DOCUMENT RESUME

ED 105 116 CE 003 376

TITLE	The Coordination of Program Planning and Evaluation Systems for Occupational Education. Volume 1: A Reporting and Evaluation System for Occupational Education.
INSTITUTION	Riverside Research Inst., New York, N.Y.
SPONS AGENCY	New York State Education Dept., Albany.
REPORT NO	F/142-5-00
PUB DATE	Mar 72
NOTE	57p.; For related documents, see CE 001 489 and CE 003 377-380
EDRS PRICE	MF-$0.76 HC-$3 32 PLUS POSTAGE
DESCRIPTORS	Academic Records; Computer Oriented Programs; *Computer Storage Devices; Data Bases; Evaluation Criteria; Evaluation Methods; Information Processing; Information Storage; *Information Systems; Program Administration; Program Coordination; Program Development; *Program Evaluation; Recordkeeping; Reports; Student Records; *Vocational Education
IDENTIFIERS	Reporting Evaluation System Occupational Education; RESOE; SEED; System for Evaluation of Educational Data

ABSTRACT

Volume 1 of the report describes the Reporting and Evaluation System for Occupational Education (RESOE) in evaluating the effectiveness of occupational program offereings, and in basing program planning and funding decisions on such evaluation. A brief introduction is followed by an outline of the requirements for reporting and evaluating occupational education programs, a discussion of existing reporting and evaluating procedures, and the tasks undertaken for the development of RESOE. The design of RESOE involved a determination of its functional specifications, ways to meet those functional specifications, and methods of managing the reporting and evaluation system data base (System for the Evaluation of Educational Data). A limited field test of RESOE is outlined, including State-required program enrollment and placement information, followup studies, and a summary of the trial. The final section presents a strategy for Statewide implementation and examines a feasibility study for implementing RESOE in the big-six cities; adding system functions in Nassau County; installation of the system at new locations; procedures for efficient system implementation and for interregional communication; and subsequent implementation. (Author/JR)

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MARCH 1972

THE COORDINATION OF PROGRAM PLANNING AND EVALUATION SYSTEMS FOR OCCUPATIONAL EDUCATION

VOLUME I:

A REPORTING AND EVALUATION SYSTEM FOR OCCUPATIONAL EDUCATION

Submitted to:

The State Education Department of New York
Dr. Robert S. Seckendorf
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Albany, New York

F/142-5-00

Authors' Note

The Reporting and Evaluation System, as it is described in this volume of the final report, was designed by Richard Pargament, James F. Wilde, and Harry Bird.

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I. Introduction

The Vocational Education Act of 1963 (VEA 63) greatly enlarged the role of publicly supported occupational education in the United States. Since 1963, occupational educational curricula have proliferated, and now encompass an extensive list of occupations. The student population served by occupational education has increased and become more heterogeneous.

According to VEA 63, occupational education must be provided to "... those in high school, those who have completed or discontinued their formal education and are preparing to enter the labor market, those who have already entered the labor market but need to upgrade their skills or learn new ones, those with special educational handicaps, and those in post-secondary schools."* Thus one of the principal objectives of contemporary occupational education is to create genuine vocational alternatives for many segments of the population. To fulfill this objective in New York State, occupational curricula are offered at a

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* From Sec. 101 of the Vocational Education Act of 1963 as amended by the Vocational Education Amendments of 1968, Public Law 90-576.

variety of educational centers including community colleges, secondary schools, and Boards of Cooperative Educational Services.

The growth of occupational education in structure, scope, and enrollment has been accompanied by increased accountability requirements. Regional administrators of occupational education are required by law to synthesize a variety of information related to the occupational programs offered in their region and the extent to which different student groups are served, and to submit this information to state and federal education authorities. In addition, local school boards, regional employers and other local interest groups have exhibited rising concern about the quality of occupational program offerings. Consequently, it has become increasingly important to evaluate the effectiveness of occupational program offerings, and to base program planning and funding decisions upon such evaluations.

II. Reporting and Evaluation Requirements for Occupational Education

To satisfy the need for more effective reporting and evaluation, the New York State Education Department decided to develop a Reporting and Evaluation System for Occupational Education.* Riverside Research Institute (RRI), in coordination with the New York State Education Department Division of Occupational Education Planning, carried out several tasks which have resulted in a general design for this system. Reporting and evaluation requirements for occupational education, and the tasks carried out by Riverside to arrive at the system design, are discussed in this section of the report.

A. Reporting Requirements for Occupational Education

1. Mandated requirements.

Under federal and state mandates, a substantial amount of information about occupational education must be

* The development of a Reporting and Evaluation System for Occupational Education is one of three major tasks carried out under contract #C-50484 between the New York State Education Department and Riverside Research Institute. The other tasks carried out by RRI under this contract are described in The Coordination of Program Planning and Evaluation Systems for Occupational Education. Volume II: A Targeting System for Occupational Education. Volume III: A Monitoring System for Occupational Education.

collected by the New York State Education Department. School districts, Boards of Cooperative Educational Services (BOCES), public colleges, the Big Six schools and other agencies are required to file reports which are used to monitor the expenditure of state and federal funds, to develop the State Plan for occupational education (required under VEA 63), and to assess the extent to which occupational programs carried out at various educational centers are in conformance with that plan. For each program administered, local educational authorities are required to provide enrollment information, including the numbers of each type of student (general, disadvantaged, handicapped) enrolled in the program, the numbers of students enrolled at various educational levels (grades 9-12, adult supplementary, adult preparatory, etc.), and the ethnicity of the students.

