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APPLICATIONS OF THE DACUM OCCUPATIONAL ANALYSIS METHODOLOGY TO HEALTH OCCUPATIONS EDUCATION

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Abstract: Addressed in this article is the potential value of the "Developing a Curriculum" occupational analysis methodology in curriculum development for health occupations education programs. Basically a workshop approach to the identification of occupational duties and tasks, this is a highly flexible methodology which is growing in popularity among those involved in performance-based vocational curriculum development. Strengths and weaknesses of using this approach are presented in context of traditional procedures and possible applications to health-related programs are discussed. This approach appears to compensate for many of the problematic aspects of conventional occupational analysis and provides a viable alternative for curriculum development specialists in health occupations education.

"Developing a Curriculum" (DACUM) refers to a comprehensive set of procedures for the development of vocational curriculum originally

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designed by the Experimental Projects Branch, Canada Department of Manpower and Immigration and the General Learning Corporation of New York. In practice, however, it has come to refer to a particular methodology for conducting occupational analysis. Occupational analysis is defined as a process "by means of which the essential elements of an occupation, or any part of an occupation or activity, are identified and listed for instructional purposes" (Frylund, 1970, p. 1). DACUM is basically a workshop approach to the identification of functions and tasks associated with a specified occupation or occupational cluster. The DACUM technique has been utilized and refined by many educational agencies and is becoming increasingly popular among training departments in business, industry, and public administration.

The former National Center for Research in Vocational Education, now the Center on Education and Training for Employment, has been involved for some time in the development and promulgation of the DACUM methodology. Since 1976, the Center staff has conducted more than 125 DACUM workshops, trained numerous workshop facilitators, and published a DACUM Handbook (Norton, 1985). Their collective impact on the growing utilization of the methodology has been significant.

While the DACUM technique is rather innovative and possesses many attractive features, it has not been fully substantiated by research. Claims are made that this is a research procedure which generates a viable research base for vocational curriculum development. Some findings have been published that demonstrate this to be the case (O'Brien, in press). No findings have been published to refute the position that DACUM yields reliable and valid results. Although there

is clearly a need for further investigation into the efficacy of this technique, local and program-specific applications of the technique can be made with a relatively high degree of confidence.

Curriculum Development Through Task Inventory

In recent years, projects using occupational analysis for purposes of vocational curriculum development have tended to employ the task inventory technique. A survey research approach to occupational analysis, task inventory generates "a list of appropriate (function) and task statements covering the tasks performed by workers in an occupational area" (Melching & Borcher, 1973, p. 3). Task inventory has become highly refined and sophisticated as a specialized research procedure. Extensive developmental work on this procedure has resulted in the availability of substantiated guidelines for methodological questions such as delineation of occupational scope, task definition, instrument design, sample selection and stratification, and data analysis. United States military analysts, the former National Center for Research in Vocational Education, the Vocational-Technical Education Consortium of States, the Interstate Distributive Education Curriculum Consortium, and others have contributed significantly to the development of task inventory. Notable among these were the development of the Comprehensive Occupational Data Analysis Programs (CODAP) by the United States Air Force (Christal, 1974; Schroeder, 1975) and the adaptation of CODAP by the former National Center for Research in Vocational Education in the creation of a program for vocational education, the Task Inventory System (TIS) (Melching & Borcher, 1973). The Center had particular impact on the field with the

publication of a five volume series entitled Performance Content for Job Training (Ammerman, Essex, Mead, & Pratzner, 1977).

Task inventory is familiar to most health occupations educators through the efforts of the Vocational-Technical Education Consortium of States (V-TECS). V-TECS conducts task inventory projects and develops related curriculum guides for a number of different occupational areas, including health. The organization has published instructional catalogues for the training of licensed practical nurses, nursing assistants, hospital ward clerks, health care workers, dental hygienists, dental assistants, dental laboratory technicians, medical assistants, medical laboratory technicians, medical record technicians, emergency medical technicians, operating room technicians, radiography technicians, respiratory therapists, surgical technicians, and other occupational specialties in the health field. V-TECS catalogues are widely used for curriculum development purposes at both secondary and postsecondary levels of education.

