISED STANDARD OCCUPATIONAL CLASSIFICATION SYSTEM USING A SKILLS BASED CONCEPT

to
Advise the
SOC ADVISORY PANEL

for

DTI GOVERNMENT AND COMMERCIAL SERVICERS GROUP
AND U.S. DEPARTMENT OF LABOR

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March, 1995

The authors accept all responsibility for the accuracy of the contents of the paper, and for all opinions that are expressed. There should be no presumption that these views are shared by anyone affiliated with the sponsoring agency, the Department of Labor.

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The observations in this paper regarding the revision of the Standard Occupational Classification System around a skills based concept are from the perspective of two staff members of the Vocational-Technical Education Consortium of States, a non-profit organization that has been conducting occupational analysis, task analysis, performance based instructional analysis, and criterion-referenced assessment/test development using incumbent workers and their supervisors for over twenty-two years. In this capacity they work directly with twenty-five states and indirectly with every state in the nation as well as with six federal agencies including the technical commands of the Army, Navy, Air Force, and Marine Corps. This organization is also conducting the Heating, Air Conditioning and Refrigeration National Skill Standards Project for the U.S. Department of Education and sub contract work on the National Automotive Technician Education Foundation (NATEF) of the National Institute for Automotive Service Excellence (ASE) and Electric Industry Foundation (EIF) Skill Standards Projects.

Ronald D. McCage, Ed.D., Executive Director, V-TECS

Before Dr. McCage arrived at V-TECS in 1980, he served as Director of Research and Development for the Department of Adult, Vocational and Technical Education, Illinois State Board of Education. In this capacity he ran a five million dollar per year research, curriculum development, exemplary programs, professional development, and sex equity operation. Prior to that he taught at the secondary and university levels and served as a placement coordinator in an adult vocational school in Cairo, Illinois.

Dr. McCage has served on several state and national advisory committees and boards to include the Board of Directors of the American Vocational Association where he served as Chair of the Legislative Committee during the reauthorization of the 1990 Carl D. Perkins Vocational Education and Applied Technology Amendments. He held three seminars in Chile and Uruguay and hosted forty visits from thirty different countries at the V-TECS offices. Paralleling these experiences, Dr. McCage served for twenty-eight years in the United States Army Reserve (USAR). Over half of his time in the USAR was spent in three Reserve Forces Schools where he was a Military Occupational Specialist, Branch Officers Advanced Course and Command and General Staff Instructor as well as the Director of Officer Courses and an Assistant Commandant for the Chamblee, Georgia, USARF School which serves the Northern half of the State of Georgia.

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Prior to Dr. Olson's arrival at V-TECS in 1994, he served as Michigan's Technical Coordinator to V-TECS from 1976-1988. His responsibilities in Michigan included developing the Michigan Articulation Model, developing Michigan curriculum guides, developing the Michigan Occupational Data Analysis System (MODAS), and developing the Michigan assessment process to permit formative evaluation of Michigan's vocational programs. In this capacity, he worked closely with the Occupational Analysis Field Center in Detroit and with MOICC and NOICC.

From 1988 until joining V-TECS, Dr. Olson worked with private industry performing occupational analysis, literacy audits, and designing instructional programs. He also provided occupational analysis, demand driven assessment, and counseling training to counselors in

Indiana's Workforce Development Centers. He developed the model for the Indiana Proficiencies initiative and provided training to Indiana teachers and administrators to use the proficiencies to provide certificates of technical achievement.

OBSERVATIONS REGARDING A REVISED STANDARD OCCUPATIONAL CLASSIFICATION SYSTEM USING A SKILLS BASED CONCEPT

By

Ronald D. McCage, Ed.D.
Chris M. Olson, Ph.D.

EXECUTIVE SUMMARY

Background

The United States Department of Labor (USDOL) is well into the redesign of the Dictionary of Occupational Titles (DOT) using a database content model. Concurrently, the Office of Management and Budget (OMB) is working with the Bureau of Labor Statistics (BLS) to revise the Standard Occupational Classification System (SOC). There are at least two schools of thought concerning what the system should look like: one based on skills; the other on economic considerations. The purpose of this paper is to define what is needed to build such a system using a skills based concept. This will be achieved by conducting a thorough analysis of all existing classification systems as well as the new DOT content model so that any recommendations made regarding the revisions of the SOC system would be in concert with the evolving DOT Content Model. The authors also borrowed heavily from the McCage DOL article, "Observations Regarding the Development of Occupational/Skills Clusters" written earlier to advise the National Skill Standards Board process.

The first task the designers of the new SOC have to face is determining the framework for separating out or classifying the various industries, occupations, clusters, and jobs that exist in the workplace. They will have to decide whether they will need to invent a totally new structure or build on what already exists. In our opinion, there is only one answer, and that is to build on what already exists. While a new structure would be nice, the cost in developing such a system from scratch would be prohibitive, not to mention the inconvenience to those who already use the current systems. More importantly, it is our opinion that the existing systems are reasonably sound. The basic problem is that there are too many different systems.

Consequently, we recommend that the new SOC become what it was supposed to be from day one: the crosswalk, or better yet, the single system that replaces all other major occupational classification systems currently in place. To be more accurate, what we are recommending is that SOC become the system or framework for consolidating the OES survey-based matrix, OES survey occupational codes and titles, and the current census code. We think that there are good elements in each of these that could be condensed around the OES matrix titles to build one system with three to four levels of specification for some 600 - 700 occupational clusters organized under 12 to 14 major occupational families. We believe

that the Prototype Skills Based Job Family Matrix is an excellent place to start for building an hierarchial framework for the SOC and DOT. We have recommended the Prototype Matrix because it has fourteen logically defined occupational families under which most occupations could be clustered with minimum duplication. An analysis done by McCage for his skill standards paper came up with fourteen similar titles by simply using the process of deductive reasoning to collapse and slightly alter the major category families in the 1990 Classification of Instructional Programs. The classification systems used by the U.S. Military and the federal government should be maintained since they serve highly specialized audiences.

Conclusion and Recommendations

Rather than address the Twelve Principles of Classification for the 1980 SOC, the authors have used the questions at the beginning of their paper to serve as a framework for presenting their conclusions which are based on our supply-side experience in the vocational-technical education community as well as having worked with business and industry to analyze work. Our general conclusions are as follows:

1. An occupational analysis protocol must be developed that allows for the continual flow of new and fresh information into the new DOT Content Model and subsequently into the revision and updating process for the new SOC. If a consistent protocol was developed, such as the one currently being used in the Indiana Proficiency Panel Initiative, an information exchange could be arranged to permit the database to be fed from a variety of sources outside of the typical governmental agency units charged with summarizing the data. Such a protocol would have to follow precepts of the Total Quality Management concept in order for the exchanged data to have validity and reliability.

2. A common language should be adopted for the collection of data that is to be used for defining the occupational titles to be included in the database. The authors recommend a combination of duty/task statements or generalizable work activity statements coupled with descriptions of the skills needed in the occupation which could be organized under a framework such as SCANS. This would be supplemented with data sets drawn from the APDOT process which would be applied equally to those performing analysis to identify jobs on the demand side and to those developing training on the supply side.

   The authors would like to cite from the Drayse, et. al., article on the "Future Use of the SOC" in the Proceedings of the International Classification Conference because it expresses very well our feelings about the issue of using an economic or skills based model.

   > A primary test of the usefulness of occupational information is its power to provide a plausible, grounded account of the actual experience of workers. Just as a job should connect an individual's activities with a larger group of workers and their activities, and that in turn with the output of a product or service that is valued by a changing society, a useful description of that job should reflect significant characteristics of the worker, the activity, linked activities of other workers, and processes of change. Since the labor market is not in equilibrium, descriptions of constant and established factors offer good but only partial insight; in effect, a snapshot in time. The dynamic relationships among occupations, and between occupations and changes in demographics, production processes and markets, make it necessary to continuously

incorporate fresh information into occupational classification systems (p.48).

3. A consistent occupational classification structure should be developed to maintain the integrity of the customer/supplier relationship between the various agencies that collect, report, and use labor market data. This structure can be modeled after existing structures such as the CIP but should be hierarchical as follows:

Numbering	Name of Occupational Field	Example
00.	Family/Industry	Creative Arts
00.00	Cluster/Programs	Architecture Cluster
00.0000	Specialties/Clusters/Skills	Landscape Architecture
00.000000	Job Titles (DOT Level)	Landscape Architects

4. The authors feel that the existing classification systems can make substantial contributions to this initiative to revise the SOC. People who use and report labor market information from both the supply and demand sides have gained valuable experience and insights into what the future system should include and how it should be structured. It would be folly to ignore this and begin to develop a revised system from scratch.

5. There should be a direct relationship between the occupational clusters, selected occupational analysis system(s), and the data collection system(s) used that will redefine the new Database of Occupational Titles, Standard Occupational Classification System, and the National Skill Standards Board. We contend that a system can be designed using a hierarchy from general to specific perhaps with four levels (but not necessarily limited to four levels) which will account for current and future occupational structures and will provide satisfactory information for customers of the data. We feel that the Prototype Skills Based Job Family Matrix is such a framework.

6. It is recommended that the NOICC Units of Analysis be considered as a scheme for identifying occupational clusters as they relate to occupational titles. The authors have been provided the most current work being done on the Units of Analysis by the NOICC staff and are very impressed with it. It is envisioned that the Units of Analysis as used in the state Career Information Delivery Systems (CIDS) would provide a valuable tool permitting multi-state surveys of the activities of incumbent workers in various occupations. The recommendation is that such surveys be conducted in a manner similar to the Indiana protocol. By using the Units of Analysis, planning can be done to identify areas for analysis and enhance the placement opportunities of program completers or graduates.

7. The DOT and SOC should be used for statistical and planning purposes for the education and training environment as well as for all other traditional uses. If the hierarchy suggested previously can be implemented, the SOC will be a more general category of related DOTs, since DOT data can be aggregated to the SOC level. If this concept was adopted, a collecting and reporting data process could be developed whereby vocational-technical education and other training providers could provide the information required to develop relevant programs for the current workforce.

The following data sets should be present in a DOT/SOC information base for use by vocational-technical education and school-to-work program planners, curriculum developers, and counselors:

Demand Data
(Employment)
- Historical employment (currently 1984 levels)
- Current employment (1995)
- Average annual job openings (growth + replacement)
- Hourly wages
- Some form of a SVP

Supply Data
(Enrollments by Occupational Cluster)
- Secondary
- 2 Year Postsecondary
- College/University
- Adult Secondary
- Proprietary
- Apprenticeship
- Military
- Other

8. The authors realize that the SVP doesn't have much stock with the current DOT and SOC developers, however, we believe the concept behind the SVP is very important to the education and training community since it does provide very important clues as to the structure of career ladders. Training time is probably a reasonably accurate descriptor since it considers both school based and work based preparation. The SVP concept should be modified around the following five levels since they reasonably represent the ways people become prepared for the workplace.

Level 5	CEO, Management Administration, Advanced Degree
Level 4	Supervisor, Basic Degree, Advanced Professional Certificate
Level 3	Master Technician/Journeyman Level, Postsecondary Degree of Certificate
Level 2	Specialist Level, Postsecondary Certificate, Secondary Certificate, On-the-job Training
Level 1	Trainee Exit Level, Position Entry Level, Secondary Diploma of Certificate of Mastery

9. A properly designed system can be used as a framework for certifying workers in their various industry or occupational specialties by using national or state level skill standards and certifying processes. In Indiana, the Certificate of Technical Achievement will serve this purpose and look similar to a portfolio. In other situations individuals will sit for an exam or actually perform relevant work activities to demonstrate competence.

10. The new DOT/SOC must use a common language for building occupational clusters as well as for identifying common or transportable skills that cut across industry families/occupational clusters/specific occupations as well as geographic boundaries. This must take the form of a well designed taxonomy of work activities and skills which doesn't currently exist.

The authors have experience in setting up and implementing a model for identifying the literacy skills found in the workplace. They used the GED definitions as found in the DOT as well as other sources for developing descriptors for classifying literacy skills. These

skills were placed into a matrix and were coded to jobs and an assessment of people. The discrepancy between the people assessment and the job assessment was used to identify training needs.

The authors' experience with the GED indicated that a consistent set of skills could be used in a variety of work environments and on a variety of jobs. For example, V-TECS has the Basic/Essential Skills Taxonomy developed by Lester M. Snyder, Jr. at Arizona State University. This or a similar "skills" taxonomy could be used to craft a consistent set of skills that could be applied across occupational levels. Once a skill has been identified and verified as relevant to the workplace and is not redundant to another skill in the database, it could be added. In this way, at the skill level, occupations could be described in a common language. This does not preclude the possibility that a contextual qualifier couldn't be added to the basic skill. In fact, the qualifier may be necessary in some levels to make distinctions in and among occupations given the trend toward over generalization.

PURPOSE AND BACKGROUND

The United States Department of Labor (USDOL) is well into the redesign of the Dictionary of Occupational Titles (DOT) using a database content model. Concurrently, the Office of Management and Budget (OMB) is working with the Bureau of Labor Statistics (BLS) to revise the Standard Occupational Classification System (SOC). Everyone involved in this process has expressed a desire to move more toward a single occupational classification system using a SOC/DOT framework. At a minimum, all parties involved want to make these two systems as compatible and as interactive as possible so that much of the existing duplication can be eliminated from the various occupational classification systems currently operating in the United States.

Given the current dialogue regarding the numerous changes that are taking place in the workplace, many policy makers believe that our occupational classification systems should be moved away from the traditional concepts of classifying work based on tasks performed to a system based on skills clustering or economic considerations. This paper will strive to define what is needed to build such a system using a skills based concept. This has been achieved by conducting a thorough analysis of all existing classification systems as well as the new DOT Content Model so that any recommendations made regarding the revisions of the SOC system will be in concert with the Database Content Model of the evolving DOT. The authors also borrowed heavily from the McCage DOL article, "Observations Regarding the Development of Occupational/Skills Clusters" written earlier to advise the National Skill Standards Board process.

A. Structure

The first step taken in writing this paper was to carefully review the background papers provided by Emily Parry of DTI and Donna Dye of the Department of Labor so as to better grasp the primary issues and questions that should be addressed in this paper. The primary documents reviewed include the Proceedings of the International Occupational Classification Conference that was held in Washington, DC, on June 23-24, 1993, as well as the fifteen papers recently prepared to advise the National Skill Standards Board (NSSB) which dealt with a number of the same issues regarding skills identification and clustering that are being faced by those redesigning the SOC and DOT. Obviously, the revision of the DOT and SOC should be coordinated with the implementation of the National Skill Standards Board since Title V of the Goals 2000 legislation calls for a framework of some 10-20 occupational families as a guiding principle for the grouping of occupational clusters. As a consequence, the following questions were selected as being the most critical to this discussion.

1. What do the existing classification systems have to offer this endeavor?

2. What should be the relationship between the occupational clusters and the occupational analysis system(s) and data collection system(s) that will redefine the new Dictionary of Occupational Titles, Standard Occupational Classification System, and the National Skill Standards Board?

3. How many occupational clusters will ensure coverage of the world of work?

4. Should the SOC occupational classifications be developed using a supply/demand (economic) base or a skills/work activity base?

B. Use

The authors pose several questions concerning the possible uses of a skills based SOC which this paper addresses.

1. How does the vocational technical education and training community (supply side) use this type of information?

2. How can the DOT and SOC be used for statistical and planning purposes for the education and training environment as well as for other users?

3. How can a properly designed system be used as a framework for certifying workers in their various industry or occupational specialties?

4. How can the concept of a skills taxonomy be used as a common language for building occupational clusters as well as for identifying common or transportable skills that cut across industry families/occupational clusters/specific occupations as well as geographic boundaries?

Indiana Scenario

When we were asked to write this paper, we were asked to illustrate how the vocational/technical education and training community makes use of the various classification systems in designing and delivering programs. This is quite significant since most of the reading we did regarding the SOC was from the perspective of the demand side. Our discussion begins with the Indiana Scenario which illustrates how labor market information is used to drive program and curricular decisions.

In 1992, a significant event occurred in Indiana with the passage of P.L. 19-1992 which created the Indiana Workforce Proficiency Panel. The Panel was named by Governor Evan Bayh and includes representatives of education, organized labor, business and industry.