In addition, the State Education Department (SED) requires follow-up reports for each program offered. Follow-up reports contain the number of students completing and not completing each program, and a variety of other information concerning the characteristics, education and employment status of the program's participants. Information which describes the programs, such as program budgets, personnel characteristics, types of program offerings and so on, is also submitted to the SED.

2. Additional reporting requirements.

In addition to formal reports required by state and federal authorities, occupational education data must be provided for regional public relations, planning and many other purposes. Specific information on the status of occupational education is often desired by administrators of local school districts, school boards, regional occupational education advisory committees, union officials, parent-teacher associations, and minority group representatives. Reporting of this kind is essential to the successful administration of publicly supported occupational education.

Reports to parent and teacher groups, school boards, students and others support guidance functions, familiarize individuals with regional occupational program offerings and interpret the expanded role of occupational education to the community. Reports to the regional advisory committees in various occupational fields are an important part of the program planning process. Reports to employers, union officials and industry representatives serve to facilitate cooperative education programs and to create a job market for occupational program graduates.

B. Evaluation Requirements for Occupational Education

1. Assessment of program effectiveness.

Follow-up studies are the traditional means of assessing the effectiveness of occupational programs. If a

substantial proportion of a program's graduates obtain jobs or advanced placement in the occupational cluster for which they were trained, it is assumed that the program is effective. Traditionally, program effectiveness has been thought to be a matter of the contribution that the program makes to the employment status of its graduates. In the context of Riverside's studies, this definition of effectiveness has been associated with the effectiveness of the occupational educational system as a whole.* Program effectiveness is taken to mean the degree to which the specific, stated objectives of occupational programs have been fulfilled.

Thus follow-up evaluations do not measure program effectiveness, i.e., they do not allow the occupational educator to determine whether or not programs have succeeded in transmitting the skills and knowledge that they are designed to impart. Recently, attempts have been made to establish explicit curriculum objectives related to the entry-level requirements of the occupations for which training is being provided. If the students meet the objectives, the program is considered effective. If a large number of students do not meet the objectives, it becomes necessary to find out why and to revise the program accordingly.

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* See Volume II of the final report for a discussion of system effectiveness.

2. Evaluation for occupational education planning.

A capability to evaluate programs is needed for a variety of planning purposes within occupational education. The planning of specific courses, for example, should be based on an evaluation of previous results. Thus, occupational educators need to be able to assess the consequences of different instructional methodologies on program costs and performance outcomes. A variety of important variables, such as different levels of teacher training, can affect program effectiveness. These variables must be identified so that effective programs can be designed, and the effectiveness of existing programs improved.

An evaluation capability will also be helpful to identify the student abilities and knowledge which are necessary for satisfactory performance in different programs. Such information will allow meaningful entry requirements to be developed for occupational programs.

C. Existing Reporting and Evaluation Procedures

Not all of the reporting and evaluation requirements previously discussed are currently being met within occupational education. Follow-up studies constitute the only form of evaluation which is consistently undertaken and the quality of these studies is extremely variable. Reporting requirements are often met with guesses rather than with real data and reports are therefore frequently invalid.

D. Tasks Undertaken for the Development of a Reporting and Evaluation System for Occupational Education

1. The determination of informational requirements and functional specifications for the Reporting and Evaluation System.

In order to develop a set of functional specifications for the Reporting and Evaluation System, both the kinds and amounts of information that the system would require were investigated. In addition to student names and addresses, program enrollments, school district identifications, ethnicity and other typical information elements, the requirements for the inclusion of additional student characteristics (e.g., objective test scores, cognitive ability, socio-economic status) and new effectiveness indicators (in both the cognitive and arfective domains) were studied. The results of these efforts and the functional specifications of the system which were obtained are reported in Section III A of this report.

2. The development of a general design for the Reporting and Evaluation System.

On the basis of the determination of informational requirements and functional specifications, alternative approaches to a reporting and evaluation system were analyzed, and the System was designed. The System description is given in Section III B of this report. A description of how the System meets the functional specifications is given in Section III C.

3. Software requirements for the Reporting and Evaluation System.

The development of the Reporting and Evaluation System included the specification of some of the required electronic data processing software. Appropriate procedures were developed for storing student, program, and personnel information in a computer, and for the organization of data banks to be used for longitudinal (e.g., time-series) evaluations. In addition, the applicability of Riverside's software package, System for the Evaluation of Educational Data (SEED), to the Reporting and Evaluation System was established, the package was modified, and a SEED user's manual was written. The suitability of SEED for the Reporting and Evaluation System is described in Section III D. The SEED user's manual is presented in Appendix I.

4. Field trial of the Reporting and Evaluation System.

The system design was empirically tested during the contract period at the Nassau County Board of Cooperative Educational Services (BOCES) center. This field trial is described in Section IV of this report.

5. Statewide implementation strategy.

On the basis of the field trial, a strategy for statewide implementation of the Reporting and Evaluation System was developed jointly with State Education Department personnel. This strategy is described in Section V.

III. Design of a Reporting and Evaluation System for Occupational Education

A. Determining the Functional Specifications of the Reporting and Evaluation System

1. Preliminary system study.

In the initial phase of the work, RRI met with members of the State Education Department Division of Occupational Education Planning to define current and projected reporting and evaluation requirements for occupational education.