Task Inventory Procedures

Task inventory involves four broad steps: (a) definition of the scope of the occupational analysis, (b) preparation of an initial listing of functions and tasks, (c) verification of the initial listing, and (d) data analysis and compilation of the final listing of functions and tasks. These steps are described in the following section:

1. A task inventory project begins with specification of the occupational scope of the study; the particular occupation or occupational cluster to be examined is specified.

2. An initial listing of the functions and tasks believed to be performed by workers in the target occupation is developed; usually on the basis of a review of literature pertinent to the occupation being studied. Such a review would typically include completed task inventories, curriculum guides, instructional materials, evaluation instruments, technical manuals, and so forth. The initial listing is sometimes reviewed by a group of selected occupational experts before the verification process begins.

3. During verification, the task listing is distributed to a larger number of qualified, incumbent workers in the occupation of concern to obtain their ratings of selected task attributes. The preferred mode for verification is survey research and, although there are different approaches to the administration of such surveys, great care is given to criteria for respondent selection, design of appropriate sampling strategies, utilization of established rating scales, and related matters. The verification phase is usually designed to elicit information concerning selected attributes of tasks, such as task occurrence, importance, frequency, criticality, and difficulty.

4. The final step in a task inventory project involves the statistical analysis of survey data, establishment of decision criteria for task selection, and compilation of the final listing of functions and tasks for the occupation.

According to Melching and Borcher (1973) and others, "the results of the task inventory can be validated and checked for stability using conventional statistical techniques" (p. 3). Moreover, the reliability and validity of this methodology have been well-documented during the

last three decades. Reliability of task inventory results can be determined by administering the same survey to the same group of respondents one or two weeks apart and then comparing responses (McCormick, 1976). An alternative technique is to compare survey responses from one sample with those obtained from a second sample with similar characteristics (Gael, 1983). A common, although statistically untenable, method for determining the validity of task inventory results is to compare responses from incumbent workers with those of first-line supervisors. The optimal, but most difficult, approach to the determination of validity is to compare task inventory results with actual job performance data (Gael, 1983).

Concerns Regarding Task Inventory

In spite of its sophistication, task inventory is subject to several criticisms which concern those who utilize such studies for curriculum development. A frequent criticism is that, in practice, the initial listing of functions and tasks is usually developed by an educator or curriculum specialist (someone other than an incumbent occupational expert) relying on secondary sources of information. Another criticism is that there is often great disparity in the scope of the individual task statements. Some task statements are very narrow and specific in focus, while others are very broad and general. Proper organization and structure are often lacking in listings developed through task inventory. Tasks that are logically related to one another are often found dispersed throughout the listing. Redundancy and repetitiveness among tasks are frequently evident in listings generated in this manner. When identified, functional groupings of tasks sometimes seem artificial and fail to provide

meaningful organization or structure to the listing. Task inventory also tends to generate lists of functions and tasks which are inordinately long. Melching and Borcher (1973) indicate that a "task inventory should contain at least 200 and not more than 600 task statements" (p. 8). In practice, it is common for such lists to include as many as 500-1,000 task statements. Obviously, lists of that length are unwieldy and extremely difficult to utilize effectively in the design of vocational curricula.

Overview of the DACUM Approach

The DACUM approach to occupational analysis involves the organization of a panel of 8-12 practicing experts in the occupation being examined. Depending on the size of the panel, 6 to 10 members should be expert incumbents in the occupation and 2 panel members should be immediate supervisors of persons employed in the occupation. This organization is recommended to provide a manageable group size and to capture potential discrepancies between employee perceptions and supervisory expectations of work performance. Members of the panel should be carefully selected to obtain the most knowledgeable and competent individuals possible. The outcomes of the DACUM process can be no better than the panel members asked to create them.

Once selected, the panel of experts is assembled for a two to three day workshop during which they generate a "DACUM chart" for the occupation: a graphic profile of the functions and tasks performed by workers in the occupation under study. A facilitator trained in the DACUM process, but preferably not an expert in the occupation being examined, leads the panel through the workshop assisted by a recorder. Utilizing brainstorming, discussion, and consensus-building strategies,

the facilitator assists the panel in identifying and organizing occupational functions and tasks, thereby creating the DACUM chart. Functions and tasks are sequenced on the chart according to the order in which they are most likely to be encountered by a new employee in the position.