> ***The mission of the Workforce Proficiency Panel is to work with people from business, labor, and education to identify a common set of essential and technical skills required to be effective in major occupational areas. These skills will be based on a portable certification system allowing secondary, postsecondary, and adult learners to demonstrate what they know and can do.*** Taken from Annual Report: Indiana Workforce Proficiency Panel, July 1994, p. iii.

A Customer Driven Approach:

The Indiana Workforce Proficiency Panel wanted employers to identify what their employees needed to know and be able to do in order to perform high quality, competitive work. The Panel asked employers to identify and validate essential skills and technical proficiencies required for Indiana's major occupations. The Panel designed a process to produce knowledge and skill standards which are industry-based, useful

for making hiring and promotional decisions and that are valid statewide. The Panel considers the "Customer" of the proficiencies to be the workplace and developed a Handbook to provide a protocol to ensure that a consistent process was in place for assessing and certifying skills for:

- students at the secondary and post-secondary level,
- employers who want to provide necessary training and provide employee compensation for what their employees know and are able to do, and
- adults seeking employment, desiring to change jobs, or wishing to create an inventory record or portfolio of their work experiences.

Certificates of Technical Achievement:

Certificates of Technical Achievement will be used to describe and certify a person's proficiencies and will function as "open transcripts." They will provide a record of what a person knows and is able to do, not where and how knowledge and skills are learned. Certificates will be upgraded as participants complete additional secondary, postsecondary and/or employer sponsored education and training. Agencies and/or institutions can be authorized by the Workforce Proficiency Panel to develop and conduct the assessments according to the standard protocol. The standard protocol will ensure consistency among all assessments and ensure statewide validity and portability of the Certificates.

Skill Portability:

Agreements between and among secondary and postsecondary education and training providers to ensure geographic portability are being developed. Institutions participating in this process must provide evidence of commitment by:

- awarding advanced standing/dual credit,
- decreasing time/credits required to complete a program of study,
- reducing costs for program completion, and/or
- providing other advantages to students.

These agreements add value to the Certificates of Technical Achievement, and will foster movement toward competency-based admissions at state-sponsored postsecondary institutions. This process encourages School-to-Work Transition or Youth Apprenticeship Programs where education and business and industry are working together to provide an articulated program designed to develop a world-class workforce. In addition, business and industry participation in this process, perhaps with the assistance of the Indiana Workforce Development Centers, allows current workers to be assessed with Certificates being issued to assist in hiring and promotional decisions. The Proficiencies provide a continuum of essential skills and technical proficiencies that provide for recognition of a person's "real" skills whether they are earned in the secondary, postsecondary, or workplace environment and allows a person to continually improve and expand their repertoire of skills (open transcript). The protocols have been designed to be consistent with the primary elements of the many Quality Models now being widely implemented in business and industry and education. Because Total Quality Management is very much a part of the Indiana Essential Skills and Technical Proficiency Program, the protocols identify a process that can be monitored, analyzed, and continually improved.

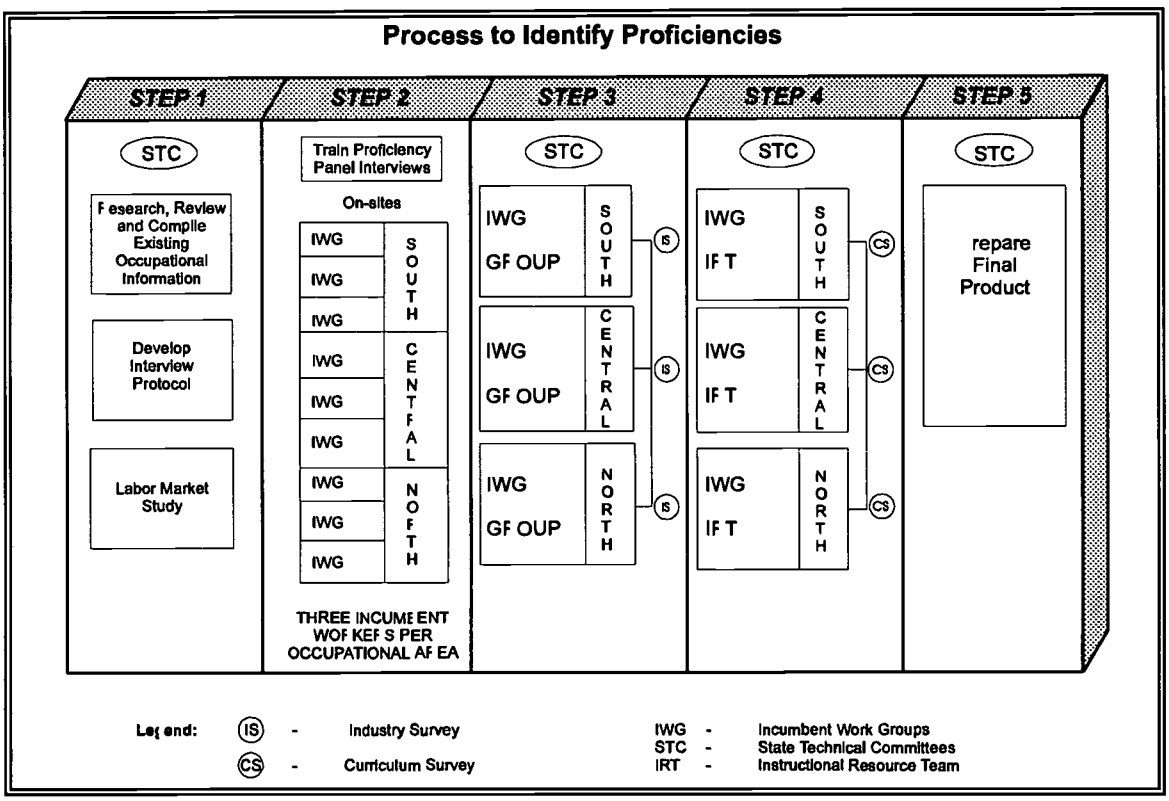
The Process to Develop the Proficiencies:

The process to develop the proficiencies follows a protocol that has been formally approved by the Workforce Proficiency Panel. The resulting product of the process, the Proficiency Guide, includes a

report of the duties and tasks performed in the occupation, the tools and equipment that are used, and the context in which work is performed using SCANS as an architectural framework. The developmental components are:

- Review of Labor Market Supply and Demand Information
- Establishment of State Technical Committees (STC)
- Conduct of On-site Visits to Business and Industry
- Conduct of Statewide Surveys to Validate Tasks
- Identify Proficiencies Using Incumbent Worker Groups (IWG)
- Review/Edit by Incumbent Worker Groups/Instructional Review Teams (IWG/IRT)
- Prepare Final Proficiency Guides

FIGURE 1
Process to Identify Proficiencies



Review of Labor Market Supply and Demand Information:

The MICRO-OIS System sponsored by INDOICC (Indiana Occupational Information Coordinating Committee) was used to identify high demand, low supply occupations. There were four components to this process:

- Examine labor market supply and demand information on the MICRO-OIS.
- Identify high demand occupations based on employment data, projections, percent change, industry growth, etc.

- Review supply information from secondary and postsecondary schools, apprenticeship programs, proprietary schools, the military, and supply in the employment and training system.
- Determine the priority of major occupational areas in which to develop Proficiencies.

The MICRO-OIS that provided the Labor Market Information basically uses the NOICC Units of Analysis that matches occupational demand information collected through the OES process with supply information reported through the CIP classification structure. The process is very helpful to the education and training community but it is less than precise due to the incompatibility of the OES and CIP classification systems it is based on. An examination of a MICRO-OIS report does not always provide good matches, consequently, the user must interpolate the data and make generalizations about various relationships between jobs as they are performed versus programs as they are delivered.

The authors propose that the new SOC be designed in such a way that data can be collected and reported that will provide a more precise match with supply data to ensure a more meaningful response by training providers and placement agencies to the employment and training needs of business and industry. Statistics related to persons employed in occupational/skills clusters are needed as a basis for determining which clusters should be addressed for evaluating training needs in terms of growth and replacement. Such information cannot be determined from individual employers. Occupational families or clusters lend themselves much more readily to the gathering of labor market data which are critical to this effort. One of the major problems that local program providers have had for years is that the structure for collecting labor market data doesn't match the structure for organizing occupational clusters and delivering programs as demonstrated in the Indiana experience. This is why the current NOICC Units of Analysis and proposed refinements, such as the Super Units of Analysis being developed by NOICC have extremely high value for the education and training community.

Establishment of State Technical Committees (STC):

The process in Indiana continues with the formation of State Technical Committees. These committees are composed of management level personnel from select companies in Indiana which are geographically distributed, range in size, include those that are minority owned, and represent all aspects of the major occupational area. For example, the STC for Electronics included representatives of avionics, biomedical equipment repair, automotive repair, consumer repair, computer equipment repair, etc.

To identify companies, the results of the prioritization process are communicated to the Labor Market Information section of the Indiana Department of Workforce Development. They "cross-walk" the OES codes from the MICRO-OIS to employer lists coded by SIC (Standard Industrial Classification). Reports are generated that identify businesses who employ persons in the occupations under consideration.

Employers on this list are ordered by size, location, ownership, etc., and then contacted by staff. They are asked:

- Are they willing to participate on the State Technical Committee?
- Are they willing to host an on-site visit for the Development Team?
- Are they willing to supply incumbent workers to help identify the Proficiencies?

The STC meets three times for a given proficiency area. At the first meeting, committee members are oriented to the process, identify sites for visits of the Development Team, and nominate incumbent workers to write the Proficiencies. At the second meeting, progress is reported to include the work of the incumbent workers. At the third meeting, the committee considers approval of the Proficiencies. Approval is required by the STC from the industry before the Proficiencies can be presented to the

Workforce Proficiency Panel for their adoption. This requirement is also a part of the National Skill Standards Board guidelines.

Conduct of On-site Visits to Business and Industry:

A minimum of nine on-site visits are scheduled to help the Proficiency Development Team to understand the context of work in the broad occupational area and to gather information for the development of the Proficiencies. The on-site visits include a tour of the facility and interviews with incumbent workers. If the employer hosting the on-site visit has contributed an incumbent worker for the next phase, that person is interviewed and oriented to the responsibilities of an incumbent worker in the process.

Conduct of Statewide Industry Survey to Validate Tasks:

In order to verify the duties and tasks performed in the occupation, a survey is sent to a random sampling of over 120 businesses and industries statewide that employ persons in the major occupational area. The results of this survey are cited in the final report.

The businesses and industries are identified from the employer lists submitted by the Labor Market Information section of the Indiana Department of Workforce Development. Employers are randomly selected and surveys are mailed. If a suitable response is not received, follow-up calls are made.

Identify Proficiencies Using Incumbent Worker Groups (IWG):

Concurrent with the statewide survey, and after the on-site visits are completed, three regional meetings are scheduled with incumbent workers. At these meetings, each worker identifies from duty and task lists those they perform as a part of their job. Secondly, each worker identifies the tools and equipment they use from a list that is provided. Workers are also encouraged to add duties and tasks and/or tools and equipment that have been missed in the earlier stages or represent emerging technology.

Finally, a facilitator from the development team conducts a structured interview/response process which uses the SCANS architecture to identify the context in which work is performed. In this process, the facilitator discusses how each SCANS Competency was observed during the on-site visits. Then each IWG records how they perform the competency as part of their job. This process is repeated for each of the 20 SCANS competencies.

The results of the three incumbent worker meetings are entered into a computer database template in preparation for the next phase.

Review by Incumbent Worker Groups/Instructional Review Teams (IWG/IRT):

This phase brings the incumbent workers together with an instructor from the occupational area being reviewed. The purpose of this meeting is to incubate confidence on the part of instructional personnel that the Proficiencies represent on-the-job practices as reported by incumbent workers. A second purpose is to ensure that the Proficiencies were not altered in such a way when they were entered into the template to negate their content validity. Finally, the instructor and worker identify behavioral indicators organized around the SCANS Foundation Skills to be used to assess proficiency developed in the classroom laboratory and/or the workplace.

Prior to the IWG/IRT meeting, each instructor is asked to complete a survey which reports the duties and tasks they teach in their programs. The results of this survey are compared with the statewide survey and the incumbent worker survey. This provides a discussion piece to help identify discrepancies between what is reported as performed in the workplace and what is reported as being taught in the education and training environment.

Prepare Final Proficiency Guides:

The Indiana Essential Skills and Technical Proficiencies for the occupational area result from this process. The skills data collected from the STCs, the on-site visits, the statewide surveys, IWG input and IWG/IRT review is entered into the V-TECS DIRECT Database. The results of the statewide survey, incumbent worker survey, and instructional survey of worker skills are reported to provide users the capability to compare the various survey results. For example, employers might find that there are tasks being performed statewide that could improve their company's competitive performance. The employer might also survey their existing workforce and compare the results with the statewide survey to identify training needs. Curriculum developers can compare the instructor survey to the statewide results and identify areas where increased emphasis is required.

In addition to the duties and tasks, each Proficiency Guide contains the IWG inputs using the SCANS architecture. This information is entered as text data and provides individual "snapshots" of various workers in the broad occupational cluster as to how they perform SCANS skills as part of their employment. With this information in V-TECS DIRECT, keyword searches can be conducted which allows users to quickly locate information that has particular value to their application. Figure 2, page 14, shows a V-TECS DIRECT report for one of the SCANS Proficiencies for Metal Working Occupations. The protocol supports systematic review and updating/supplementing the "snapshots" to ensure continual improvement (TQM) of the guide.

Training Implications

The Indiana model discussed so far has specific application to the education and training community. The Proficiencies have been used as part of an Assessment Protocol to support scenario based assessments. The scenarios represent a real-time situation on the job and the person being assessed performs as if they were a real employee. The protocol, in its most ideal application, would be applied in school-to-work or youth apprenticeship situations where the assessment would be conducted as part of workplace-based training. Furthermore, several states as well as at least four other multi-state consortiums do similar work using similar processes. These authors believe that the results of these efforts could be used as a source for writing descriptions for the DOT/SOC effort.

Workforce Entry, Reentry, or Empowerment:

Several years ago Indiana established 16 Workforce Development Centers in their SDAs. Each Workforce Development Center has two counselors who were provided with a wide variety of training. The authors of this paper shared major responsibility for training the counselors in conducting occupational analysis, performing assessments based on employer demand, and counseling for employment security. This training used the standard V-TECS duty and task list to identify performance skills required by employers and possessed by potential employees. As a result, clients of the Workforce Development Centers were provided an opportunity to "match" their skills against those required by employers and, thus, to put them into a position of advantage when applying for a job.

In addition, the Workforce Development Centers provided a wide range of assessment from aptitude and interests to employability skills. The output of this service provided the opportunity for a client developed and maintained "portfolio" that could be used throughout life. This concept of "one-stop-shopping" has been reinforced recently through the provision of grants from the U.S. Department of Labor to selected states, Indiana included.

The occupational analysis training for the Workforce Development Center counselors included five days of classroom-type, hands-on instruction on the process of conducting occupational analysis and using computerized databases including V-TECS DIRECT. After these five days, the counselors spent two, four day (eight days total) on-site sessions conducting occupational analysis in various Indiana businesses and industries. These occupational analyses used V-TECS duty and task lists and included an analysis of the basic skills (reading, writing, speaking, listening, and mathematics) required to perform the tasks. The resulting report was suitable for establishing worker upgrade training and several of the businesses and industries used the reports in support of grant applications to the Indiana Department of Commerce for Workforce 2000 training grants.

The counselors have continued to conduct occupational analysis in business and industry. The authors believe that opportunity is lost when initiatives like this occur in the states and there is no vehicle to capture this information to analyze, review, and revise standard occupational definitions.

What This Means to the SOC Advisory Panel

The work described in the previous pages would not have occurred had the authors not had a strong experience base in working with the literacy and training needs of business and industry. The authors of this paper count over 150 specific instances where they have worked in an industrial setting with labor and management to identify training needs, to reconfigure job descriptions, to identify literacy skills required of the job, and to develop contextual and specific training for employers that would increase their competitiveness.