Following the definition of these requirements, RRI conducted a system study of reporting and evaluation operations and procedures at the educational centers where occupational programs are offered. The purposes of this study were:

- to identify current and projected needs for reporting and evaluation at the local level;
- to assess difficulties which have arisen in connection with meeting current reporting and evaluation requirements; and
- to determine how a statewide reporting and evaluation system could be implemented and sustained at the local level.

The system study was primarily conducted at the Nassau County Board of Cooperative Educational Services (BOCES).* The study was conducted at a BOCES for several reasons:

- the BOCES are conducting an increasing portion of the secondary and adult occupational programs offered in New York State;
- in many important respects, reporting processes at the BOCES are similar to reporting processes at Big-Six and post-secondary agencies; and
- since the State Education Department requires the BOCES to assume substantial reporting responsibilities for their own programs as well as the occupational programs offered within the school districts in each BOCES region, BOCES reporting problems include the reporting problems and requirements of local school districts.

* In addition to the system study carried out at the Nassau County BOCES, RRI obtained additional information concerning local reporting and evaluation operations by accepting an additional task. RRI carried out a computer synthesis of Vocational Education Data System (VEDS) 1970-71 reports, submitted to the State Education Department from community colleges, BOCES, and school districts throughout the State. This task provided insight into reporting difficulties and into procedures for eliminating them.

The system study revealed that a variety of problems exist in connection with the execution of existing reporting and evaluation functions, and also identified many reporting and evaluation requirements which cannot be met at present. For example, BOCES centers are expected to obtain information about the numbers and different types of students enrolled in occupational programs offered at all local educational centers within each BOCES region. Local district personnel are asked to survey students in these programs and to transmit the required information to the BOCES center.

In practice, conflicts arise between BOCES and local district personnel because, in order to obtain the required information, teachers or guidance counselors in the local districts must be diverted from other tasks or asked to complete the surveys as an additional task. Neither of these choices is an attractive one, and it is not surprising that the BOCES have difficulty in obtaining cooperation from local districts.

Furthermore, the BOCES are dependent upon the local districts to purchase services provided by BOCES centers. Not all local districts do so, and the BOCES are interested in increasing the number of local districts which directly support their operations. Under the circumstances, the BOCES

are reluctant to exert pressure on either affiliated or non-affiliated local districts to complete student surveys for occupational educational reporting and evaluation purposes.

2. Functional specifications of the System.

On the basis of the system study and the earlier conferences with State Education Department personnel, a set of functional specifications for the Reporting and Evaluation System were formulated.

a. The System must be able to meet all legal reporting requirements applicable to occupational education (see Section II A.1).

These requirements have been imposed by the State Education Department Division of Occupational Education Planning to provide information for the State Plan and for the preparation of the statewide annual report on occupational education.

b. The System must be able to provide summaries and other required information for regional, "state of occupational education" reports (see Section II A 2).

Such reports are needed to inform school districts, regional constituencies, school boards, potential employers, labor unions, advisory groups, and others, of the status of occupational education in each region. For the purpose of creating a job market for occupational graduates, all administrative units providing occupational education

(e.g., local school districts, community colleges, Big-Six cities, BOCES) need the capability to produce such reports.

The BOCES have additional regional reporting requirements--particularly for secondary students--which must be met by the System. Some local school districts send secondary students to BOCES centers to receive occupational education, and pay tuition to the BOCES for these students. The BOCES are accountable to these school districts, and therefore must have the capability to provide individual student information, performance summaries for each student sent by each district, and other information of interest to the local districts.

c. The System must be able to carry out evaluations of program effectiveness.

Since the results of follow-up studies are used to assess the effectiveness of occupational programs, the Reporting and Evaluation System must be capable of supporting the execution of follow-up studies for program graduates as well as students who do not complete programs. The System should be able to carry out follow-up studies independently or in coordination with the Targeting System.*

The System must also permit the evaluation of program effectiveness with respect to a variety of new effectiveness criteria. For example, a relatively recent

* See Volume II of the final report.

development in assessing the effectiveness of occupational programs has involved the establishment of explicit behavioral objectives and procedures for determining whether or not program objectives have been met. The Reporting and Evaluation System must be capable of incorporating such data, whatever its form, without revision of the System. In addition, the System should be capable of providing summary analyses of the extent to which skills and knowledge have been imparted in particular programs. This capability would enable regional and statewide planning objectives to be formulated in terms of the delivery of specific skills and training to students, rather than in terms of the services provided and the number of students expected to participate in programs.

In addition to assessments of program effectiveness, the System must be capable of identifying the conditions under which programs are effective and the conditions under which they are not. For example, the Reporting and Evaluation System must have the capability to include and analyze the following student characteristics of recognized importance in occupational education: measures of cognitive functioning; measures of occupational interests; aspirations; measures of attitudes toward school and occupational education; and demographic characteristics such as age, sex, race and socioeconomic status.

The System must also be capable of incorporating specific measures which may be needed for particular programs: medical information, measures of eye-hand coordination, manual dexterity, and so on. In the past, occupational educational administrators have collected at least some of these student data, but have not had the means to assess their impact upon program effectiveness. In addition to student data, the System must be capable of processing teacher characteristics and other information relevant to the assessment of program effectiveness.

Finally, the Reporting and Evaluation System should provide the capability to assess the effectiveness of programs relative to costs. To be capable of carrying out cost-benefit analyses, the System must be able to process program cost data and to analyze these data with respect to a variety of effectiveness measures, including the indicators derived from system effectiveness studies.*

d. The System must be capable of meeting record-keeping requirements for student certification.