Steps in the DACUM Process

According to Norton (1985, pp. 35-36), the major steps through which the facilitator guides the panel of experts during the workshop include:

1. Orientation to workshop procedures,
2. Review of occupation of concern (occupational scope),
3. Identification of functional areas of responsibility,
4. Identification of specific tasks associated with each functional area,
5. Review and refinement of function and task statements,
6. Sequencing of function and task statements.

Depending on the needs of the sponsoring agency, the panel might also be asked to generate additional information, such as the identification of those tasks performed by entry-level employees. Importance, frequency, difficulty, and other attribute ratings for each task could easily be provided by members of the panel. In the analysis of occupations in the health field, for example, it would be valuable to ask the panel to identify performance standards and safety factors associated with the execution of each task.

The DACUM technique can be used to examine virtually any occupation, regardless of technical complexity or level of responsibility. It has been employed to analyze hundreds of different

occupations, including radiologic technicians and respiratory therapists. Resulting occupational performance profiles usually contain 8-12 duty areas and 50-200 task statements. The profiles are sometimes incorporated in survey instruments and distributed to a larger group of occupational experts for verification and/or collection of additional data.

DACUM Handbook

The DACUM Handbook (Norton, 1985) has become the principle source document on the DACUM methodology and has been instrumental in the promulgation of the technique. An examination of the handbook's contents provides detailed instructions for conducting an occupational analysis with DACUM. In addition to information about the nature of DACUM, the purposes of DACUM, how to plan a workshop, and how to conduct a workshop, information is provided concerning all four of the major phases of traditional task inventory.

Analysis of the DACUM Methodology

Despite certain declarations in the text of the DACUM Handbook, it seems that the DACUM technique per se is not a radically different approach to occupational analysis. Rather, it appears to be an attractive and potentially valuable approach to the development of an initial task listing. It is also a realistic alternative for developing a listing of functions and tasks for an occupation or occupational cluster when conditions do not warrant or resources do not permit a more traditional task inventory. Moreover, the basic technique is so flexible that it can be employed to develop listings of almost anything on which one would wish a group to reach consensus. The methodology can be easily adapted to facilitate the development of

competency lists, conceptual maps, goals and strategies, as well as plans and procedures.

As a technique for developing an initial task listing, DACUM is extremely appealing. The technique appears to compensate for almost all of the major shortcomings of the traditional approach to this step in occupational analysis. Information is obtained directly from primary sources, incumbent workers and supervisors, not from secondary sources in the literature. The technique tends to generate a more manageable, and hopefully more meaningful, list of functions and task statements. Since all of the functional areas are identified first, providing an overall framework for task generation, the resulting list is likely to exhibit greater consistency, organization, and structure.

In regard to the utilization of the DACUM technique as an alternative approach to occupational analysis, both the advantages and certain caveats should be considered. As indicated by Norton (1985), the advantages of the DACUM technique include the following:

> First, it is a quick process; one that can be completed in only two or three days once committee members have been identified. Secondly, DACUM is certainly inexpensive when compared to the cost of traditional occupational analyses ($1,000 to $2,000 will cover the cost of most DACUM workshops). Finally, the end product of a DACUM analysis, a complete competency profile of an occupation, can be favorably compared in validity with any other method. (p. 3)

In this instance, Norton (1985) compared the two to three day DACUM workshop with the entire process of traditional occupational analysis. This is a case of taking one component out of an overall

process and evaluating it in isolation, this notion should be viewed with some caution. If one does not account for some type of procedure for verification of the occupational profile, or for careful and thorough data analysis, two of the claims are clearly justified. A two to three day workshop is certainly quick when compared to the months involved in conducting a task inventory project. It is also inexpensive, even though the figures mentioned by Norton may not include all of the direct and indirect costs associated with a DACUN workshop.

The claim concerning the validity of a competency profile which has not been verified should be considered carefully by anyone contemplating an application of the DACUM technique. Throughout the handbook, the DACUM technique is referred to as a reliable "research procedure" which generates a valid "research base" for vocational curriculum development. These positions have not been fully documented by research evidence. In a study designed to address the reliability and validity of a DACUM-generated occupational profile, however, the author did find the profile to possess a high degree of reliability (>.90) and substantial construct validity. The construct validity of the profile was manifested both when the listing was considered as a whole and when it was considered in terms of separate functions.