The purpose for describing the authors experience, particularly in Indiana, is to illustrate the results of using labor market information and of working in business and industry by members of the training community to better meet the work force supply needs of America. When unemployment was relatively high, the authors work addressed the issue of transferability of skills. When unemployment was relatively low, the focus was to train or retrain for better fits given technological changes. Under both conditions, the focus has been on working with employers to identify the need and working with training providers and placement agencies to meet these needs. Several other states have or are setting up processes similar to the one described in Indiana.

FIGURE 2
SAMPLE FROM V-TECS DIRECT OF AN INDIANA PROFICIENCY

ELEMENTS LIST

Occupation: 663 METAL WORKING OCCUPATIONS
Duty: A ALLOCATES TIME
Task: 001 Estimate each work order for total completion time.

PERFORMANCE OBJECTIVE

CONDITIONS FOR PERFORMANCE OF TASK

Resources: Identify, organize, plan and allocate resources. This includes understanding, preparing and following a schedule; preparing and following a budget; and allocating material, facility and human resources.

PERFORMANCE

Toolmakers estimate each work order for total completion time. The toolmaker is queried weekly by printout as to the percentage completed. If troubleshooting a down machine, you stay until the machine is up. If carry through is necessary, you communicate the status to the next shift.

STANDARD

Basic Skills:
1. Reading: Toolmakers read prints.
2. Writing: Toolmakers use the computer to convey to the next shift machine operating problems.
3. Mathematics: Toolmakers estimate machine time and percentage of work accomplished for the week.
4. Listening/Speaking: Toolmakers communicate with other shifts to maintain job efficiency.

Thinking Skills:
1. Creative Thinking: Toolmakers identify the cost efficient machining process for each job.
2. Decision Making: Toolmakers determine where to start each job.
3. Problem Solving: Toolmakers analyze problems step-by-step until solved.
4. Seeing Things in the Mind's Eye: Toolmakers think a step or two ahead of the machining process.
5. Knowing How to Learn: Toolmakers know where references are.
6. Reasoning: Toolmakers reason from references and prints.

Personal Qualities:
1. Responsibility: Toolmakers use lockouts and proper safety equipment.
2. Self-Esteem: Toolmakers take pride in their work.
3. Social: Toolmakers get along with their coworkers.
4. Self-Management: Toolmakers work on their own without supervision.
5. Integrity/Honesty: Toolmakers do unto others as they wish done upon themselves.

SOURCE

This proficiency was developed by an incumbent worker in the Metal Working Industry in Indiana. It reflects how that person performs within the culture and environment of their employer.

FINDINGS AND IMPLICATIONS

The First Task

The first task that the designers of the new SOC will have to face is determining the framework for separating out or classifying the various industries, occupations, clusters, and jobs that exist in the workplace. They will have to decide whether they will invent a totally new structure or build on what already exists. In our opinion, there is only one answer, and that is to build on what already exists. While a new structure might be nice, the cost in developing it from scratch would be prohibitive, not to mention the inconvenience to those who already use the current system. More importantly, it is our opinion that the existing systems are reasonably sound, the major fault being that there are too many. Consequently, we recommend that the new SOC become what it was supposed to be from day one: the crosswalk, or better yet, the single system that replaces all other occupational classification systems currently in place. To be more accurate, what we are recommending is that SOC become the system or framework for consolidating the OES survey-based matrix, OES survey occupational codes and titles, and the current census code. We think that there are good elements in each of these that could be condensed around the OES matrix to build one system with three to four levels of specification around some 600 occupational clusters organized under 12 to 14 major occupational families. We believe that the Prototype Skills Based Job Family Matrix is an excellent place to start as a framework. The classification systems used by the U.S. military and the federal government should be maintained since they serve highly specialized audiences.

Defining Occupational Skill Clusters

The most important issue to be faced in this endeavor is how to define the industrial or occupational clusters. Certain assumptions that are being thrown by several writers simply don't hold water out where the rubber meets the road. One such assumption is that all occupations can be reduced to some 17-20 occupational skill clusters in which people can be taught and certified as being competent. The facts are that all occupations can be easily grouped into about 10 - 20 occupational or industrial families, but to assume that meaningful instruction, training, and skills certification can occur at this level is simply not feasible or practical.

For the record, the vocational and technical education community has had this occupational cluster discussion for many years. In fact, the Office of Adult and Vocational Education, U. S. Department of Education had this same discussion about twenty years ago when Dr. Sidney Marland's Career Education concept was in vogue. His office conducted several research projects which resulted in the identification of some fifteen clusters. Today most state vocational agencies operate under six - eight broad program categories, as illustrated in Figure 3, page 16. These eight categories have their roots in the federal coding structure for reporting data on programs being operated within states. However, these six to eight categories do not assume that anyone is competent at a broad cluster level since this level is viewed as the point at which the "all about the industry" concepts are taught. Competence is taught and/or certified at an occupation cluster or occupational specialty level based on successful completion of a program or certificate examination (general to specific continuum needed for exploring occupations and becoming certified to enter, reenter, or become empowered in the workforce). This means that quality education and training resulting in meaningful certification of verifiable work based skills, does not begin to emerge until you reach the second or third tier of any given occupational classification system.

This is especially true when assessment and certification of competence is introduced into the equation as required in the 22 National Skill Standards Projects and as inferred in the School-to-Work Opportunities Act. Meaningful assessment and certification of work based competence cannot occur until one can clearly define an occupation in terms of work activities or skills or what one has to know and be able to do in the context of that occupational specialty, occupation or occupational cluster.

FIGURE 3
Typical Way of Organizing Vocational Technical Education
In Most States as Summarized by the American Vocational Association
In a Recent Brochure Describing this Enterprise

Areas of Study

The hundreds of programs available to vo-tech students usually fall into these eight major areas of study:

- Health occupations, such as nursing, medical and dental assistants and radiologic technicians.
- Business education, including accounting, office occupations and business management programs.
- Trade and industrial education, which imparts occupational skills in a range of trades, including auto mechanics, construction, manufacturing, graphic arts and cosmetology.
- Agriculture, including horticulture, agricultural mechanics and agribusiness.
- Marketing education, including general merchandising and the marketing of apparel and accessories, real estate and financial, business and personal services.
- Technology education, including engineering, architecture, drafting, electronic communications, graphic arts, biotechnology, and transportation.
- Home economics, which encompasses consumer and homemaking education as well as occupational fields such as food services and professional child care.
- Technical education, which involves instruction at the postsecondary level in a variety of technical occupational fields, such as communications, engineering-related technologies and computer sciences.

Source: American Vocational Association "Vocational Technical Education Today" (Brochure). (1994) Alexandria, Virginia, Page 3.

If there is one thing we have learned from our twenty plus years of experience in this business, and as illustrated in the Indiana example, is that work activities, duties, tasks, and skills have little meaning unless they are treated in the context of a given application and that application is normally within a group of jobs or occupations that are closely related. Without this rationale, meaningful analysis, research, and documentation cannot be provided with any degree of accuracy, reliability, or validity to meet, for example, the requirements of the Americans With Disabilities Act (ADA) as well as other applicable civil rights statutes. The flow must be from broad occupational clusters that provide a rationale for what follows and to allow for valid career exploration to a specific level that allows for meaningful certification. Several of the skill standards papers also support this contention. Kenneth Pearlman says it best when discussing the issue of whether we can go to a totally skills based system centered around basic and cross functional skills only. His conclusion is that we cannot because when we generalize at this level of definition, every occupation begins to look alike. He contends that we will have to have a system that has skill statements as well as generalizable work activities since it is the work activities that provide the occupational relatedness which is the element that creates the distinction in and among the various occupations.

The Need for Definitions and Relationships Within Occupational Families

Before meaningful work can begin on the SOC, its developers should arrive at a set of operational definitions to guide their work. For example, when the term "industry-wide" is used, one group will think of the construction industry, the electronics industry, or the manufacturing industry while another group will think of the residential construction industry or the commercial construction industry. To others residential or commercial construction are occupations or jobs while to others, occupations or jobs are roofer, painter, framer, etc. In arriving at definitions, you'll never find a set of definitions that everyone will totally agree with. Who cares? What is important is that the organization calling the shots has its own set of operational definitions for the conduct of its own dialog and its own work.

Thoughts About How Occupations Relate

Experience has also revealed that industry-wide clusters don't sort out as easily and as defensibly as do occupational clusters when assessment becomes the focal point. Admittedly, there are groupings of occupations that equal an industry. Industries play an important part in relation to the SOC data collection. We would have been lost without industry staffing patterns developed through the OES survey programs which provide a way for us to identify which occupations exist in which industries.

While some people might not consider the automotive service industry an occupational/skills cluster, the industry cannot employ people successfully under this industry wide concept. Its context or cluster is automotive service and repair with certification based on the identification and validation of competencies in a specialty area of the occupation or at a master technician's level given competence in all specialty areas. The pattern of certification used in this field permits a person to progress from a specialist to a master technician when they are competent in some 560 tasks that have been identified and validated by other master technicians nationwide; consequently, an ASE (Automotive Service Excellence) certified person in any of the areas listed is employable nationwide and is not tied to any one employer, automotive brand name or region of the country. Any occupational classification system that ignores training patterns and standards established by an industry will lead to utter confusion in that industry.

A redesigned occupational/skills cluster classification system, must make provisions within the occupational/skills cluster for the occupations that are represented in the major sub-divisions of the skilled occupation as defined by experts in the industry. As an example, the automobile technician occupation involves eight major sub-divisions, engine repair, automotive transmission, manual transmission and drive train, suspension and steering, brakes, electrical system, heating and air-conditioning, and engine performance. Persons work as specialists in one or more of these specialized areas and have a high level of mobility based on their level of competence and the needs of the workplace. In heating, air conditioning, and refrigeration, our V-TECS National Skill Standards Project business and industry partners tell us that their technicians work in the residential, light commercial, and commercial areas or they specialize in refrigeration or work as power engineers or operators in the large self-contained facilities.

What Analysis Processes Should Be Used

There is no one analysis process that will fit every occupational classification in every business or industry because of the way each business and/or industry is structured. First, it must be recognized that there are occupations which are structured in very linear patterns where one skill builds on another in an almost vertical or hierarchal pattern. Occupations such as the specialty areas in heating, air conditioning and refrigeration tend to fit this mold. These workers tend to diagnose system and address failures. They tend to install, maintain, repair, and operate highly technical systems. On the other hand, a person who

specializes in electronics has skills that are supportive to many occupational clusters such as HVAC, automotive, computer repair, manufacturing, etc. The same is true for administrative support type occupations.

Certain people want to write off many of the occupational and task analysis processes that have been used very successfully in the past. In their mind they try to draw a parallel between these approaches and Taylorism. They think that since task analysis results in very detailed information about task performance on a task by task basis, that each person will only perform one or two tasks in meaningless, low-paying jobs, such as those previously performed by many workers on an assembly line, or that they will pump gas instead of diagnosing the electrical or fuel system of an automobile. Nothing could be further from the truth. What occupational and task analysis provides is a total description of all aspects of an occupation. It provides the basics upon which the academic skills such as language arts, math, science, can be derived. V-TECS has even used a modified version of its occupational and task analysis process to identify and to validate a list of generic workplace skills by using business and industry in seventeen states to verify these skills. Occupational and task analysis does the best job of providing the documentation between training and work that is needed to develop reliable criterion referenced and performance based assessment vehicles. Without a good occupational and task analysis which defines what is done, you cannot identify the knowledge and skills involved to any degree of accuracy.

As far as this writer is concerned, the jury is still out on the value of the work being done by ACT under the direction of Dr. Robert Korte. In reading the documentation describing this work, there is little doubt that the processes being used are sound and will stand the test of good research and assessment techniques. However, even if the study proves what it has set out to achieve, which is very possible, the use of generalizable skill statements don't mean much unless they are written in the context of their actual application. V-TECS has learned this lesson through its experience with the Snyder Taxonomy of Essential Skills which is used as a tool to identify academic skills for each occupational area. On the one hand, the Taxonomy is a tremendous tool since it can be used as a crosswalk across occupations and as a vehicle for making judgements about what language, math and science skills are embedded in each occupation so that we can determine what the core skills are in an occupational cluster; however, the skill itself is not mastered until it is practiced in context. Saying someone needs "to be able to solve problems" isn't enough since this concept is practiced very differently in a manufacturing environment as compared to that of a service technician environment. In a manufacturing environment problem solving would be done as a part of a team. In a service environment an automotive, electronic or HVAC technician would most likely solve the problem alone following a specific diagnostic or decision tree process.

Once we know what goes on in the workplace someone has to translate the information into curriculum and assessment tools that insure effective training and certification of skills. Vocational-technical education state leaders, JTPA providers, local instructors, labor and industry trainers are the ones who have to do this. Our feeling is that when this type of information gets too general it magnifies the problems of delivering meaningful instruction and training, especially, when developing assessment and certification tools which will stand the legal test are included. That is why so many people buy into the competency or performance based instruction concept since it focuses on using criterion referenced assessment tools that are based on actual workbase activities and standards of performance. Our plea is to involve educators as much as possible and recognize the work that has already been done in this arena by organizations such as V-TECS, Mid-America Vocational Curriculum Consortium (MAVCC), National Occupational Competency Testing Institute (NOCTI), and the competency based instruction and assessment systems in the states of Oklahoma, Arkansas, Ohio, Kentucky, North Carolina, as well as several others. They have already crossed many of these bridges and much can be learned from their experiences; just ask ASE, EIF and NACFAM how valuable their input has been. These organizations

know who the real experts are in the conduct of this type of work since these people have spent their time doing it rather than philosophizing about it.

Clusters and Tasks are More Durable Than One Might Think Given Technological Changes

Technology changes but occupational/skills clusters are more durable than many might think. There were carpenters fifty years ago and there will be carpenters fifty years from now; however, they will perform their tasks with new materials and technologies which require different skills and knowledge. In the future, persons presently working in these occupational/skills clusters will probably still be employed in the same occupational family but will be required to obtain upgrade training on an on-going basis in order to stay current. Contrary to popular belief, the tasks that these workers will perform over time will not change that much if they are properly identified and verified to start with. What will change are the materials and technology that drive the processes, not the core tasks that are performed by workers. Another interesting fact about new job formulation is that there are not very many brand new jobs or occupations that emerge that are made up of totally new tasks. What generally happens is that already known skills from three to four existing technologies tend to merge. For example, robotics represents the merger of electronics, pneumatics, mechanics and hydraulics.

There is no question that all workers need higher level academic and workplace skills, however, our experience shows that the transportability and generalizability of these skills isn't as clear cut as some would lead us to believe it is. There is strong evidence to suggest that the basic skills, advanced academic skills and SCANS/Workplace Skills should be delivered as a base for all students whether they are college bound or work bound and then be reinforced in the context of the occupation they are to be applied in. These type of skills should become the backbone for a certificate of initial mastery or others such as Indiana's Certificate of Technical Achievement. This is the approach already being used by the state of Oregon and others, who are in the process of implementing CIM/CAM models.

The point of this discussion is that many people are rapidly buying into a philosophy that is based almost entirely on what is occurring in the manufacturing and big business sector of the economy when manufacturing constitutes less than 20% of the workforce and this percentage is still dropping, yet 47% of the current DOT is based on out-dated manufacturing jobs. While the manufacturing sector is moving to a more generalizable context, other sectors of the economy are not. In fact, many service technician jobs are becoming more and more specialized because of the impact of technology and the need for higher order skills. We need to realize that we are not dealing with a one size fits all world of work.

Implications of the Goals 2000 National Skill Standards Board for the SOC/DOT

The National Skill Standards Board (NSSB) has been charged with developing a system for clustering occupations. The following points have been extracted from the Goals 2000 legislation.

Section 502, Title V, spells out the purpose of the Board as follows:

> It is the purpose of this title to establish a National Skill Standards Board to serve as a catalyst in stimulating the development and adoption of a voluntary national system of skill standards and of assessment and certification of attainment of skill standards --
>
> (1) that will serve as a cornerstone of the national strategy to enhance workforce skills;
> (2) that will result in increased productivity, economic growth and American economic competitiveness; and

(3) that can be used in connection with civil rights laws --

Section 504 of Title V spells out the functions of the Board.