In occupational education, it is possible to set rational behavioral program objectives and to determine whether students have met them. The objectives can be consistent with the entry level skills required for the jobs

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* See Volume II of the final report.

for which the programs are providing training. For example, behavioral objectives suitable for a program in refrigeration equipment maintenance could include the ability of students to dismantle and reassemble refrigerators of different types.

When students have met the objectives, they may be certified as having the training and skills necessary for work within a given occupational category. Some form of statewide certification would undoubtedly help to create a job market for program graduates, and to improve training standards within occupational education. Riverside's system study, conferences with SED personnel, and studies of the occupational educational literature indicate that certification of competence in a given field is both feasible and desirable. Therefore, Riverside recommends that procedures for generating certificates of competence in particular occupations be included in the Reporting and Evaluation System.

The Reporting and Evaluation System should be capable of being the record-keeper of student performance. Since some programs incorporate courses which are taken by students in different years, the System must be capable of keeping records over long periods of time. Finally, the Reporting and Evaluation System must be able to process student records with certification algorithms developed by occupational educators, and to report which students are entitled to certification in each program.

e. The System must be capable of test scoring and analysis.

Test scoring and analysis are required for the reporting, evaluation and certification functions.

f. The System must be capable of attendance processing, course scheduling, and the execution of a variety of fiscal functions within occupational education.

Although attendance, course scheduling and fiscal operations are not completely germane to reporting and evaluation as defined in this report, many of these operations make use of data that would be contained and processed in the Reporting and Evaluation System. Redundancy could be eliminated by linking these operations to the Reporting and Evaluation System.

3. Structural specifications of the System.

a. The Reporting and Evaluation System must be usable by the diversity of educational centers which offer occupational programs in New York State. These units include two- and four-year colleges, Big-Six agencies, school districts which subscribe to BOCES occupational services, and those which do not.

b. The System must be compatible with the Basic Educational Data System (BEDS) and other information systems under development or currently maintained by the State Education Department.

c. The System must serve to reduce the time required of personnel in local educational centers to fulfill reporting and evaluation requirements.

B. Description of the Reporting and Evaluation System

1. General system flow.

Figure 1 is a schematic representation of the Reporting and Evaluation System. As indicated in the figure, the System includes operations carried out at or near the sites where occupational programs are offered (Regionalized Occupational Education Operating Functions), as well as operations performed by a Centralized System Integration and Management Unit. For illustrative purposes, Figure 1 shows only one local occupational educational unit (e.g., a school district, a BOCES center, or a community college) linked to the Centralized System Integration and Management Unit. In actual practice, the Integration and Management Unit would have responsibility for all local occupational educational units.

As indicated in Figure 1, local operating functions such as attendance, enrollment, test scoring, and grade reporting are integrated at the local level with the support of local or regional data processing centers. Thus the data associated with the local operating functions would be checked, organized, and aggregated (when necessary) at the local level.

