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Paper Session I-C - Career Outcomes Assessment and Human Resource Policy in Science and Engineering

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ABSTRACT

Based upon our experience with programs targeted to increase participation in careers in science and engineering (S/E), this paper discusses career outcomes assessment as an approach that enables policy makers and program administrators to identify and interpret indicators of participant-related outcomes, such as changes in career-related behavior and performance.

INTRODUCTION

Historically in the United States, concern over projected shortages of scientists and engineers has been the driving force to establish many programs targeted to increase participation in science and engineering (S/E) careers. One unintended consequence of this is that, after the programs are established, the concern goes away. Another consequence is that the continued operations of programs developed in response to shortages—anticipated or actual—tend to be uncertain, because the shortages tend to be cyclical.

Little if any systematic follow-up is done to find out if the programs are doing what they were designed to do. Sometimes when planners and administrators of intervention programs ask for program evaluations, what they really want is information on the participants in these programs.

'The opinions in this paper are solely those of the author and do not necessarily reflect those of the National Research Council nor its constituent organizations.
CAREER OUTCOMES ASSESSMENT DEFINED

Career outcomes assessment provides answers to such basic questions as "what—and how well—are certain individuals doing professionally?" The answer to the "what" question is fairly objective; the answer to the "how well" question is less so. Therefore, the assessment yields indicators and proxy measures of professional productivity and achievement—such as number of publications in professional refereed journals, number of patents issued, and membership in honorific organizations—so that decision makers can answer the "how well."

CAREER OUTCOMES ASSESSMENT AS PROCESS

Outcomes assessment is an iterative process that clarifies and operationalizes human resource policy issues, selects measures and assesses their applicability to those issues, interprets the results, and repeats the entire process until the client is satisfied or lack of resources forces closure [Figure 1].

In the case of programs targeted to increase participation in careers in science and engineering, we start by developing an operational definition of the primary program objective that is appropriate to the level of participant targeted by the program. Then, we identify, collect, and provide contexts for interpreting indicators of participant-related outcomes, such as changes in career-related behavior and performance. For example, this may be examined in light of careers in aerospace. At the post-baccalaureate level, these outcome indicators would be more directly related to aerospace careers, such as the number of program participants earning advanced degrees in aerospace fields. At pre-baccalaureate levels, these measures would be related less directly to pursuing careers in aerospace and more to career preparation in broader science, engineering, and technology fields; one example would be the number of program participants declaring a major in a mathematics or science field.

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OUTCOMES ASSESSMENT

Outcomes assessment is a systematic way to provide objective and defensible measures to inform human resource policy choice. Sometimes we let the data that we have, or can collect, drive what we examine. For example, many programs collect data on the number of program participants at one point in time, although these data give no information about the quality of the experience of any one participant at a given point in time. One important part of the outcomes assessment process involves compiling indicators into user-friendly data bases. Because each indicator relates to program objectives, this data base provides program administrators with objective criteria to support what will be collected and why. [This helps them defend themselves against requests to collect certain information "because it would be interesting."]

Many targeted programs collect data on the characteristics of the participant—i.e., number of years of schooling—but none on the characteristics of the setting in which the program experience occurred. However, contextual data are particularly important for understanding what aspects of a targeted program contribute to the observed outcomes; examples of these aspects include the frequency of interaction with program staff, availability and condition of equipment needed, and the physical characteristics (e.g., how crowded the room was). Therefore, it is often desirable to compile two data bases—one on the characteristics of individual participants and the other on characteristics of the contextual setting. [Figure 2.] Both types of data base can provide feedback for program operations on a real-time basis.

CAREER OUTCOME ASSESSMENT, ENVIRONMENTAL IMPACT ASSESSMENTS, AND FORMAL PROGRAM EVALUATION

Career outcomes assessment—like environmental impact assessments—can provide not only a checklist of measures of career-related performance, but also guidelines for interpreting those measures. For example, although bibliometric measures and citation counts are often used as indicators of career-related performance, they are better suited to assess the lifetime impact of a scholar at an advanced stage in his or her career than to predict the future success of a scholar in an earlier stage in that career.
Outcomes assessment is a complement to--and not a substitute for--formal program evaluation and can be considered a pre-evaluation activity insofar as it identifies some of the measures that are used in formal program evaluation. The policy implications of outcomes studies can be different from those of cost-benefit analyses: program evaluation focuses on process, whereas outcomes analysis focuses on end products--such as attitude change or increase in performance or achievement. Another end product of interest to program sponsors and administrators is the level of participation. Career outcome analysis provides information on the professional careers of program participants. This information is useful to sponsors who must make decisions about program funding levels: whether to maintain, increase, or decrease the current funding level.

Not only does career outcomes assessment focus on developing measures that can be used to formulate human resource policy, it also can help shed light on the ways in which targeted programs make a difference in a participant's decision to take the next step to pursue a career in science, engineering, or technology.
Figure 2