> ... the National Board shall identify broad clusters of major occupations that involve one (1) or more than one industry in the United States that share characteristics that are appropriate for the development of common skill standards.

To achieve this task, Congress set a deadline of December 31, 1995, for the National Skill Standards Board to identify those occupational clusters pursuant to Section 504(a) that would represent a substantial portion of the workforce for which the initial sets of skill standards for the clusters identified would be developed. Given this deadline and this provision, it is imperative that those working on the revised SOC, new DOT, and NSSB be on the same page regarding the framework to be used.

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."

To those of us who have spent several years doing this type of work, virtually every word in this definition has real meaning in terms of providing clarity for the task at hand. Under this definition skills become the derivative of a formal process of analyzing occupations which means there are at least two levels in the hierarchy of clusters within occupational families or industrial families. What this Law requires is that we look at occupations that group together based on their common work characteristics or skills as opposed to trying to create artificial groupings based on skill statements that have little meaning out of context.

Points of Concern

Some points of concern as we look to develop new concepts of a revised occupational/code structure:

- We need to be careful when we look at model classification systems from other countries. The work force in the United States is much more heterogeneous in terms of race, creed, original nationality, family structure and social attitudes than many of the European and Asian countries that we tend to make comparisons to. In this regard we need to be careful about trying to implement models that are much more limited in scope given that our country is much larger and much more diverse than most of the countries we are looking at. However, we do believe that the International and Canadian model have elements that could inform our process since they are more comprehensive and compatible to our needs than most of the systems used in other countries.

- Equal attention needs to be given to ALL SECTORS of the business and industry community particularly that of the small business sector where most of the new jobs are being created. These sectors are not as capable of investing heavily in training since they have very limited resources for this purpose; however, they do benefit significantly from occupational classification systems.

- No system of occupational/skills clusters can ignore industry employment trends or policies or the educational programs that prepare people for employment. There is little question that the number of low skilled production occupations and the number employed in them will continue to decline. There is little question that those occupations that the SOC developers should address

first should come from those industries and occupations with the largest numbers of skilled workers in the areas of greatest change due to the impact of technology.

What Classification System(s) Best Serve the Purpose of Grouping Occupations

To address the questions of what occupational classification system best serves as a base for the grouping of occupations using a skills based concept, several occupational classification systems were reviewed to gain a better grasp of what each system does or does not provide. This was necessary for these authors since we do not use the systems on a daily basis. To facilitate the process of focusing on each system, a format was developed which provides an extract of the major codes and titles that are representative of the various levels of each system. In addition, at least one breakout for each subdivision or tier was included to better illustrate the various levels included in each system. For each system the authors have provided comments regarding how useful each system has been or could be in terms of accurately defining occupations. Those systems reviewed include the following:

- Standard Occupational Classification (SOC)
- Occupational Employment Survey (OES)
  -- OES Survey-Based Matrix Occupational Codes and Titles
  -- OES Survey Occupational Codes and Titles
- Classification of Instructional Programs (CIP)
- Database of Occupational Titles (DOT) Content Model
- NOICC Master Crosswalk
- Prototype Skills-Based Job Family Matrix

STANDARD OCCUPATIONAL CLASSIFICATION (SOC) SYSTEM

The original purpose of the SOC was to serve as an umbrella for all other occupational classification systems. At best it has become a framework for crosswalking existing systems. The SOC could become a very useful system for creating occupational skill clusters if certain modifications were made. However it needs to be updated and many of its titles should be merged. A close examination of the next page illustrates why the issue of occupational classification is so complex as well as why industry-wide clusters using broad generalizable skills won't work given the vast number of occupational/job titles and the variety of settings in which work is performed. Figure 4 shows the major categorical titles for the SOC while Figure 5, page 23, provides an excerpt illustrating a sample set of sub-categories. The SOC contains a coding system and nomenclature that covers all occupations in which work is performed for pay or profit, including work performed in family operated enterprises where direct remuneration may not be made to family members.

The SOC is structured on a four-level system with 20 Divisions (plus military and miscellaneous), 58 Major Groups, 222 Minor Groups, and 538 Unit Groups. (Major groups, minor groups and unit groups are indicated by a two-, three-, or four-digit code respectively.) Each level represents groupings in successively finer detail which enables the user to tabulate or analyze data on different levels of aggregation. Residual categories are established, where necessary, at all levels to handle groups of occupations that do not warrant separate identification or do not fit into one of the specific groups.

FIGURE 4
Standard Occupational Classification (SOC) System

Major Code Number	Major Categorical Titles
11, 12, 13, 14	Executive, Administrative and Managerial Occupations
16	Engineers, Surveyors and Architects
17-18	Natural Scientist and Mathematicians
19, 20, 21	Social Science, Social Workers, Religious Workers and Lawyers
22, 23, 24, 25	Teachers, Librarians, Counselors
26, 27, 28	Health Diagnostic and Treating Practitioners
29, 30	Registered Nurses, Pharmacists, Dietitians Therapists, and Physicians Assistant
31, 32, 33, 34	Writers, Artists, Entertainers, Athletics
36	Health Technologists and Technicians
37, 38, 39	Technologists and Technician Except Health, Engineering and Science
40, 41, 42, 43, 44	Marketing and Sales Occupations
45, 46, 47	Administrative Support Occupations, including Clerical
50, 51, 52	Service Occupations
55, 56, 57, 58	Agricultural Forestry and Fishing Occupations
60, 61	Mechanics and Repairers
63, 64, 65	Construction and Extractive Occupations
67, 68,69	Precision and Production Occupations
71, 73, 74, 75, 76, 77, 78	Production Worker Occupations
81, 82, 83	Transportation and Material Moving Occupations
85, 86, 87	Handlers Equipment Cleaners Helpers and Launders
91	Military Occupations
99	Miscellaneous Occupations

FIGURE 5
Typical Listings Within a SOC Category

Precision Production Occupations	
67	SUPERVISORS; PRECISION PRODUCTION OCCUPATIONS
68	PRECISION PRODUCTION OCCUPATIONS
681-2	PRECISION METAL WORKERS
6811	Tool and Die Makers
6812	Precision Assemblers (Metal)
6813	Machinists
6814	Boilermakers
6816	Precision Grinders, Filers, and Tool Sharpeners
6817	Patternmakers and Model Makers (Metal)
6821	Lay-out Workers
6822	Precision Hand Molders and Shapers (Jewelers)
6823	Engravers
6824	Sheet Metal Workers
6829	Miscellaneous Precision Metal Workers
683	PRECISION WOODWORKERS
6831	Patternmakers and Model Makers, Wood
6832	Cabinet Makers and Bench Carpenters
6835	Furniture Finishers
6839	Miscellaneous Precision Woodworkers
684	PRECISION PRINTING OCCUPATIONS
6841	Precision Typesetters
6842	Precision Lithographers and Photoengraver
6844	Bookbinders
6849	Miscellaneous Precision Printing Occupations
685	PRECISION TEXTILE, APPAREL AND FURNISHINGS WORKERS
6852	Tailors and Dressmakers, Hand
6853	Upholsterers
6854	Shoemakers and Leather Workers Repairers
6855	Precision Laundering, Cleaning, and Dyeing Occupations
6856	Apparel and Fabric Patternmakers
6859	Miscellaneous Precision Apparel and Fabric Workers
686	PRECISION WORKERS; ASSORTED MATERIALS
6861	Precision Hand Molder sand Shapers (Except Jewelers)
6862	Precision Patternmakers, Lay-out Workers and Cutters
6863	Detail Design Painters and Decorators
6864	Optical Goods Workers
6865	Dental Laboratory Technicians
6866	Gem and Diamond Working Occupations
6867	Precision Electrical and Electronic Equipment Assemblers
6868	Photographic Process Workers
6869	Miscellaneous Precision Workers, Not Elsewhere Classified
687	PRECISION FOOD PRODUCTION OCCUPATIONS
6871	Butchers and Meat Cutters
6872	Bakers
6873	Matchmakers (Candymakers, Cheesemakers, Etc.)
6879	Miscellaneous Precision Food Workers
688	PRECISION INSPECTORS, TESTERS, AND RELATED WORKERS
6881	Precision Inspectors, Testers, and Graders
6882	Precision Adjusters and Calibrators

OCCUPATIONAL EMPLOYMENT SURVEY (OES)

Of the classification systems reviewed for this paper, the OES Matrix has the most to offer for the restructuring of the SOC since there are already crosswalks available through NOICC that show its relationship to the SOC, SIC, CIP, and the OES survey codes and titles. The OES is currently used to collect Labor Market information through the OES survey of employers as well as a base for the conduct of the census; consequently, it is the most current of all systems. Its focus on worker roles makes it very useful since some of the titles already being used do an excellent job of clustering like types of work from different industries together. Since it is basically an occupational titles classification system, it would be very useful in helping to bring the current SOC and DOT groupings down to a manageable number. Figure 6 illustrates the major OES Groupings, while Figure 7, page 25, provides breakouts for a typical sub set. Both the matrix codes which are used to report data and the survey codes which are used to collect data are illustrated. Some matrix occupations are matched to two or more OES survey occupations. This occurs where occupations were combined to form a single matrix occupation.

The OES tables contain a listing arranged in ascending numerical order of all eight-digit OES survey-based matrix codes with their five-digit OES survey equivalents. The first two digits of a survey-based matrix code indicate the broad occupational category, such as 10000000, Professional; 20000000, Managerial, or 70000000, Service. The third and fourth digits indicate a subdivision of the major group. Thus, 10200000 is Engineers, 10040000 is Lie and Physical Scientists, and 10200000, Teachers. The fifth and sixth digits indicate a specific Census occupational title or summary level title such as 10201000, Adult Education Teachers; 10202000, College and University Teachers, or 10203000, Elementary School Teachers. The final two digits indicate the specific OES occupation. Thus, 10202002 is College Teachers, 10202003 is Graduate Assistants, and 10202004 is Extension Service Specialists.

FIGURE 6
Occupational Employment Survey (OES) Major Grouping

Major Code Number	Title
00000000	Total, All Occupations
10000000	Professional, Technical and Kindred Occupations
20000000	Managers and Officials
30000000	Sales Clerks
40000000	Other Clerical Workers
50000000	Crafts and Kindred Workers
60000000	Operatives
70000000	Service Workers
80000000	Laborers Except Farm
90000000	Farmers and Farm Workers

FIGURE 7

CONVERSION TABLE: OES SURVEY-BASED MATRIX OCCUPATIONAL CODES AND TITLES
TO OES SURVEY OCCUPATIONAL CODES AND TITLES

MATRIX OCCUPATIONS		OES SURVEY OCCUPATIONS	
CODE	TITLE	CODE	TITLE
50060000	METAL WKG CRAFTS WKRS, EX		
50060200	BLACKSMITHS	55A20	BLACKSMITH
50060400	BOILERMAKERS	55A24	BOILERMAKER
50060600	HEAT TREATERS, ANNEALERS,	55J85	HEAT TREATER,ANNEALER
50060800	FORGE & HAMMER OPERATORS		
50060803	FORGING PRESS OPERATOR	55I94	FORGING PRESS OPERATOR
50060803	HAMMERSMITHS, OPEN DIE	55J70	HAMMERSMITH, OPEN DIE
50060804	HEADER OPERATORS	55J84	HEADER OPR
50061000	JOB & DIE SETTERS, METAL		
50061002	DIE SETTERS	55H69	DIE SETTER
50061003	MACHINE TOOL SETTERS, M	55L04	MA TOOL SETTER, METAL
50061005	SETTERS, MOLDING & CORE	55N94	SETTER MOLDING/COREMK
50061007	PUNCH PRESS SETTERS, ME	55R79	PUNCH-PRESS SETTERS, M
50061008	SHEAR &/OR SLITTER SET	55R81	SHEAR/SLITTER SETTER
50061009	SETTERS, PLASTIC MOLDING	55S28	SETTER, PLAST MOLD
50061200	MACHINING OCCUPATIONS		
50061202	LAYOUT MARKERS, METAL	55K61	LAY-OUT MARKER, METAL
50061206	MACHINISTS	55B84	MACHINIST
50061600	MILLWRIGHTS	55B95	MILLWRIGHT
50061800	MOLDERS, METAL		
50061801	METAL MOLD MAKERS	55L21	METAL MOLD MAKER
50061804	MOLDERS, BENCH &/OR FLO	55L57	MOLDER, MACHINE
50061805	MOLDERS, MACHINE(METAL)	55L62	MOLDER, PATTERN
5006180	MOLDERS, PATTERN	55P13	SHELL-MOLD-CORE MA O
50061808	SHELL MOLD/SH CORE MAC		
5006220	PATTERN & MODEL MAKERS		
50062202	PATTERNMAKERS, PLASTICS	55M06	PATTERNMAKER, PLASTIC
50062203	PATTERNMAKERS, METAL	55M09	PATTERNMAKER, METAL
50062204	PATTERNMAKERS, WOOD	55M10	PATTERNMAKER WOOD
50062206	PATTERNMAKERS, STONE	55M12	PATTERNMAKER, STONE CUT
50062209	MODEL &/OR MOLD MAKERS	55V10	MODEL AND/OR MOLD MK
50062400	ROLLERS & FINISHERS, METAL		
50062403	FORGING/STRAIGHTENING	55I95	FORGING/STRAIGHTENING
50062404	GUIDE SETTERS	55J68	GUIDE SETTER
50062407	MANIPULATORS, TABLE/BED	55R99	MANIPULATORS, TBL/BED OP
50062415	ROLLING MILL OPS/ATTEN	55N32	ROLLING-MILL OPR
		55V01	ROLLING MILL OP/ATTND
50062416	ROLLING MILL OPERATOR	55V02	ROLLING MILL OP HELP
50062600	SHEET METAL WORKERS	55C81	SHEET METAL WORKER
50063000	TOOLMAKERS & DIEMAKERS		
		55K21	INSTRUMENT MAKER
50063001	TOOL & DIE MAKERS	55D23	TOOL AND DIE MAKER
		55H66	DIE MAKER
50063003	DIE SINKERS	55H70	DIE SINKER

CLASSIFICATION OF INSTRUCTIONAL PROGRAMS (CIP)

One of the best classification systems for creating meaningful occupational clusters is not even an occupational classification system. It is the Classifications of Instructional Programs, developed by the National Center for Education Statistics, U. S. Department of Education. At first glance the typical reader would not agree with this contention; however, when the program titles that lead to employment through the traditional higher education/university degree route are stripped away, what is left is a set of codes and titles that with a few word changes rapidly becomes a structure for defining clusters using broad based occupational groupings. Those familiar with how the better vocational and technical education programs are actually operated know that these programs have always been organized around clusters of occupational titles. By looking at Figure 10 one can readily see how clusters can be easily formed at the four and/or six digit level. If you simply count the four digit codes for technical programs in the current CIP manual, you arrive at approximately 70 occupational clusters. If the six digit titles are used, the total falls between 150-160 titles. Figure 9 illustrates how descriptions are written for each code which provides excellent insight into what the programs are about.

The reason the CIP is so useful is that Dr. Robert Morgan and his fellow developers at NCES came to this task with very strong occupational education backgrounds. They also knew how important it was to make the codes and titles as occupationally descriptive as possible. They developed the CIP model after studying and borrowing from each of the existing structures described earlier in this paper. They also worked very closely with NOICC to insure compatibility which is best illustrated in the NOICC Units of Analysis Crosswalk. Another plus for the 1990 CIP is that it is reasonably current, consequently, it closely reflects the composition of today's world of work and can be easily modified as the world of work changes.

Another major advantage of the CIP is that it already contains much of the educational degree/certificate equivalency information built into its descriptions; consequently, a matrix could be easily created showing the traditional education and training requirements for all occupations from top management down through occupational titles that represent the basic threshold skills needed to enter any field at any point. The CIP is a very easy document to interpret since it has a six-digit, three-level structure representing a definite hierarchy in terms of broad to more specific titles. If further definition is needed, two digits could be added to the present six-digit structure to create an eight-digit structure which could include even more specific occupational or job titles represented within a cluster. This could be the DOT/SOC codes and titles. Please refer to Figures 10 and 11 for specific details regarding the major codes and titles for CIPs, typical sub-titles. Sample definitions for the four and six digit codes are shown at Figure 9. This is a very useful feature and should be incorporated into the SOC and Dot. While we do not expect the SOC Advisory Committee to use the CIP as its classification much can be gleaned form it in terms of structure, meaningful descriptions, and coherence between systems. Figure 12 illustrates how V-TECS relates its occupational task list to the CIP.