Essentially, the concern here involves the need for empirical verification and the degree to which one wishes to generalize the results of a DACUM application. Norton (1985) acknowledges two basic attitudes toward the issue. One attitude is that verification adds little or nothing to the quality of the occupational profile and only increases the costs of research. The other attitude is that

verification of the profile is essential due to the fact that the DACUM panel of experts does not represent an adequate sample of occupational incumbents. Norton suggests that if some form of verification is desired, a simple review of the profile by an existing program advisory committee or a specially convened verification committee will suffice. When viewed strictly from a research perspective, the adequacy of a sample of 12 subjects is certainly questionable. Typically, one is concerned with obtaining a sample of adequate size in relation to the population from which it is drawn. In most cases, consideration of stratification variables such as geographic region, type of institution, and occupational category are also of interest and have the effect of increasing the minimum sample size required for analysis purposes. Quantitatively, "a sample should be large enough so that it can be stratified in several ways and still allow meaningful statistical comparisons between subsamples" (Gael, 1983, p. 116). Statistically, the capacity for making inferences and generalizations in regard to an occupational profile generated by 12 individuals is severely limited. From this point of view, verification through survey research is critical to the confident application of such a profile to curriculum development.

When viewed pragmatically, the need for verification actually varies from situation to situation and there are many instances in which the utilization of inferential statistics would be unnecessary or irrelevant. Such statistics would be highly important if one were developing national standards or a curriculum to be implemented uniformly nationwide. In designing curriculum for a specific program in a specific community, however, one would probably have little need

to be concerned about generalization and the expenditure of resources for verification would be inappropriate. Ultimately, this issue should be resolved at the application level. It should be determined on the basis of what is appropriate for each specific set of needs and circumstances.

Applications of DACUM to Health Occupations Education

The DACUM methodology offers curriculum developers in health occupations education an additional tool which can help them to resolve a number of curriculum-related problems. Although it is no panacea and would not be appropriate for all curriculum projects in health occupations education, it does provide an excellent alternative approach in many situations. Best of all, it is an alternative approach that can be used by any health educator competent in managing group discussion and consensus-building and equipped with a copy of the DACUM Handbook.

V-TECS Versus DACUM

One curriculum problem faced by health occupations teachers, as well as teachers in other vocational programs, is the difficulty in utilizing the V-TECS catalogues and similar materials designed for their occupational areas. The task listings contained in many of these documents are fraught with all of the weaknesses associated with the task inventory methodology. Moreover, a V-TECS catalogue is based on a study conducted within a single state which may be far removed from a given state in which it is being implemented.

Teachers often perceive these task listings as being out of date, incomplete, repetitive, disorganized, and generally of little value in developing curriculum. DACUM provides a viable alternative for the

teacher faced with this problem on the local level. Instead of struggling to adapt a problematic task listing developed elsewhere to the needs of the local community, the teacher can easily conduct a local DACUM workshop and generate an occupational profile custom-made for that situation. The local advisory committee would be an excellent source for identifying the panel of experts and the activity would possess a concomitant public relations value for the local program.

Congruence Between Work Force and Configuration of Programs

A related problem faced by curriculum developers in health occupations education concerns the congruence between the occupational structure of the work force in the health care industry and the configuration of programs in health occupations education. Historically, educational and training programs for health care practitioners have been structured to focus on various occupational specialties in the health care field. The occupational structure of the health care industry is changing, however, with more emphasis being placed on the need for multi-skilled workers. According to information obtained from the National Multi-Skilled Health Care Practitioner Clearinghouse (1988), these health care workers are described as follows:

> Multi-skilled health workers are persons who are cross-trained to provide more than one function, often in more than one discipline . . . combined functions can be found in a broad spectrum of health related jobs ranging from the non-professional to the professional level including both clinical and management functions. (p. 2)

Cross-Training

The trend toward increased frequency of interdepartmental assignments has created a heightened need for cross-training and a greater demand for multi-skilled workers. Since the utilization of multi-skilled workers reduces labor costs, this trend can be expected to continue and expand. Jaffe, Oglesby, and Drewes (1982) suggested that health occupations educators must be sensitive to this trend and develop program modifications to respond to the changing manpower needs in the health care field.