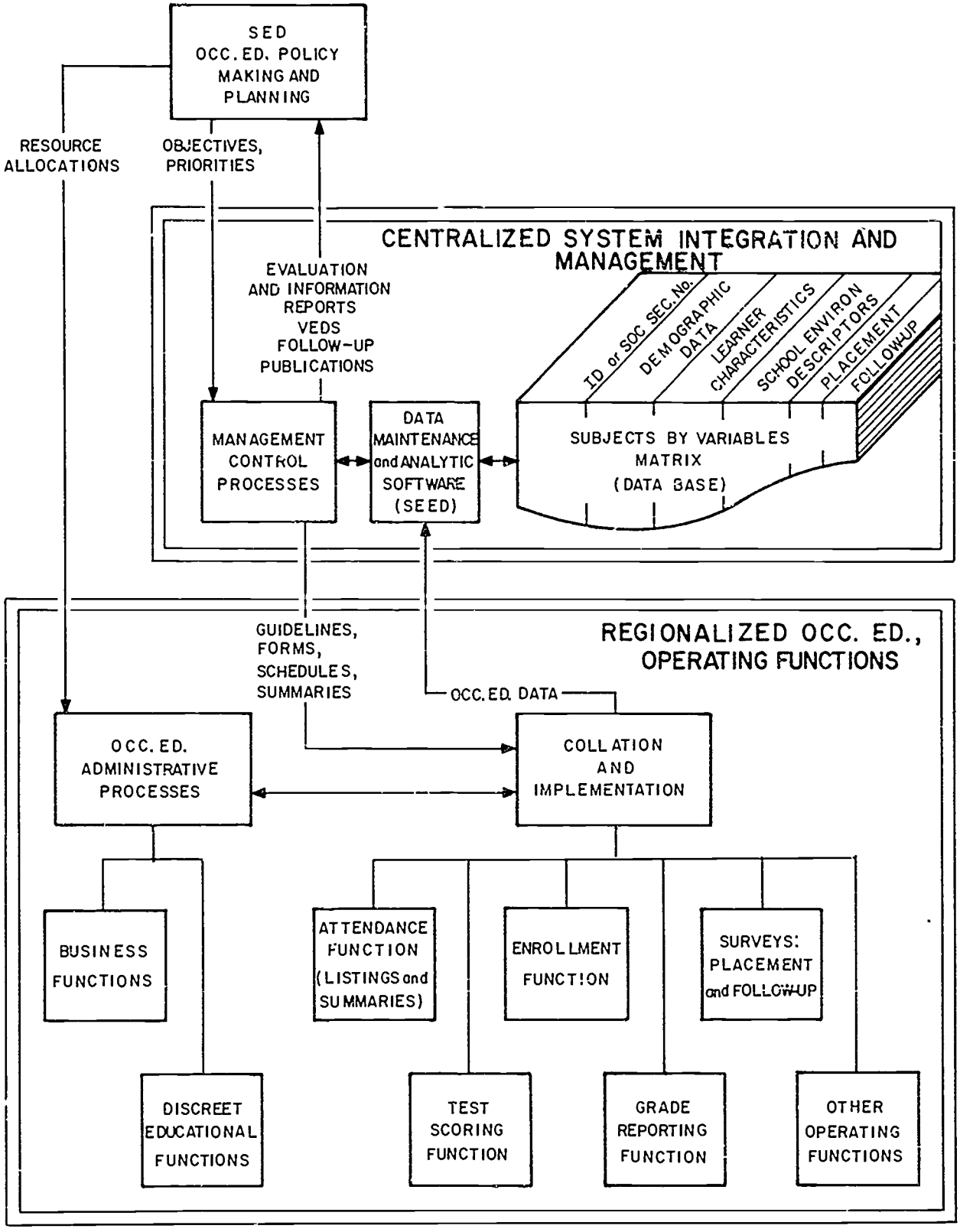

FIG. 1 INFORMATION FLOWS IN THE REPORTING AND EVALUATION SYSTEM

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Management Control would develop forms, schedules, guidelines and procedures for local information collection and integration. These materials would be developed to ensure that needed information is efficiently gathered and to ensure that the information requirements of the State Education Department, local occupational educators and other groups are being fulfilled.* When necessary to do so, Management Control would also develop software to be used locally for the efficient integration of local operating functions.

Data would be sent by the local data processing units to the System Integration and Management Unit to be organized and added to a central, computer data base. A computer software package, System for the Evaluation of Educational Data (SEED), would be used by Management Control for data maintenance purposes. Management Control would have the responsibility of organizing data collection processes and meeting requests for reports and evaluations from the State Education Department, from regional educational centers, and from all other sources.

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* Specific procedures for integrating local operating functions might vary to some extent with the type of local occupational educational agency administering the programs (e.g., BOCES, community college, Big-Six city, etc.). However, it is RRI's judgment that relatively standard practices can be and need to be developed for the execution of local operating functions.

2. The data base.

The largest component of the data base would contain student information. Information for each student receiving occupational education would be maintained within a computer data base. As indicated in Figure 1, the information would be stored in matrix form. Each student occupies a row of the matrix, and each student datum is stored in a particular column of the matrix.

The entry of information into the student data base begins at the time of enrollment of the student in an occupational program. Management Control would provide guidelines and forms to help guidance counselors, admissions personnel and others involved in the local enrollment process to obtain student information for subsequent entry into the student data base. Student information to be entered would include student name, Social Security number, address, race, sex, ethnicity, educational level (secondary, post-secondary, etc.), type of student (handicapped, disadvantaged, regular), parent's occupation, available objective achievement data, and any other information (such as medical data) which can be obtained conveniently when students enroll.* The Office

* The measurement of social immobility will require additional information, such as each student's family members, friends in the region, attitudes, and so on. See Volume II of the final report.

of Education Program Code corresponding to the program that the student was taking would also be included.*

The student's Social Security number is very important to the Reporting and Evaluation System. It provides a unique numeric identifier for each student while avoiding the problems associated with maintaining a separate identification system. Although many occupational education students currently do not have Social Security numbers, they would be asked to obtain them. Assistance can be provided from local educational agencies for this purpose.**

As the student continues in occupational education, more information is added to the data base. For example, Management Control would issue computer lists containing student names, occupational education course numbers, and Social Security numbers. These lists would be used by teachers to record students' grades. The lists would then be returned to the central data processing unit, where grade information would be entered into the student data base.

Similar procedures would be used to enter test scores, aggregated attendance data and other information required for evaluation and reporting purposes. The last elements

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* Office of Education Program codes may be found in Vocational Education and Occupations (1968).

** The Social Security number has considerable advantages for the System. The Social Security Administration will assign numbers to students if requested to do so. In addition, there is evidence that, within a few years, the Social Security Administration will automatically assign numbers to elementary school children.

of information to be entered would probably be student placement and follow-up data.

The student data base would be supplemented in some instances by other information. For example, another component of the data base would contain information about teaching personnel. This component would contain Social Security numbers, experience, training, type of teacher (regular, paraprofessional), teaching assignment (course code), salary information and other data. For the Big-Six and large local occupational educational agencies, a third component of the data base would be organized by occupational program.