FIGURE 8
United States Department of Education
1990 Classification of Instructional Program Codes and Titles

Codes and Titles for All Program Groups		Codes and Titles Which Cover the Majority of the Occupational Program or Clusters that Would Likely Occur in a Skill Standards Environment	
01	Agricultural Business and Production	01	Agricultural Business and Production
02	Agricultural Science	02	Agricultural Science
03	Conservation and Renewable Natural Resources	03	Renewable and Natural Resources
04	Architectural and Related Programs		
05	Area Ethnic and Cultural Studies		
08	Marketing Operations/Marketing Distribution	08	Marketing and Distribution Occupations
09	Communications		
10	Communications Technologies	10	Communication Technology Occupations
11	Computer and Information Sciences	11	Computer and Information Sciences Occupations
12	Personal and Miscellaneous Services	12	Personal and Miscellaneous Occupations
13	Education		
14	Engineering		
15	Engineering - Related Technologies	15	Engineering and Engineering Related Technology
16	Foreign Languages and Literature		
19	Home Economics (*** Degree or Non-paid)		
20	Vocational Home Economics/Consumer and Homemaking Programs	20	Vocational Home Economics and Consumer Occupations
21	Technology Education/Industrial Arts		
22	Law and Legal Services	21	Technology Education
23	English and Literature/Letters		
24	Liberal Arts and Sciences, General Studies and Humanities		
25	Library Science		
26	Biological Science/Life Science		
27	Mathematics		
28	Reserve Officers Training Corps		
29	Military Technologies	29	Military Technology Occupations
30	Multi-Interdisciplinary Studies		
31	Parks Recreations Leisure and Fitness Studies	31	Parks, Recreations, Leisure & Fitness Occupations
32	Personal Improvement and Leisure Program/Basic Skills		
33	Citizenship Activities		
34	Health Related Knowledge and Skills		
35	Interpersonal and Social Skills		
36	Leisure and Recreational Activities		
37	Personal Awareness and Self-Improvement		
38	Philosophy and Religion		
39	Theological Studies and Religious Vocation		
40	Physical Sciences		
41	Science Technology	41	Science Technology Occupations
42	Psychology		
43	Protective Services	43	Protective and Legal Service Occupations
44	Public Administration and Science		
45	Social Science and History		
46	Construction Trades	46	Construction Trades
47	Mechanics and Repairs	47	Mechanics and Repairs
48	Precision Production Trades	48	Precision and Production Occupation
49	Transportation and Material Movers	49	Transportation and Material Movers
50	Visual and Performing Arts	50	Applied Art and Design Occupations
51	Health Professions and Related Services	51	Health Related Occupations
52	Business and Management and Administrative Services	52	Business Management and Admn Service Occupations
53	High School/Secondary Diploma Certificates		

Source: United States Department of Education. Classification of Instructional Programs. (1990). Washington, DC. Pages 1 - 48

FIGURE 9
Typical Descriptors for Each Code and Title from
The Classification of Instructional Programs

15.06		Industrial Production Technologies. A group of instructional program that prepare individuals to apply basic engineering principles and technical skills in support of engineers and other professionals engaged in developing and using industrial processes.
		. . . . .
*	15.0603	Industrial/Manufacturing Technology/Technician. An instructional program that prepares individuals to apply basic engineering principles and technical skills in support of engineers and other professionals engaged in developing and using industrial manufacturing system and processes. Includes instruction in design and prototype testing, instrument calibration, operational and maintenance procedures, operational diagnosis and repair, applications to specific system and products, and report preparation.
*	15.0607	Plastics Technology/Technician. An instructional program that prepares individuals to apply basic engineering principles and technical skills in support of engineers and other professionals engaged in developing and using industrial polymers. Includes instruction in the principles of macromolecular chemistry, polymerization and plastic manufacturing processes and equipment, design, and operational testing procedures, equipment maintenance and repair procedures, safety procedures, applications to specific products, and report preparation.
*	15.0611	Metallurgical Technology/Technician. An instructional program that prepares individuals to apply basic engineering principles and technical skills in support of engineers and metallurgists engaged in developing and using industrial metals and manufacturing processes. Includes instruction in principles of metallurgy, related manufacturing systems, laboratory techniques, testing and inspection procedures, instrument calibration, system and equipment maintenance and repair, applications to specific processes, and report preparation.
*	15.0699	Industrial Production Technologies/Technicians, Other. Any instructional program in industrial production and technologies not described above.

Source: United States Department of Education. Classification of Instructional Programs. (1990). Washington, DC. Pages 96-97.

FIGURE 10
Typical Sub Listings from the
Classification of Instructional Programs (CIP) *

15. ENGINEERING-RELATED TECHNOLOGIES

15.01 Architectural Engineering Technology

15.0101 Architectural Engineering Technology/Technician

15.02 Civil Engineering/Civil Technology

15.0201 Civil Engineering/Civil Technology/Technician

15.03 Electrical and Electronic Engineering-Related Technology

15.0301 Computer Engineering Technology/Technician
15.0303 Electrical, Electronic and communications Engineering Technology/Technician
15.0304 Laser and Optical Technology/Technician
15.0399 Electrical and Electronic Engineering-Related Technologies/Technicians, Other

15.04 Electromechanical Instrumentation and Maintenance Technology

15.0401 Biomedical Engineering-Related Technology/Technician
15.0402 Computer Maintenance Technology/Technician
15.0403 Electromechanical Technology/Technician
15.0404 Instrumentation Technology/Technician
15.0405 Robotics Technology/Technician
15.0499 Electromechanical Instrumentation and Maintenance Technologies/Technicians, Other

15.05 Environment Control Technologies

15.0501 Heating, Air Conditioning and Refrigeration Technology/Technician
15.0503 Energy Management and Systems Technology/Technician
15.0505 Solar Technology/Technician
15.0506 Water Quality and Wastewater Treatment Technology/Technician
15.0507 Environmental and Pollution Control Technology/Technician
15.0599 Environmental Control Technologies/Technicians, Other

15.06 Industrial Production Technologies

15.0603 Industrial/Manufacturing Technology/Technician
15.0607 Plastics Technology/Technician
15.0611 Metallurgical Technology/Technician
15.0699 Industrial Production Technologies/Technicians, Other

15.07 Quality Control and Safety Technologies

15.0701 Occupational Safety and Health Technology/Technician
15.0702 Quality Control Technology/Technician
15.0799 Quality Control and Safety Technologies/Technicians, Others

. . . . . (More listed, but not used)

Source: United States Department of Education. Classification of Instructional Programs. (1990). Washington, DC. Pages 15-16.

FIGURE 11
Typical Sub Listing from the
Classification of Instructional Programs (CIP)

47. MECHANICS AND REPAIRERS

47.06 Vehicle and Mobile Equipment Mechanics and Repairers

47.0603 Auto/Automotive Body Repairer
47.0604 Auto/Automotive Mechanic/Technician
47.0605 Diesel Engine Mechanic and Repairer
47.0606 Small Engine Mechanic and Repairer
47.0607 Aircraft Mechanic/Technician/Airframe
47.0608 Aircraft Mechanic/Technician, Powerplant
47.0609 Aviation Systems and Avionics Maintenance Technologies/Technician
47.0610 Bicycle Mechanic and REPAIRER
47.0611 Motorcycle Mechanic and REPAIRER
47.0699 Vehicle and Mobile Equipment Mechanics and Repairers, Other

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48. PRECISION PRODUCTION TRADES

48.01 Drafting

48.0101 Drafting, General
48.0102 Architectural Drafting
48.0103 Civil/Structural Drafting
48.0104 Electrical/Electronics Drafting
48.0105 Mechanical Drafting
48.0199 Drafting, Other

48.02 Graphic and Printing Equipment Operators

48.0201 Graphic and Printing Equipment Operator, General
48.0205 Mechanical Typesetter and Composer
48.0206 Lithographer and Platemaker
48.0208 Printing Press Operator
48.0211 Computer Typography and Composition Equipment Operator
48.0212 Desktop Publishing Equipment Operator
48.0299 Graphic and Printing Equipment Operators, Other

48.05 Precision Metal Workers

48.0501 Machinist/Machine Technologies
48.0503 Machine Shop Assistant
48.0506 Sheet Metal Worker
48.0507 Tool and Die Maker/Technologies
48.0508 Welder/Welding Technologies
48.0599 Precision Metal Workers, Other

49. TRANSPORTATION AND MATERIALS MOVING WORKERS

Source: United States Department of Education. Classification of Instructional Programs. (1990). Washington, DC. Pages 15-16.

FIGURE 12
Excerpts from the V-TECS Product Priority Matrix Using CIP Codes And Program/job Titles

1990 CIP	OCCUPATIONAL TITLE
15 ENGINEERING RELATED TECHNOLOGIES	
15.03	ELECTRICAL AND ELECTRONIC ENGINEERING RELATED TECHNOLOGY
15.0304	Laser System Technician
15.04	ELECTROMECHANICAL INSTRUMENTATION AND MAINTENANCE TECHN
15.0401	Biomedical Equipment Technology
15.0402	Computer Equipment Repair
15.0403	Electronic Mechanical Technician
15.0404	Instrument Repair Technician
15.0405	Robotics Technician
47 MECHANICS AND REPAIRER OCCUPATIONS	
47.03	INDUSTRIAL EQUIPMENT MAINTENANCE AND REPAIRER
47.0302	Heavy Equipment Mechanic
47.0303	Industrial Maintenance Mechanic
47.06	VEHICLE AND MOBILE EQUIPMENT MECHANICS AND REPAIRS
47.0603	Auto Body Repairer
47.0604	Auto Mechanic
47.0604	Diesel Engine Mechanic (Revision)
47.0604	Auto Mechanics: Suspension Systems, Brakes & Steering
47.0604	Auto Engine Performance Technician
47.0604	Auto Engine and Drive Train Technician
47.0604	Auto Air Conditioning and Electrical System Technician
47.0606	Small Engine Repairer
47.0608	Motorcycle Mechanic
48 PRECISION PRODUCTION TRADES OCCUPATIONS	
48.05	PRECISION METAL WORKERS
48.0503	Machine Tool Operation
48.0503	Computerized Numerical Control
48.0503	Machinist (Revision)
48.0506	Sheet Metal Worker (Revision)
48.0507	Tool and Die Maker
48.0508	Welder (Revision)

What Can We Learn From The Classification of Instructional Programs About Organizing Occupations

The set of titles shown have been derived by broadening the context of the Occupational Titles shown on the right side of Classification of Instructional Programs as illustrated in Figure 8, page 27. By making a few word changes and adding such terms as arts, finance, education and training, we have developed a schema that also allows for the inclusion of management and higher level clusters. It's interesting how closely this list parallels the prototype system developed for DOL using the Canadian model as a base.

CIP Codes	MODIFIED CIP TITLES
01, 02, 03	AGRICULTURAL, FORESTRY, NATURAL RESOURCE OCCUPATIONS
08	MARKETING AND DISTRIBUTIVE OCCUPATIONS
	PERSONAL SERVICE AND MISCELLANEOUS OCCUPATIONS
09, 10	ARTS AND COMMUNICATION OCCUPATIONS
14, 14, 15, 41	ENGINEERING AND SCIENCE RELATED OCCUPATIONS
08, 20, 31	HOSPITALITY AND TOURISM OCCUPATIONS
22, 43	PROTECTIVE AND LEGAL SERVICES OCCUPATIONS
46	CONSTRUCTION TRADES OCCUPATIONS
47	MECHANICS/TECHNICIANS, INSTALLERS, REPAIRER SERVICE OCCUPATIONS
48	PRECISION AND PRODUCTION OCCUPATIONS
49	TRANSPORTATION AND MATERIAL MOVING OCCUPATIONS
51	HEALTH OCCUPATIONS
44, 52	BUSINESS, FINANCE MANAGEMENT AND ADMINISTRATION
13	EDUCATION AND TRAINING OCCUPATIONS

To take this concept one step further, the following four-, six-, or eight-digit system could emerge whereby clusters could be developed for at least two levels under each family.

00.	Occupational Family/Industry	
00.00	Occupational Cluster/Programs	SOC LEVEL
00.0000	Occupational Specialties/Clusters/Skills	
00.000000	Occupational Job Titles	DOT LEVEL

This model covers every option with minimum duplication and allows for clusters to emerge at two or more tiers which is extremely important since level of specificity tends to vary based on the industry or occupation being reviewed. Each group could also be arranged or classified as follows:

Level 5	*CEO, Management Administration* - Advanced Degree
Level 4	*Suprvisor* - Basic Degree or Advanced Certificate
Level 3	*Master Technician/Journeyman Level* - Postsecondary Degree or Certificate
Level 2	*Specialist Level* - Postsecondary Certificate; Secondary Certificate; On-the-Job Training
Level 1	*Trainee Exit Level/Position Entry Level* - Secondary Diploma or Certificate of Mastery

DICTIONARY/DATABASE OF OCCUPATIONAL TITLES

Given that the decision has been made to design a Database of Occupational Titles (Figure 13, page 35) instead of revising the Dictionary of Occupational Titles, these authors have chosen to endorse the concept and simply comment on the importance of each element of the proposed data base rather than critique an out-of-date DOT. At V-TECS the DOT is used to assign codes to occupational analysis outcomes where applicable and meaningful. Since V-TECS has historically conducted occupational analysis around what it calls occupational domains or clusters, which are simply groupings of occupational job titles that are similar enough to serve as a solid and reliable research base. The DOT is used to indicate that a given V-TECS domain relates to certain DOTs; not as a concrete title to develop around. In the earlier years, V-TECS used the Vocational Preparation and Occupations (VPO), developed by the National Occupational Information Coordinating Committee (NOICC), as a primary source for crosswalking the Office of Education (OE) Codes and Titles and the Dictionary of Occupational Titles since it was already formatted to provide a direct crosswalk between these two code structures as well as across other coding structures such as SOC, OES, etc. Today V-TECS uses the VPO successor, the NOICC Master Crosswalk electronic database for the same purpose.

These authors totally support moving the DOT information to a database environment. The APDOT has done an outstanding job of thinking through the various elements and descriptors that should be included in the database; however, when each sub-descriptor is studied carefully, there appears to be some potential for overlap. Consequently, further consolidation should be seriously considered given the potential magnitude of this database.

Another thing very critical to the marketing and usability of this database is that it be developed around a software shell that treats each set of descriptors as independent elements so that each user can use as little or as much information in its DOT system as they need depending on how they intend to use the information. For instance, while we believe labor market information is very important, we don't use it on a daily basis to the degree we would worker aptitudes, work content, or outcome information. The worst thing you can do to a database of this importance is to try to satisfy everyone's needs to the degree that you overload its capabilities to the point that no one can use it. When you do so, you wind up satisfying no one since every element added means more disk space occupied with a direct slowdown in access time.

Using DOT Information

In the early 1980s, a CETA Part B grant was awarded to the Department of Agricultural and Extension Education, Michigan State University, to perform occupational analysis in five occupational areas. The Michigan Employment Security Commission, Occupational Analysis Field Center, was a partner in this project. Duty and task lists were fabricated using a combination of V-TECS data and the raw data collected for the Dictionary of Occupational Titles. ES202 employer lists were used by Field Center staff to survey employers. The results of the project were validated task lists made available to curriculum developers in both the Michigan labor and education environments.