The response to this trend by curriculum planners in health occupations education has been to utilize more of a cluster approach in program design. A significant problem exists, however, in developing curricula for such programs. Almost all of the task or competency lists currently available focus intensively on one occupational specialty in the health field. Therefore, planners encounter the complex problem of attempting to integrate a number of different lists in order to create a foundation for curriculum development. This is an intricate, tedious process which presents a formidable barrier to even the most experienced curriculum designer. In this situation, it would seem more expeditious to employ the DACUM technique to create a single composite performance profile for the occupational cluster of concern. Essentially, it would be a matter of organizing the panel of experts in a manner that reflects the nature of the occupational cluster for which the program is intended. The panel would be composed of representatives from different specialty areas commonly linked in cross-training. The resulting DACUM chart would be comprehensive in nature and would provide an adequate base for curriculum development.

The DACUM approach represents a superior alternative to the subjective integration of a series of highly specific task or competency lists by a curriculum specialist or committee. Its utilization could do much to facilitate the design of curricula for cluster programs and, by extension, enhance the marketability of program graduates.

Flexibility of the DACUM Technique

The flexibility of the DACUM technique makes it adaptable for use in almost any curriculum development project and may provide structure to a process which is sometimes a bit chaotic. State approved courses of study, for example, are usually developed by task forces or curriculum committees which meet periodically and determine curriculum content through discussion and agreement. Depending on the background and perspective of the particular group, curriculum may be expressed in the form of tasks, competencies, objectives, topics, activities, or in some combination of these forms. Procedures used for discussion and consensus-building in such groups are often informal and tend to be subject to the varying influences of personalities, vested interests, and politics. The basic procedures involved in conducting a DACUM workshop can be used with any form of curriculum content and need not be restricted to functions and tasks. DACUM guidelines for management of the group interaction process and the simple techniques used to visually depict the curriculum as it is developed are highly amenable to the task force or curriculum committee scenario. Applications of a modified DACUM methodology to the work of such groups may enhance the objectivity of their procedures and improve the caliber of resulting curricula.

Organizations and agencies which utilize more traditional approaches to curriculum development, such as task inventory or some other form of survey research, should find DACUM to be a superior technique for developing an initial listing of the content to be included in the survey instrument. Since DACUM requires that input be obtained directly from occupational or content experts in a structured manner, all of the deficiencies of the customary approaches to this step can be avoided. Constructing an initial listing through content analysis, interviews, or observations tends to be time-consuming, subjective, and prone to error. By augmenting their research procedures with the DACUM process at this early stage of analysis, organizations like V-TECS can reduce costs and increase their effectiveness at the same time.

Conclusions

It is clear that the DACUM methodology is increasing in popularity as an alternative approach to occupational analysis. Since few research findings have been published which tend to substantiate the reliability of the procedure and the validity of a resultant DACUM chart, careful consideration should be given to specific applications. While workshop techniques have become highly refined, DACUM has not yet been proven to be an independent research procedure that yields reliable and valid results. The need for verification of an occupational profile generated through DACUM remains an issue and is dependent on the nature of each different application.

DACUM is an appealing technique for a number of different reasons. One important reason, as indicated by Walters (1988), is that it

directly involves business and industry in the curriculum development process as stipulated below:

> In planning for curricula change and developing a framework for the future, vocational educators should reinforce, strengthen, and continue to work in partnership with the private sector, utilizing business and industry personnel on program advisory committees to update specific programs. (p. 38)

Workshops of this type represent excellent opportunities for facilitating such partnerships and ensuring sound vocational curricula. Another dominant reason for the appeal of DACUM is that it provides a realistic, practical alternative for the local vocational educator engaged in curriculum development or revision. Most local teachers have neither the resources nor the expertise to conduct complex task inventory studies. When confronted by situations in which no sound data are readily available, DACUM provides teachers with a viable option. This feature alone makes DACUM worthy of some merit.

The structured nature of the DACUM workshop offers those involved in task inventory with a technique for developing an initial task listing that is greatly superior to current practices. The flexibility of the methodology provides all vocational educators new means of managing different types of curriculum development activities and resolving complex curriculum problems.

Recommendations

Further research is needed concerning the efficacy of the DACUM methodology and its capacity to function as an independent, stand-alone procedure. Educators, including health occupations educators, need to know more about the reliability of the technique and the validity of an

occupational profile generated in this manner. Several types of validity should be investigated, including construct, concurrent, and predictive validity. Investigations should focus on replicating the reliability and construct validity data exhibited in earlier research, as well as on determining how well a DACUM profile correlates with task listings generated by traditional methods and how well such a profile serves as a predictor of actual job performance measures.

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