C. Meeting the Functional Specifications. System Outputs and their Utilization.

1. Legal reporting requirements.

a. Enrollment reports. Enrollment reports would be generated by Management Control by aggregating information contained in the student data base. The information could be aggregated to meet the needs of the State Education Department Division of Occupational Education Planning. For example, for each occupational program given at each local center, the number of enrolled students would be reported. This information would be sorted by student sex, ethnicity, educational level and type of student (general, disadvantaged or handicapped). For enrollment reports as well as other information required by the State, data would be submitted from each local

occupational unit to the Integration and System Management Unit. There it would be stored, aggregated over units according to State Education Department needs, and submitted to the State Education Department in a convenient form.

b. Follow-up reports. The Reporting and Evaluation System could produce follow-up reports in two ways. On the assumption that the Targeting System is operating, Management Control would retrieve (from the student data base) the Social Security numbers of students who completed each program as well as those who did not. The Social Security numbers would then be traced in the Targeting System data base, the Dictionary of Occupational Titles (DOT) codes for the graduates' jobs would be obtained, and the relatedness of the graduates' jobs to their training would be assessed.*

If the Targeting System were not operating, the Reporting and Evaluation System would carry out follow-up studies in the following manner. Lists of addresses and telephone numbers of students who had completed programs, as well as those who had not, would be obtained from the student data base. Management Control would produce computer-generated mailing labels and send out a carefully designed follow-up survey form on which student Social Security numbers had been pre-entered. A number of questions would be asked to determine

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* This procedure is described in Volume II of the final report.

the employment status of each student being surveyed. As the surveys were returned, the data would be collected by the local occupational units and subsequently entered into the student data base. For students who did not respond, lists of student names, last-known addresses, Social Security numbers, and last-known telephone numbers would be sent to the local occupational units. Students would be telephoned by local personnel and the follow-up data would be entered in the lists. When a sufficient number of students (or their parents) had been reached, the lists would be returned to the System Integration and Management Unit, where the new information would be merged into the student data base.

Management Control would then aggregate the information in the student data base to fulfill the State's requirement for follow-up information. As in the case of enrollment reports, follow-up data could be aggregated to meet current planning and evaluation requirements of the State Education Department. For example, the numbers of students who completed and the numbers of students who did not complete each program within each local occupational unit would be reported. The information could be partitioned by sex, ethnicity, type of student, educational level, and employment status (unemployed, employment related to training, employment not related to training, part time, full time, continuing education at higher level, etc.).

c. Personnel data. Personnel information would be reported to the State Education Department by Management Control. The information would be obtained and aggregated from the personnel file. In accord with current reporting requirements, the following personnel data could easily be reported for each local occupational unit: the number of full-time teachers, part-time teachers, paraprofessionals, and so on, teaching in various occupational fields.

2. Other reporting requirements.

Management Control would meet a variety of reporting requests that come from local occupational educational units and other sources. Management Control would formalize a request system so that individual administrators could have indirect access to centrally stored data. Since it is not possible at this stage of system development to predict all of the ways in which occupational administrators might want data analyzed and reported for regional purposes, it is not possible to describe the exact procedures for meeting these regional reporting requirements. However, SEED software (described in Section III D) will enable Management Control to fulfill virtually any request for aggregation or analysis of information which had been stored previously in the data base.

3. Evaluations of program effectiveness.

As indicated elsewhere in this report, there is a definite trend in occupational education to establish explicit

program objectives. These objectives are sometimes termed "behavioral objectives" or "career educational performance goals." The objectives are based upon the entry-level skills required in the jobs for which the program is providing training. Since the objectives may be related to required entry-level skills as defined by job analysts, the objectives are easier to develop in occupational education than in practically any other educational area.*

For programs which have explicit objectives, information may be collected concerning the extent to which each student has met the objectives. This information, coupled with grades and other student data, may be stored within the student data base of the Reporting and Evaluation System and used as the basis for evaluations of program effectiveness.**

At the end of a program, a full summary of the extent to which various student groups have met the program's objectives would be reported to local occupational education administrators. These data would also be aggregated into a general

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* For example, an objective for a figure clerk might be as follows: when given a bundle of 100 cash slips fastened by a rubber band, a rubber thumb, and a 10-key adding machine, the student must be able to obtain a tape total from the adding machine. A second total will then be run for verification. One tape will be dated and attached to the bundle of sales slips. The entire operation is to be completed within five minutes (Huffman & Byers, 1971).

** Such information could also be used for program monitoring processes. Program monitoring in occupational education is described in Volume III of the final report.

program effectiveness summary. If costs could be associated with programs, then costs-effectiveness measures would also be computed and reported.

If a program was judged to be unsuccessful in providing the skills and knowledge required to enter the occupational cluster to which the program was directed* (i.e., when students did not meet the program's objectives), local occupational educators could request evaluative analyses from centralized management to help to identify any program deficiencies.

Virtually any type of evaluative analysis could be carried out. For example, the importance of meeting the objectives could be determined by analyzing the relationship between the attainment of objectives and follow-up employment experiences. Through the statistical analysis of program results, it would also be possible to identify factors which are correlated with failure to meet program objectives (e.g., student reading level, student attitudes toward occupational education, attendance). The results of such program analyses would be given to local occupational educators along with an interpretive summary and a set of recommendations for adjusting the program. On the basis of such reports, occupational educators could plan a variety of changes in the program to improve its effectiveness. For example, occupational educational personnel could request local districts to devote more resources

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* See Volume II of the final report for a discussion of job similarity and job relatedness.

to improving reading skills, or request them to introduce activities designed to motivate students to attend relevant courses.

The Reporting and Evaluation System has been designed to fulfill many evaluation requirements. Programs with similar objectives but using different pedagogical approaches could be compared to determine which approach is most effective for different student groups. The effects of an array of factors (such as class size, teacher experience, student occupational aspirations, attitudes toward school) upon program success could be determined. Studies of dropouts from occupational education could be conducted. The evaluative processes which the System is capable of performing are far too numerous to mention in these pages. However, the system will provide the capability for general program evaluation as well as the capability to carry out idiosyncratic evaluations of particular programs for a variety of local purposes.