A more important outcome of that work was the study of the Handbook of Occupational Keywords and how it related to the curriculum development process. The result was the development of the Michigan Occupational Data Analysis System (MODAS). The MODAS combined three databases: the V-TECS duty and task lists, the keywords in the HOOK Book, and the occupational characteristics information from the NOICC Master Crosswalks as derived from the DOT. Users of the system had several options:

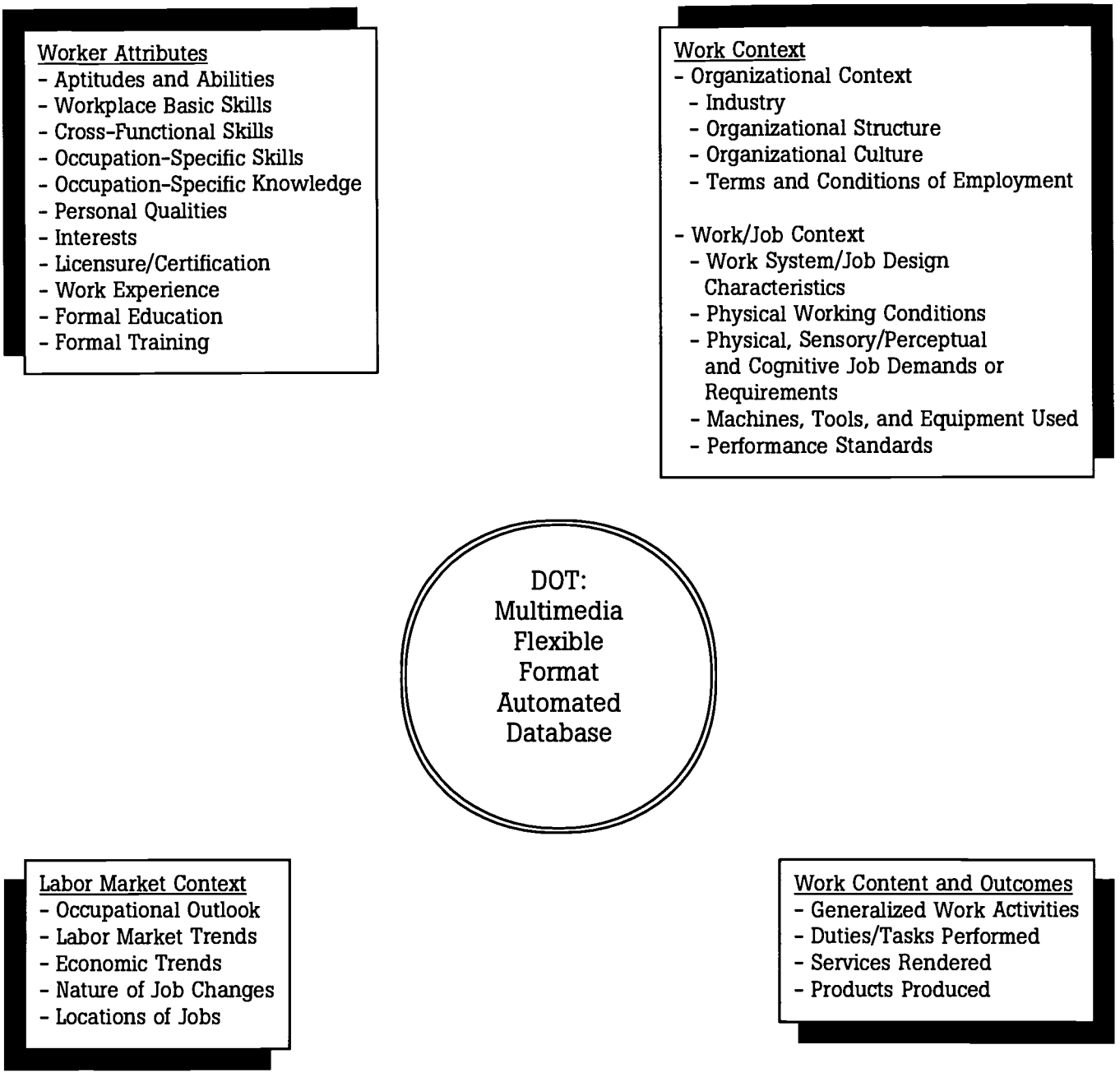
- Duty and task lists could be retrieved from the system using a modified CIP code as an identifier.
- Tool and equipment lists could be retrieved from the system using the same modified CIP code identifier.
- Searches could be made using "and" and "or" logic to identify tasks related to keywords or combinations of keywords.
- Reports from the Vocational Preparation and Occupations could be customized to meet the needs of various audiences such as vocational rehabilitation, special populations, etc.

This was a significant event for vocational education and others involved in the design of training programs. While the HOOK Book had been designed to be used by job developers and counselors to match people to work using the keywords rather than using DOT codes, MODAS took this a step further so that tasks associated with the keywords could be identified, reviewed, edited, and configured for an individual's needs. A person could use the keywords to help write a skill resume or an employer could use the keywords to write a job description. It is important to remember that the system was driven by keywords and not job titles. Descriptions were at the task level, not at the keyword level. Data associated with DOT titles for which the tasks were developed could be retrieved and reviewed in the context of the new configuration and used as appropriate.

We believe that the new DOT/SOC must rely on a taxonomy of terms to create descriptors and a computer based keyword concept to look at descriptors to identify common skills. This is the only way you can have a consistent language and deal with the transferability of skills across occupations. This is the only way you can create a skills based system and maximize on its purpose.

An element by element, side-by-side review of the proposed Database of Occupational Titles has been presented in a two column format for ease of review and to insure a direct correlation for each point discussed (Figure 14, page 36). We realize that every potential DOT user would rate each element differently given their perspective or purpose in using the information. Ours is from the perspective of a vocational and technical education training perspective.

FIGURE 13
The New DOT Content Model



Source: United States Department of Labor, Employment and Training Administrative Advisory Panel on the Dictionary of Occupational Titles. The New Dot: A Database of Occupational Titles for the Twenty First Century. (Final Report) 1993, Washington, DC. Page 32.

FIGURE 14
The DOT Content Model

DOT CONTENT MODEL

I. Worker Attributes

This section includes a series of descriptor categories related to the characteristics or qualifications that a worker brings to a job. The first five descriptors listed represent an approximate hierarchy or continuum of skills-related information (moving from general to increasingly specific levels of description and analysis) that is expected to provide a wide range of application options for users requiring skills information of different types and at different levels of specificity. It is expected that appropriate verification, elaboration and specification of these descriptor categories and their specific component elements will require further research.

DESCRIPTOR	CRITICALITY
Aptitudes and Abilities. The capacity to perform particular classes or categories of mental and physical functions; examples include: cognitive abilities (examples include: verbal, quantitative, abstract reasoning), spatial/perceptual abilities (examples include: spatial orientation and visualization, perceptual speed, flexibility and speed of closure), psychomotor abilities (examples include: arm, manual, and finger dexterity, eye-hand coordination), sensory abilities (examples include: vision, hearing, color discrimination) and physical abilities (examples include: static strength, dynamic strength, stamina, extent flexibility).	VERY IMPORTANT and should definitely be a part of the DOT. Selected data elements need to be more clearly defined. If things such as reasoning can't be better quantified than in the current DOT, just leave it out.
Workplace Basic Skills: Fundamental developed abilities that are required to at least some degree in virtually all jobs. Examples include: reading, writing and arithmetic or computational abilities. (These are included as a separate descriptor category because, although related to aptitudes and abilities, they include significant knowledge and learning components.)	VERY IMPORTANT. Things like reading, writing, arithmetic, need to be defined or quantified and made as contextual as possible. For example, write sentences is not near as descriptive as write sentences using technical terms.
Cross-Functional Skills. The various types of developed generic skills that are related to the performance of broad categories of work activity that tend to occur across relatively wide ranges of jobs. Examples include: information gathering, oral communication, problem analysis, negotiating, organizing and planning, coordinating with others and coaching or mentoring.	VERY IMPORTANT. Same comment as above. Descriptors need to be tied to functions. Problem analysis in one occupation is quite different than it is in another. In air conditioning, one person usually analyzes a failed component following a diagnostic process while in manufacturing problems may be solved by a team using a pre-determined problem solving process.

Occupation-Specific Knowledge. Understanding or awareness of, or familiarity with, the facts, principles, processes, methods, or techniques related to a particular subject area, discipline, trade, science, or art. Includes knowledge of foreign languages, computer programming languages and specific compute software packages or applications. Examples include: financial planning and analysis, fire protection systems, computer graphics, data communication networks, patent law, Spanish, COBOL, and spreadsheet software.	VERY IMPORTANT. Could be combined with or included in work content.
Personal Qualities. An individual's characteristic, habitual, or typical manner of thinking, feeling, behaving, or responding with respect to oneself, others, situations, or events. Examples include: self-esteem, sociability, responsibility and integrity/honesty.	MODERATELY IMPORTANT. This category could be included in workplace skills by using a set of slightly different descriptors.
Interests. Expressed affinity for performing particular types or categories or work tasks or activities, or applying particular types of skills. Examples include: realistic, investigative, artistic, social, enterprising and conventional.	MODERATELY IMPORTANT. Could be left out or incorporated into other descriptors that specify types of work. This is generally assumed to be part of analyzing one's background and should not necessarily be in this database since it is somewhat duplicated in other sections.
Licensure/Certification. The type of name of particular state licenses or professional or technical certification programs required for given jobs or possessed by an individual. Examples include: Board of Certified Safety Professionals (BCSP) certification; Certified Public Accountant (CPA); Registered Nurse licensure; American Production and Inventory Control Society (APICS) certification; and Academy of Certified Social Workers (ACSW) certification.	IMPORTANT now. Will become even more important as time goes on as more and more systems are in place to certify workers.
Work Experience. The type and amount of either paid job experience (acquired in regular full- or part-time employment, military jobs, paid apprenticeship, internship, or trainee positions) or unpaid job experience (acquired in volunteer or civic activities or in student work-study programs) required or characteristic of workers in a given job or possessed by an individual.	IMPORTANT but should be kept very brief and concise. Could be combined with licensure/certification information since these tend to require work experience as a part of the qualification criteria.
Formal Education. The type and amount of secondary school, vocational-technical school, college, or university education required or characteristic of workers in a given job or possessed by an individual.	IMPORTANT. Often closely related to licensure/certification and work experience.
Formal Training. The type and amount of learning or instruction, acquired through such means as apprenticeships, certification programs, military training programs, practicums and organization- or association-sponsored training programs (but outside of formal academic or educational settings) required or characteristic of workers in a given job or possessed by an individual.	Should have one category for formal education and training. As we move toward a skills environment, the distinction between degrees and certificates will tend to merge.

II. Work Context

This section includes descriptors for Organizational Context and Work/Job Context. Organizational context includes descriptors related primarily to the broader organizational system within which work is carried out. Work/Job Context includes descriptors related to the more immediate job context.

It should be noted that some of the descriptor categories and component elements listed in this section (more so than in other sections) are prone to vary as a function of the specific setting, location or type of organization in which a job is performed, and hence may not represent generalizable characteristics of a job or its context. APDOT's view is that this determination should be based on empirical job analysis. Such data can then be used to determine the most appropriate manner of treating such characteristics in a DOT occupational description.

ORGANIZATIONAL CONTEXT	
Industry. The major or defining activity or purpose of the establishments in which a given job is performed, such as defined in the Standard Industrial Classification (SIC) system. Examples from the current SIC include: Retail Trade, Finance, Insurance, Real Estate, and Health Services.	Use the Industry/Occupation Crosswalk Matrix to crosswalk occupations into industries.
Organizational Structure. Includes such elements as: • size of organization (examples include: number of employees, divisions, work units) • type of organization (examples include: non-profit, conglomerate, multinational) • degree of product or service diversity or specialization • mode of organizational structure and production control (examples include: hierarchial versus flat, centralized versus decentralized) • Reward structure (examples include: bases for wage and salary treatment, bases for performance and promotion evaluation)	VERY IMPORTANT. In some ways this category indirectly infers those things that tell people whether their interest match the place of employment.
Organizational Culture. Includes such elements as: • operating values/style (examples include: institutional fairness, employee involvement, open communication, customer focus, continuous learning environment, entrepreneurial, diversity, social responsibility) • strategic emphases (examples include: quality, speed of production, innovation, low cost, automation/technology infusion)	SAME COMMENT AS ABOVE. This again tells me whether I would be interested in an occupation based on my interest.
Terms and Conditions of Employment. Includes such elements as: • work schedule (examples include: hourly, shift work, daily) • type of compensation (examples include: salary, wages, fee-for-service, incentive or commission) • amount of compensation (examples include: ranges) • travel or relocation requirements • degree to which work is unionized • special clothing or uniform requirements	VERY IMPORTANT. However, the wages category will require a significant amount of upkeep.

WORK/JOB CONTENT	
Work System/Job Design Characteristics. The characteristic manner in which a given job is designed and work is organized, especially in relationship to other aspects of the organizational system of which the job is a part. (Note: The combination of many of these elements may be used to define what has come to be called a "high performance" workplace or organization, and hence may help to determine the degree to which it is appropriate to characterize a given organization or work setting in this manner.) Examples of such elements include: • degree of shared or interdependent task or job responsibility (examples include: team vs. individual organization of work) • degree and nature of interactions with technology • decision making and/or dollar accountability (examples include: degree of empowerment, autonomy or latitude for judgment) • degree to which job entails performance of a variety of tasks or use of a variety of skills • degree of task or job identify • skill or knowledge acquisition or maintenance demands (examples include: degree to which frequent or continuous learning is required) • nature of job impact (examples include: remote, indirect, contributory, shared, direct) • degree of job impact (examples include: sphere of influence, number of people affected) • degree of structure (examples include: presence of formal guidelines, policies or standard procedures) • pace or intensity of work • degree and duration of contact with others • scope and nature of communications or interactions with others • degree of stability or dynamism in work schedules, methods and procedures or job duties and responsibilities • degree and type of performance feedback available	VERY IMPORTANT. But tends to replicate some of the sub-descriptors shown under the other major descriptors in this category.
Physical Working Conditions. The nature of the immediate physical environment in which a job is performed. Includes such elements as: • the nature or type of work setting (examples include: indoor/outdoor) • type of work location (examples include: factory, office) • physical hazards present (examples include: chemicals, radiation, combustibles, etc.) • physical discomforts present (examples include: noise, vibration, odors, dust, fumes, etc.)	SAME COMMENT AS ABOVE.

Physical, Sensory/Perceptual and Cognitive Job Demands or Requirements. An occupation's characteristic type and degree of physical (examples include: standing, carrying, lifting, climbing, stooping), sensory/perceptual (examples include: color or auditory discrimination, depth perception) and cognitive (examples include: vigilance or information encoding, processing and retrieval) job demands.	VERY IMPORTANT to guidance counselors since you can't legally tell a disabled person they can't do a certain task or job but you can advise them that if they go into a given occupation they will have to lift objects weighing 150 lbs, or climb a ladder, which leaves the decision regarding degree of disability to the individual based on how they perceive themselves.
Machines, Tools and Equipment Used. Physical instruments or devices used to carry out or facilitate the completion of particular jobs, work activities or tasks. Examples include: printing press, electric hoist, bulldozer, milling machine, pneumatic hammer, tape measure, camera, photocopying machine, facsimile machine, laptop computer, radio transmitter and vide recorder.	VERY IMPORTANT.
Performance Standards. The nature of the production or quality criteria by which the work performed in a given job is typically judges or evaluated. Examples include: amount produced, quantity sold, error or defect rates and timeliness of production or service.	VERY IMPORTANT but is already reflected in other sections. Could also be tied to Products Produced by Adding to What Standard.
III. Work Content and Outcomes This section includes a series of descriptor categories related to the content of the work actually carried out by an individual and the outcomes resulting from this work.	
Generalized Work Activities. Aggregations of related duties or tasks into somewhat more general activity statements that do not include highly job-specific content. Examples include: writing technical reports, reading blueprints, preparing budgets and repairing electrical appliance.	IMPORTANT. Somewhat duplicative of what we define as cross-functional skills. Some of these can also be duties or task performed, given the context of discussion.
Duties/Tasks Performed. The specific work steps, elements, or activities performed in order to achieve a given work objective. Examples include: locate and repair leaks in pressurized cable, prepare written replies to customer inquiries or complaints and type and proofread statistical reports.	VERY IMPORTANT. If this section is developed properly, it will reveal a lot about basic skills, workplace skills, etc.
Services Rendered. The services provided by an individual or organization based on the work that individuals or work teams perform. Examples include: guidance and counseling, cleaning, teaching and medical testing.	REDUNDANT
Products Produced. The products designed, developed, made, or manufactured by an individual or organization based on the work that individuals or work teams complete. Examples include: automobile parts, compact discs and food products.	REDUNDANT. Section III Work Content and Outcomes could be combined with Section I and eliminate a lot of redundancy.

IV. Labor Market Context This section includes a series of descriptor categories related to the boarder economic and labor market setting in which jobs are performed, as well as information regarding how these factors affect given jobs. It is expected that the information comprising this category will not be obtained from the job analysis process used to gather data on individual jobs, but rather from linkages with other databases and information sources such as those developed by the U.S. Office of Personnel Management (OPM), Bureau of Labor Statistics (BLS), and the U.S. Department of Education	
Occupational Outlook. Information related to the future of the occupation, describing potential educational and occupational requirements and employment prospects. Examples include: BLS information on occupational outlook and OPM projections for future employment.	IMPORTANT
Labor Market Trends. Information related to current and future employment in specific occupations. Examples include: total employment for specific occupations.	IMPORTANT
Economic Trends. INFORMATION related to economic patterns that have implications for employment. Examples include: growth patterns by industry and/or occupation.	IMPORTANT
Nature of Job Changes. Information related to changes in occupations. Examples include: changes in employment, occupational requirements and industry.	Couldn't this be a part of the occupational outlook?
Locations of Jobs. Information related to location of occupations geographically or within the organization. Examples include: total employment of specific occupations by geographic area, organizational unit where occupation may be located such as printing department, audio visual department.	Could be covered in Section II under industry, or organizational structures.

NOICC MASTER CROSSWALKS

The NOICC Master Crosswalk is a computerized database that shows relationships among the five major occupational and educational classification systems used by the Federal government. The Crosswalk begins with the Dictionary of Occupational Titles (DOT), which is the common denominator used to link 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 of 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 (SOICs). NCSC maintains the NOICC Master Crosswalk and provides a range of products and services based on the Crosswalk and other Federal occupational and labor market information resources. NCSC is operated by the Iowa SOICC under a grant from NOICC.

In cooperation with NOICC and other Federal agencies, the National Crosswalk Service Center manages and updates the Master Crosswalk; provides technical assistance in its use; and answers requests for data and information. NCSC also services as a depository of computerized occupational and educational information resources, including:

- 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
- States depend very heavily on NOICC's and SOICC's; consequently, they need to be directly involved in this effort

PROTOTYPE SKILLS-BASED JOB FAMILY MATRIX

The new Prototype Skills-Based Job Family Matrix classification system groups different Occupational Employment Statistics (OES) occupations into skills-based job families, based on similarities in distinguishing work activity and level of preparation. By grouping narrow occupations into broader job families, this new structure is intended to expand the perspective of individuals searching for a job by encouraging them to look beyond their narrow occupation and industry to help them identify other jobs for which they may have transferable skills.

The prototype skills-based job family matrix reflects an effort to meet the current needs and demands of users of occupational data to focus on the skills components of jobs. The grouping of specific occupations with similar occupations, into broader job families, also reflects workplace changes occurring over the past two decades -- the broadening of job responsibilities and the blurring of demarcations between jobs.

Occupations are distributed within cells of the skills-based job family matrix, based on the associated level of required education, training or experience (vertical axis) and on the general field of training or work activity (horizontal axis). The matrix is organized by four "preparation levels" (plus one separate category for managers) and fourteen "distinguishing activity areas" or fields of work. There are 54 major matrix cells that contain employment, based on the OES survey.

Job Families

Each of the matrix cells is comprised of multiple, more specific job family groupings. Job families are groupings of one or more OES occupations with a similar level and field of prerequisite training or work experience, and within which a degree of occupational mobility is assumed. Some minimal retraining as well as on-the-job training may be required for individuals to effectively transition into a new job; however, occupations that require substantial specific preparation for entry into employment, such as engineering specialties, are maintained as separate job family groups. A total of 328 specific skills-based job families have been distinguished.

Preparation Levels

Five distinct preparation levels are defined according to the levels of education, training, or specific experience for entry into employment. These preparation levels, denoted on the vertical axis of the job family matrix, are very similar to the Canadian National Occupational Classification (NOC) "skill levels," and are listed below:

Level 0 -- This level covers mangers which normally requires a university education or substantial equivalent work experience.

Level 1 -- Four-year postsecondary or graduate degree is required.

Level 2 -- Two or three years of postsecondary education or training through a community college or technical institute; two to four years of apprenticeship training; or two to three years of specific work experience, on-the-job training, or training courses.

Level 3 -- High school degree preferred, as well as up to two years of on-the-job training, specific work experience, or training courses.

Level 4 -- High school degree not required; short work demonstration or on-the-job training.

The broad preparation level categories reflect general routes of entry for employment. These categories describe the average general education and training requirements for component OES occupations, rather than the range of individuals employed in these occupations.

Distinguishing Activity Areas

Distinguishing activity areas denote fields of work, knowledge, or preparation. The U.S. prototype matrix diverges further form the Canadian NOC system in delineating these groupings for two major reasons. First, some of the NOC cells (of which there are nine) seemed to be too broad. Second, some of the Canadian "skill types" are strongly reflective of internal labor markets within industries and firms. *To the extent possible, the distinguishing activities in the U.S. prototype matrix were formed in an effort to first reflect occupational skills that are transferable across industries, and then to categorize the remaining occupations that are unique to particular industries.*

The prototype skills-based job family matrix is comprised of the following fourteen distinguishing activity areas:

- Administrative, business, and financial occupations
- Natural and applied science occupations
- Health occupations
- Law, social science, and social and community service occupations
- Education, training, and instructional occupations
- Art, culture, and recreation occupations
- Sales and promotion occupations
- Protective service occupations
- Personal and commercial service occupations
- Construction and extractive occupations
- Transportation and material moving equipment operation occupations
- Agriculture and forestry occupations
- Mechanics, repairers, and precision craft occupations
- Manufacturing, processing, and plant and systems operations occupations

Source: Department of Labor: Prototype Skills-Based Job Family Matrix

NOICC PROTOTYPE UNITS OF ANALYSIS

While writing this paper, we were provided with the NOICC Prototype Units of Analysis. We have included excerpts of it here because we feel it best illustrates how the vocational and technical education and training community uses Labor Market Information to make decisions about which school-to-work programs to develop and what occupational titles might be addressed for a specific occupational cluster. The NOICC Units of Analysis crosswalks the five digit OES codes and titles used for gathering labor market information with the six-digit code or program titles of the Classification of Instructional Programs (CIP). The actual data being displayed are those employed, those needed for employment, and the growth or demand as compared to those trained or available for the workplace by educational levels (see Figure 15, page 46).

These data could be made even better given a revised Standard Occupational Classification System since different occupational clusters play out differently. For instance, we have selected three different clusters to illustrate the interpolation that has to be done now. Looking at Cluster 2260: Computer Systems, we see three different occupational titles being supplied by some twelve different program titles. For Cluster 2711: Tool and Die Making, we see a one-to-one-to-one match. For Cluster 2720: Metal Fabrication, we see one program title providing potential workers for eleven different occupational titles. This is not to argue that we should always have or will ever have a one-to-one match between work and preparation for work. However, it does illustrate the problems involved in trying to provide meaningful training programs based on current ways of collecting and reporting data. It also illustrates the excellent work being done by NOICC to solve the problems for the field that often goes unnoticed by many policymakers.

FIGURE 15
Extracts From NOICC Prototype Units of Analysis

OCCUPATION(*=ALLOC.)/PROGRAM (*=PART)		1992 EMPL	2005 EMPL	JOB OPENINGS GROWTH	JOB OPENINGS REPL.	JOB OPENINGS TOTAL	LESS THAN BA/BS	BA/BS	MA/MS	PH.D	FIRST PROF	TOTAL
CLUSTER: 2260 COMPUTER SYSTEMS												
DEMAND:												
25102	Systems Analysts and Computer Scientists	455,106	956,127	38,540	3,002	41,542						
25104	Computer Programmers	554,658	723,452	12,984	13,194	26,178						
25111	Programmers, Numerical Tool & Process Cont	7,202	7,784	45	136	181						
SUPPLY:												
11.0101	Computer & Information Sciences, General						5,371	16,070	7,022	667	0	29,130
11.0201	Computer Programming						7,643	445	71	0	0	8,159
11.0301	Data Processing Technology/Technician						5,461	288	76	0	0	5,825
11.0401	Information Sciences & Systems						1,853	3,634	1,214	22	0	6,723
11.0501	Computer Systems Analysis						126	279	73	6	0	484
11.0701	Computer Science						757	3,400	744	73	0	4,974
11.9999	Computer and Information Sciences, Other						5,992	839	399	7	0	7,237
52.1201	Mgt Info Systems & Business Data Processing						7,866	4,702	1,451	8	0	14,027
52.1202	Business Computer Programming/Programmer						5,012	30	0	0	0	5,042
52,1203	Business Systems Analysis and Design						285	72	0	0	0	357
52.1204	Business Systems Networking and Telecommuni						303	104	125	0	0	532
52.1299	Business Information & Data Processing Service						3,306	116	0	0	0	3,422
CLUSTER: 2711 TOOL AND DIE MAKING												
DEMAND:												
89102	Tool and Die Makers	137,564	128,204	0	3,691	3,691						
SUPPLY:												
48.0507	Tool and Die Maker/Technologies						615	1	0	0	0	616
CLUSTER: 2720 METAL FABRICATION												
DEMAND:												
*83000	Inspectors, Testers & Graders, Precision	35,386	26,320	0	790	790						
*87823	Sheet Metal Workers and Duct Installers	142,299	159,163	1,297	3,658	4,955						
*89198	All Other Precision Metal Workers	16,503	15,443	0	347	347						
91302	Punching Machine Setter & Set-Up Ops, Metal	45,093	37,604	0	964	964						
91321	Machine Forming Operators & Tenders, Metal/P	155,153	122,888	0	4,195	4,195						
*91399	All Other Machine Tool Cutters and Formers	51,362	45,615	0	1,103	1,103						
91714	Metal Fabricators, Structural Metal Products	45,057	45,249	15	807	822						
*92100	All Other Metal/Plastic Machine Setters/Ops	17,616	16,583	0	473	473						
93108	Fitters, Structural Metal, Precision	14,691	14,484	0	307	307						
*93196	All Other Precision Assemblers	4,643	4,727	6	99	105						
*93997	All Other Assemblers and Fabricators	103,589	82,413	0	1,740	1,740						
SUPPLY:												
48.0506	Sheet Metal Worker						1,447	0	0	0	0	1,447

CONCLUSIONS/RECOMMENDATIONS

The authors of this paper represent one aspect of the "supply side" of the labor market information community. In preparing for the task of writing this paper, they dutifully reviewed the literature that was made available to them. (See References). While the literature was very helpful for developing an understanding of the intricities of the classification systems most of the articles in the Proceedings document were written from the "demand side" perspective as to origin, development, purpose, and use of occupational information. Consequently, we have attempted to address the needs of the supply side in this paper.

The authors' purpose in presenting the Indiana Scenario as well as for providing the occupational skills cluster discussion was to present some of the needs of those who educate and train individuals for the workforce. The Indiana Scenario is a "real-time" situation and the issue of clusters is a real-life issue. In their daily work, the authors hear the ever increasing argument that the purpose of all education and training is to prepare people in the broader context so they will carry maximum flexibility to the workforce but the facts are that program completers and graduates will need work to fill positions because of the "fit" they bring to the workplace and that requires specialized preparation for their career choice.

In a recent address to the American Vocational Association Annual Legislative Seminar, the U.S. Secretary of Labor, Robert Rush, made the observation that we have approximately the same number of people looking for work that we have jobs available that can't be filled because of the mismatch between the skills these individuals have and the skills needed in the jobs that are going vacant. In this context it is ironic that on no less than three occasions in three different cities during the last three months we have been served lunch or dinner by individuals who openly stated they had just received degrees in English and were back in school pursuing a graduate degree or enrolled in a technical program in a community college or technical institute because there were no jobs for English majors other than in the field of teaching and working as a wait person paid more than teaching. Furthermore, it is relatively common knowledge in the education and training community nearly 30% of the students currently enrolled in postsecondary technical institutes or community colleges for at least the last five years already hold generic brand degrees in fields that have no employment potential.

Likewise, the authors have heard the arguments that there are many jobs, especially at the entry level or in a particular business or industry for which there are no directly related education and training programs. However, this does not negate the need for an accurate description of what the job entails. Training programs to supply the workforce were, perhaps, the first to use occupational analysis to better the fit between job applicant and the job. However, in today's world where Total Quality Management is the key, occupational analysis for jobs is critical to the quality process and this analysis is not unlike that used for training and, in fact, increasingly being used by the employer to train workers, in-house, for those jobs. Occupational and task analysis is nothing more than process analysis which is the backbone of analyzing problems in TQM.

The authors contend that those individuals who work on the supply side as well as those wanting to enter the workforce regardless of the employment level should know the job opportunities that are available and what they must do to qualify for them. Just as the person studying to be an Engineering

Technician, or a Heating, Ventilation, and Air Conditioning Technician should know what they must be able to do to be employed, the "English" major should also know what they must do to be employed. The importance of systematic and consistent occupational analysis does not increase nor diminish with the nature of the job or the preparation required of the job.

As the need for sound labor market information has become more critical to those on the supply side, it has placed those who help supply the talent for the labor market into the role of a customer for the services of those on the demand side. Conversely, as educational programs do more to improve the supply side, those on the demand side became "customer" for these services.

The originators of the original California Crosswalk and the Vocational Preparation and Occupations recognized a need for the customers on both sides to be able to communicate with their suppliers. The current NOICC Master Crosswalk continues this tradition and provides a very useful service, especially from the authors' point of view, to enable workforce entrants/participants striving to become employed, reemployed or more productive ("Future use of the SOC," Drayse et. al., p.52, Proceedings of the International Occupational Classification Conference, USDOL-BLS, September 1993, Report 833) to achieve their goals. A revised SOC that collapsed the other major classification systems into it would make it much easier for NOICC to perform these functions.

V-TECS has had to address the customer/supplier issue in the delivery of products and services. In this endeavor, it has become important to the organization to adopt a Total Quality Management model. The Indiana Scenario, likewise, describes protocols to develop proficiencies and to permit assessments that meet their customer's needs, which, in Indiana's case, is clearly the employer. Protocols such as those used in TQM by V-TECS and Indiana require a process to be clearly identified, the development of control characteristics to permit monitoring to ensure the process is being completed in compliance with the protocol. If it isn't, provision is made for corrective action and continuous improvement.

FIGURE 16
Indiana Essential Skills and Technical Proficiencies
TQM Process Control Plan
Indiana Assessment Development and Administration Protocols

Process	Process Control	Key Characteristics or Benchmarks	Root-Cause Analysis	Corrective Action	Continuous Improvement
Process includes the tasks to develop and administer assessments to report technical proficiency and to award Certificates of Technical Achievement.	Process Control includes the steps to achieve the process.	Key Characteristics or Benchmarks are the observable evidence that will be accepted as proof that the process has been followed.	After the process has been completed and evaluated, Root-Cause Analysis can be used to examine those elements that have not met the Key Characteristics or Benchmarks.	Corrective Action is the plan to achieve the Benchmarks as required of the process based upon the results of root-cause analysis.	Continuous Improvement includes any changes to Process, Process Control, or the Key Characteristics/ Benchmarks determined necessary through Root-Cause Analysis.

Germane to this discussion, is the protocol that V-TECS uses, (The V-TECS Technical Reference Handbook for Product Development) for performing occupational analysis to define occupations (reports of the duties, tasks, tools and equipment, steps, and standard for the domain or occupational titles) and other V-TECS products. The protocol for conducting occupational analysis is rooted in the Dictionary of Occupational Titles for identification of the jobs being analyzed or studied. The original protocol was adapted from the U.S. Air Force Industrial System (ISD) Design Model and has been applied equally to all occupations whether they be in the service or manufacturing sectors. The protocol allows for several DOT or occupational titles to be treated in one occupational cluster. For example, the Machine Tool Operations catalog reports as duties the various machines and as tasks, the procedure for operating those machines. Developers of the Machine Tool Operations catalog had to make a decision whether or not to comply with the protocol as there are more than five machines in most shops and the DOT treats each machine as a separate job description sometimes expanding this to develop separate descriptions for "helper" or "apprentice." The authors' experience in this industry, however, shows "entry" level workers begin mastering one machine and pay and promotion reflects the number of machines they can master and operate. The first machine they learn can vary from employer to employer. The process is constant, however, in that they begin on one machine, master other machines, and become a master machinist or supervisor when they have mastered all the machines in a given work environment.