4. Student certification.

Once program behavioral objectives have been established for occupational programs, and once procedures have been applied to objectively assess whether students have met the objectives, it will then be possible to construct a meaningful certification system. When students have met the objectives of each course within a program, they may be certified as having mastered the entry-level skills of corresponding occupations.

Since many programs extend over more than one year, the Reporting and Evaluation System student data base would be used to store student data for any number of years. As each student finished each course, the extent to which behavioral objectives were met would be added to the data base.

The criteria for certification will vary from program to program. In some cases, occupational educators might think it necessary to meet all program objectives. In other cases, some fraction of the total number of objectives might be considered sufficient for certification. In still other instances, it might be considered important for students to meet specified critical objectives plus a fraction of all other objectives.

All certification criteria would be incorporated by Management Control into certification algorithms. These algorithms would operate on the data in the student data base. Lists of students who had met the certification criteria would be generated. Information could also be provided on students who did not meet the certification criteria, and the objectives which they failed to fulfill to attain certification could be identified.

Since follow-up data would be included in the student data base, it would be possible to assess the effects of certification on the employment status of various groups of occupational graduates. Thus, the Reporting and Evaluation System could be used not only to maintain a statewide certification

system, but also to perform some needed evaluations of student certification requirements.*

5. Test scoring and analysis.

Test scoring would be carried out at the local level with standard test scoring software (provided, where necessary, by Management Control). Test scores would be entered and maintained in the student data base.

6. Attendance, scheduling, census, grade reporting, and other administrative functions.

Much administrative processing would be carried out at the local level with the support of Management Control. Since the results of much of the local processing would be merged into central data banks, Management Control would be active in providing local occupational education units with software, procedures, forms and other products which would give them the capability to carry out local processing efficiently.

D. Management of the Reporting and Evaluation System Data Base. SEED

1. The trade-off between efficiency and flexibility in computer software.

A frequent obstruction in the development and installation of management information systems is the substantial cost associated with writing and testing computer software.

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* The Targeting System (see Volume II of the final report) will also be useful in making such evaluations.

When a system cannot be completely specified at the outset, but must evolve over time, software costs can be devastating. Software developed on an ad hoc basis to fulfill initial specifications often has to be re-written many times as the system specifications change and expand with system use.

In the Reporting and Evaluation System for Occupational Education, specific system processes will undoubtedly be changed from time to time. Issues of accountability, reporting and evaluation have become important relatively recently in occupational education, and thus there is still disagreement among occupational educators concerning ultimate reporting and evaluation requirements. Furthermore, federal and state reporting requirements are likely to change, the objectives in the State Plan will change, and, as indicated elsewhere in this report, program evaluation criteria will certainly change.

If the Reporting and Evaluation System is to fulfill its purposes, the System must be able to assimilate these changes without major revisions in computer software. Flexible software must be used which will not require major modification as system requirements change and expand. However, such software will be less efficient than software specifically written to fulfill a particular purpose (i.e., more computer time will be required). Highly efficient software is appropriate when system specifications are likely to remain stable for many years and only a minimal number of non-standard system applications

are expected to be carried out. For the Reporting and Evaluation System, the costs saved by applying efficient software now would be off-set several times over by continual software redevelopment in the near future.

Thus, one of the tasks undertaken by RRI was an assessment of the applicability of an existing flexible software package, System for the Evaluation of Educational Data (SEED), to the Reporting and Evaluation System.

2. SEED and its general suitability for occupational education.

SEED is a flexible software system designed for the maintenance and analysis of educational data. During the past year, RRI has assessed the suitability of SEED for the Reporting and Evaluation System for Occupational Education. The general structure and capabilities of SEED were found to be suitable, although some changes and additions were necessary to adjust SEED to the specific needs of occupational education as defined in the system study. Some of these changes and additions were undertaken during the contract period and are reported in the next section. In addition, a nontechnical user's manual was written for SEED. This manual describes the application of SEED to data maintenance and analysis. The manual appears as Appendix A of this volume of the final report. The manual fully explains SEED's capabilities and operating procedures.

SEED is capable of maintaining the data base described in earlier sections of this report. The specific data maintenance capabilities of SEED include flexible data entry and data checking, data storage, merging new information, retrieval of individual student records, and the capacity to handle incomplete data.

SEED is capable of summarizing and reporting the data it maintains in virtually any manner. For example, once individual student and personnel data are entered into the data base maintained by SEED, the aggregation of individual data to fulfill current state reporting requirements takes just a few SEED English syntax commands. Reports generated by SEED may be in several forms: frequency distributions; cross-tabulations; plots of various types; and lists of particular groups of students by program, ethnicity, educational background, or any other characteristic included in the data bank. Since data in SEED-generated reports are labeled by SEED according to the user's directions, the reports should be easily intelligible to the recipients.

In addition to SEED's capacity to meet both state and regional reporting requirements, SEED's analytic capabilities will allow for the fulfillment of the evaluation requirements. SEED is capable of processing and summarizing follow-up data. Furthermore, grades, test results, attitude data, measures of the extent to which students have met behavioral

objectives, and virtually any other type of data relevant to the evaluation of occupational programs may be maintained and processed by SEED. SEED's capabilities for providing statistical analysis of data include: analyses of variance and covariance; t-tests; various correlations (biserial, tetrachoric, Pearson product moment); multiple regression analysis; multiple discriminant analysis; factor analysis; chi-square analysis; and analysis of uncertainty.