The V-TECS data elements accurately reflect this reality by identifying tasks required to operate all machines and includes the core tasks in areas such as benchwork and using measurement instruments. Even following the protocol limit of five DOTs, the final product was still able to be an accurate reflection of real-time practices in industry.

By contrast, in the service sector, the conditions of employment are different but the protocol for analysis is the same. In the health field, there is an occupational analysis for "Nursing Assistant" which is also a DOT title (Nurse Assistant). It treats that occupation the same as the Machine Tool Operations catalog treats the occupation of "machinist." The amount of content varies in each catalog.

Indiana added the SCANS architecture to the V-TECS occupational analysis process. Had the SCANS technology been available and applied ala Indiana when the Machine Tool Operations and the Nursing Assistant catalogs were originally developed by V-TECS' member states, there would be duties and tasks that would legitimately fall into the broad SCANS categories of Resources, Information, Interpersonal Skills, Systems and Technology. SCANS has permitted the transferability of skill at some level of specificity and has provided the means by which workers can pursue career ladders which, increasingly apparent in today's world, are probably with a different employer.

The authors offer the following as conclusions based on our observations:

1. An occupational analysis protocol should be developed that allows for the continual flow of new and fresh information into the new DOT Content model. If a consistent protocol was developed, such as the one currently being used in the Indiana Proficiency Panel Initiative and with the Indiana Workforce Development Centers, an information exchange could be arranged to permit the database to be fed from a variety of sources outside of the typical governmental agency units. Such a protocol would have to follow precepts of Total Quality Management in order for the exchanged data to have validity and reliability.

2. A common language should be adopted for the collection of data that is to be used to define the occupational titles included in the database. The authors recommend a combination of a duty/task or work activities approach along with a description of the skills which can be organized using the

SCANS competency framework. This would be supplemented with data sets drawn from the APDOT process which would be applied equally to those performing analysis to identify jobs on the demand side and to those developing training on the supply side. The SOC and DOT should have a format for reporting out this information that follows the key concepts contained in the CIP.

3. A consistent occupational structure should be developed to maintain the integrity of the customer/supplier relationship between the various agencies that collect, report, and use labor market data. This structure can be modeled after existing structures but should be hierarchical as follows:

Numbering	Name of Occupational Field	Example
00.	Family/Industry	Creative Arts
00.00	Cluster/Programs	Architecture Cluster
00.0000	Specialties/Clusters/Skills	Landscape Architecture
00.000000	Job Titles	Landscape Architects

Examples taken from NOICC Units of Analysis/

It is critical from the supply side of the equation that if we, as the customer of the demand side, are to be able to be effective in our role, we need to have as close a match as possible at the occupational level. Even when considering the argument that education should be broader based and permit flexibility on the part of the student, educators must be able to draw curricular, counseling, and placement conclusions at the occupational title or cluster level.

It is also critical from the supply side that as we respond to the Total Quality Management models currently used in business and industry (including the manufacturing and service sector) that the process be consistent, the classification scheme be consistent, and the collection and reporting procedures be consistent, to maximize the value of the information on both sides of the supply/demand equation.

Conclusions

The authors originally felt a duty to array their conclusions against the 12 Principles of Classification as reported in "The 1980 Standard Occupational Classification" by MacDonald, et. al., p. 16. (Proceedings of the International Occupational Classification Conference, USDOL, BLS, September 1993, Report 833) The article reports that "These principles were the result of trying to accommodate the diverse needs of the occupational information user community." It is not our intent to criticize the 1980 SOC but a reader of the article will find little or no discussion relating to the needs of the supply side as represented by discussion of the Office of Education coding structures used in education and training. Besides, our expertise is not in classification principles but, rather, in how the information is used on the supply side, primarily in the vocational-technical education community.

Rather than address the Principles of Classification, the authors have used the questions at the beginning of this paper as a framework and presenting our conclusions which are based upon our research and supply-side experience in both the vocational-technical education community as well as having worked with business and industry to determine what people do and what skills they need to do it.

Structure Questions:

1. What do the existing classification systems have to offer this endeavor?

The authors feel that the existing classification systems can make a substantial contribution to this initiative to revise the SOC. People who use and report labor market information from both the supply and demand sides have gained valuable experience and insights into what the future system should include and how it should be structured. It would be folly to ignore this and begin to develop a revised system from scratch. However, conditions have changed. We are moving towards total quality management systems, a workforce that needs to be empowered to be employed, reemployed and to be more productive. This means that the revised system needs to be responsive to a variety of agencies and organizations who work in this area in order to capture information that is current and fresh.

2. What should be the relationship between the occupational clusters and the occupational analysis system(s) and data collection system(s) that will redefine the new Database of Occupational Titles, Standard Occupational Classification System, and the National Skill Standards Board?

The authors contend that a system can be designed that, using a hierarchy from general to specific perhaps with four levels (but not necessarily limited to four levels) will account for current and future occupational structures and will provide satisfactory information for customers of the data. We feel that the Prototype Matrix is one such framework but also feel the twenty headers now used in the SOC are probably as definable as the fourteen used in the Prototype.

It may be that there will need to be some bureaucratic fence mending or even fence removal to achieve this goal. As business and industry have moved from the traditional Taylor model of organization to one in which the workforce is empowered, the authors suggest that the agencies and organizations that collect, report, and use labor market information adopt a more empowered model, remove the barriers, and encourage the flow of information in a flatter environment and with more lateral movement.

3. How many occupational clusters will ensure coverage of the world of work?

The answer to this questions is not easy. The authors have discussed the various clustering models and the variance in the total number of clusters. The authors recommend that a scheme such as the Prototype Skills Based Job Family Matrix or the work that NOICC is doing on the superclusters and units of analysis be carefully reviewed in the spirit of the discussion in question #2 above. The authors feel that much of the discussion on the number of clusters is driven by "turf issues" and should be resolved in a more collegial and scientific manner by those agencies involved.

4. Should the SOC occupational clusters be developed using a supply/demand (economic) base or a skills/work activity approach?

The authors would like to cite the Drayse, et. al., article on the "Future Use of the SOC" in the Proceedings of the International Classification Conference (USDOL, BLS, September 1993, Report 833, p.48) because it expresses very well our feelings about this questions:

> A primary test of the usefulness of occupational information is its power to provide a plausible, grounded account of the actual experience of workers. Just as a job should connect an individual's activities with a larger group of workers and their activities, and that in turn

> with the output of a product or service that is valued by a changing society, a useful description of that job should reflect significant characteristics of the worker, the activity, linked activities of other workers, and processes of change. Since the labor market is not in equilibrium, descriptions of constant and established factors offer good but only partial insight; in effect, a snapshot in time. The dynamic relationships among occupations, and between occupations and changes in demographics, production processes and markets, make it necessary to continuously incorporate fresh information into occupational classification systems.

The authors strongly encourage a "work activity and skills combination" approach. It is the authors' experience that this approach works best when developing curriculum and training programs, assessing the skills of the workforce, developing employer based training programs, and providing counseling and placement services to those entering employment, seeking reemployment or trying to become more productive in ways such as advancing along a career ladder.

This does not negate the importance of some of the economic issues. For example, enrollments in vocational-technical education training programs are an indicator of the economic condition of the community or other geographical region. However, enrollment data does not help with developing curriculum for the customer of vocational-technical education training programs or from the employer. The authors feel that a consistent and systematic process to identify and report the activities of the workplace will best serve the needs of the supply side.

Use Questions:

1. **How does the vocational-technical education and training community use this type of information?**

In the "Background and Purpose" section the authors have provided the Indiana Scenario. The authors felt this was appropriate since Indiana is a state that is committed to many of the current initiatives faced by all states (school-to-work, one-stop shopping, skill standards, content standards, certification of skills, etc.)

In a separate action, the Executive Committee of the V-TECS Board of Directors was presented a proposal in February which addresses many of the issues in this paper. It was recommended that the NOICC Units of Analysis be considered as the scheme for identifying occupational clusters. Since then, the authors have been provided with the most current work being done on the Units of Analysis by the NOICC staff which further enhances the value of the recommendation. It is envisioned that the Units of Analysis as used in the state Career Information Delivery Systems (CIDS) will provide a valuable tool permitting multi-state surveys of the activities of incumbent workers in various occupations. The recommendation is that such surveys be conducted in a manner similar to the Indiana protocol or that of the better National Skill Standards Projects. By using the Units of Analysis, planning can be done to identify areas for analysis and enhance the placement opportunities of program completers or graduates.

As Indiana works to develop school-to-work programs (initially in plastics manufacturing) direct linkages to specific employers will use the protocol to identify the training needs, write training contracts, identify related instruction, and provide for the articulation of secondary students into postsecondary instruction with continuous employment under the apprenticeship system.

With the introduction of one-stop-shopping grants and the use of various certifying systems (certificates of initial mastery, certificates of technical achievement, portfolio systems, etc.) it is important that job

titles and job analysis be consistent. Indiana's "open transcripts" will depend on consistent analysis, assessment, and reporting.

Indiana and seven other Great Lakes States (Minnesota, Wisconsin, Illinois, Michigan, Ohio, Pennsylvania, and New York) have entered into a contract to develop and promote the economic welfare of the region. One of the concepts of the "Great Lakes Guarantee" is that the workforce be transportable among the Great Lakes States. This, again, will require a consistent occupational analysis, assessment, and reporting process. In a world economy where the United States economic competitiveness is an issue, it would appear there is high value in a nationwide system.

It can be concluded that the vocational-technical education and school-to-work community are almost at an embryonic stage in use of labor market information and the discussion for this question outlines some of the potential uses in the foreseeable future.

2. How can the DOT and SOC be used for statistical and planning purposes for the education and training environment as well as other users?

If the hierarchy suggested previously can be implemented, the SOC will be a more general category of related DOT. DOT data can be aggregated to the SOC level. By collecting and reporting data, vocational-technical education and training providers in the supply side will provide the information required to develop relevant programs for the current workforce.

The following data sets should be considered to maintain a SOC information base for vocational-technical education and school-to-work curriculum developers, planners, and counselors:

Employment data:

Historical employment (currently 1984 levels)
Current employment (1995)
Average annual job openings (growth + replacement)
Hourly wages
Some form of a SVP

Supply Data
(Enrollments by Occupational Cluster)
Secondary
2 Year Postsecondary
College University
Adult Secondary
Proprietary
Apprenticeship
Military
Other

The authors realize that the SVP doesn't have much stock with the current DOT and SOC developers, however, we believe the concept behind the SVP is important since it provides clues as to the structure of career ladders. Training time is probably a reasonably accurate descriptor since it considers both school based and work based preparation. The SVP concept should be modified to recognize the following five levels:

Level 5	CEO, Management Administration, Advanced Degree
Level 4	Supervisor, Basic Degree, Advanced Professional Certificate
Level 3	Master Technician/Journeyman Level, Postsecondary Degree of Certificate
Level 2	Specialist Level, Postsecondary Certificate, Secondary Certificate, On-the-job Training
Level 1	Trainee Exit Level, Position Entry Level, Secondary Diploma of Certificate of Mastery

The authors question the value of the General Education Development (GED) in its current form since it is difficult to measure given the current workforce data has become skewed with the increase of overly

qualified people in jobs. It would be better to describe GED with concrete examples using the Foundation Skills Architecture of SCANS.

The authors also question the current DOT Physical Requirements and Environmental Conditions information as it tends to be too specific in the modern workplace where the organization of tasks should be flexible so as to increase the competitiveness of the industry in a world marketplace and where career ladders encourage the improvement of skills and movement from one employer or industry to another. However, it is important to know when a given occupation places extreme demands on individuals in terms of physical or environmental conditions. While a counselor cannot tell a client who is confined to a wheel chair that he or she cannot do something because the job requires them to lift 200 lbs, the counselor can provide this information for the individual and they can decide whether there is a fit based on their own analysis of their abilities against documented criteria.

One of the problems vocational-technical education and other training providers have experienced is that their programs tend to be static and not responsive to the fluctuations of the labor market. This is due in part to the traditional approaches we have taken to developing curriculum. It is expensive, traditionally hard copy, and once implemented, many instructors are reluctant to change. However, this problem is exacerbated by the inability of vocational-technical education to locate and use labor market information. This is as much the fault of the supply side as it is with the demand side. However, if the barriers between agencies can be removed, a tremendous advantage will be realized on the training side to make programs more dynamic to the needs of the customer, the employer. The future DOT and SOC are going to have to accommodate the needs of all users and with the introduction of one-stop, school-to-work and other initiatives, it is going to be important that the data in the labor market data base, both supply and demand be compatible. Maintaining the status quo relationships will only perpetuate the problems we are already experiencing.

3. **How can a properly designed system be used as a framework for certifying workers in their various industry or occupational specialties?**

Indiana's Certificate of Technical Achievement will look similar to a portfolio. It could be a three-ring notebook with pages inserted or removed as appropriate. It will be an owner-managed portfolio and will contain assessment results and other information a person may wish to include as a collection of pertinent documents representing their qualifications and achievements relative to employment, including work performance scenarios.

Such a system in the one-stop environment and given the regional considerations of the Great Lakes Guarantee (or any other regional consortium) will depend on a consistent method for documenting proficiency, skill attainment, etc. As a portfolio owner seeks employment, reemployment or to become more productive through progress in a career ladder, a consistent reporting system using a consistent set of titles will be crucial to enabling the counselor, placement officer, or participant identify jobs where there is a satisfactory "fit." In Indiana, certification is done at the duty/task level and within the SCANS architecture. SCANS performance will be framed in the actual duties and tasks performed and will be contextual to an employer and/or industry. The system must be properly designed in order to afford these opportunities to the user (employment seeker).

4. **How can the concept of a skills taxonomy be used as a common language for building clusters as well as for identifying common or transportable skills that cut across industry families/occupational clusters/specific occupations as well as geographic boundaries?**

The authors have extensive experience in setting up and implementing a model to identify the literacy skills found in the workplace. They used the GED definitions found in the DOT as well as from other sources to develop a set of literacy skills. These skills were placed into a matrix and were coded to jobs and to an assessment of people in the workplace. The discrepancy between the people assessment and the job assessment was used to identify training needs.

The authors experience revealed that a consistent set of skills could be used in a variety of work environments and on a variety of jobs. V-TECS has a Basic/Essential Skills Taxonomy developed by Lester M. Snyder, Jr. at Arizona State University which could be used to craft a consistent set of academic skills that could be applied across occupational levels. Once a skill has been identified and verified as relevant to the workplace and is not redundant to another skill, it could be added to the database. In this way, at the skill level, occupations could be described in a common language. This does not preclude the possibility that a contextual qualifier couldn't be added to the basic skill.

In Indiana, the SCANS architecture is used as the common language for competencies or activities in the areas of Resources, Information, Interpersonal Skills, Systems and Technology. The SCANS competencies are described using the foundation basic and thinking skills. It is the intent of this system that at this level the skills become transportable. It matters not if someone reads a blueprint of a machine part or of a house plan. Reading the blueprint is the skill and the "machine part" or "house plan" is the context. The skill is transportable even if there is some minor adjustment to be made (i.e., metrics, scale, CAD, format, etc.).

The Indiana system allows for articulation by reporting duties, tasks, SCANS competencies and foundation skills. This common language allows employers to see in real-time language what the person knows and is able to do and, even though the person's specific experience may not be exactly what the employer is looking for, the employer has information in which judgments can be made on the transportability of the skills.

EPILOGUE

Our observations have been focused by our bias for the supply sector. We admit to being idealistic but we feel that in a collegial environment, the traditional barriers to a common classification structure between and among agencies collecting, reporting and using occupational information can be minimized. This is critical if we are to build a world class system that will open doors in the future rather than close them to all but the most specialized users of labor market and occupational information.

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* These Skill Standards Articles are especially critical to this discussion since they provide far more detail and insight than could be contained in a paper of this length and type.

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