SEED may also be used to maintain a student certification system for occupational education. Management Control would provide SEED with certification algorithms and English syntax instructions for each occupational program. SEED could then generate the names, addresses and Social Security numbers of students who were able to meet the certification criteria as well as those who were not.

SEED software is open-ended. The user may attach temporary or permanent subprograms for certain types of analyses and reports. For example, since student names, addresses, and grades are maintained within the student data base, a subprogram may be added to SEED to generate students' transcripts and prepare them for mailing.

3. Modifications of SEED to make it suitable to the needs of the Reporting and Evaluation System.

Although SEED is generally suitable for the Reporting and Evaluation System, certain technical changes and additions

were desirable. These changes and additions were identified during the contract year, and the work efforts associated with the following changes and additions were undertaken:

- SEED formerly accepted only 8 place numeric identifiers. Since the Social Security number is 9 places (and longer identifiers might possibly be needed), SEED was revised to accept 16 place identifiers;
- during the contract year, more analytic capability was added to SEED through the addition of capabilities for multiple discriminant and uncertainty analyses;
- SEED's cross-tabulation capability was further generalized, and the output format was made more readable to enable occupational educators without technical experience to be able to interpret SEED cross-tabulation outputs;
- the development of more efficient sort-merge software was begun during the contract period. Since student, personnel and program data will be put into the Reporting and Evaluation System data base over periods of many months (and possibly many years for follow-up analyses, certification procedures and time-series studies), RRI determined that SEED's sorting and merging capabilities were not sufficient for the large number of sorting and merging operations which the Reporting and Evaluation System would have to perform.

It is Riverside's judgment that a few additional changes in SEED would facilitate its application to evaluation and reporting requirements. In addition to slightly increased analytic capability, and some changes in data maintenance procedures to obtain more efficiency, SEED also needs a built-in capability to limit data base access to authorized users. RRI expects to execute these SEED changes and additions during the forthcoming contract year.

4. The availability of SEED to the State Education Department.

SEED is a proprietary system developed under RRI auspices. SEED is based upon a software package known as P-Stat which has been developed primarily by Mr. Roald Buhler, formerly the Director of the Princeton University Computer Center. Under an agreement with RRI, Mr. Buhler has given permission for the development of SEED and has assisted RRI in this development.

Since SEED is eminently suited to the reporting and evaluation requirements of occupational education, and since the further development of SEED was undertaken in part under contract-supported work efforts, RRI is prepared to provide SEED to the State Education Department without fee for its own use. RRI has requested that SEED be used only by the New York State Education Department, only within the boundaries of New York State, and that appropriate measures be taken to prevent the use of SEED by unauthorized persons.

IV. Limited Field Test of the Reporting and Evaluation System

To test the feasibility of the Reporting and Evaluation System, a limited field trial was conducted at the Nassau County Board of Cooperative Educational Services (Nassau BOCES). Since administrators at the Nassau BOCES were primarily concerned with the fulfillment of state reporting requirements, the field trial focused upon the reporting component of the Reporting and Evaluation System.* Nassau BOCES and RRI personnel coordinated work efforts to carry out the field trial with the support of personnel within the State Education Department Division of Occupational Education Planning. The field trial is summarized below.

A. State-Required Program Enrollment Information

Boards of Cooperative Educational Services have the responsibility of aggregating enrollment information for students receiving occupational education at BOCES centers and at local school districts falling within each BOCES region. Enrollment information which must be reported includes the numbers of students in each program by educational level, sex, ethnicity and type of student. In order to reduce the time and effort expended by BOCES personnel to fulfill enrollment

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* However, past and present evaluation efforts at Nassau BOCES were also reviewed.

reporting requirements, enrollment reporting functions were included in the field trial.

For secondary students, an attendance card file was already in use as part of the student registration process. This file contained each student's name, ID number, telephone number, local school name and code, grade level, and course name and code.

SEED was used to enter the information in the card file into a computer data base. SEED was also used to enter the information from an existing teacher card file into the data base. Teacher information included in the data base consisted of each teacher's name and the names and code numbers for each teacher's courses. SEED was used to associate teachers with students and to generate a form with the names and ID numbers of the students enrolled in each course. Next to each student's name, the teacher circled the appropriate identifiers for sex, ethnicity, student type (general, disadvantaged, handicapped) and work experience. After the forms were returned by the teachers, the data were key punched and merged with the other student data in the SEED-maintained data base.

Since no card files existed for adult and special education students, forms were developed on which teachers entered student's names and the same enrollment information that was collected for secondary students. Special education and adult

enrollment data were also keypunched and entered into the SEED-maintained data base. Special education, adult and secondary student information was then aggregated by SEED into a single matrix. The enrollment data were aggregated according to State Education Department enrollment reporting requirements. In addition, SEED was used to aggregate and report the enrollment information submitted to the BOCES by local school districts.

B. Placement Information

To obtain placement information, SEED would be used to create forms for graduating students which would be similar to the enrollment forms. Guidance counselors would encircle appropriate responses to placement questions appearing next to each student's name. Although placement data are reported by program, student sex, ethnicity, and so on, this information ordinarily would not have to be indicated by guidance counselors because it would have been entered into the data base at the time of the students' enrollment. However, guidance counselors could update such information as students' addresses and telephone numbers in order to make follow-up studies more efficient. Placement data would be merged into the data base and aggregated to meet reporting requirements.

These procedures were followed in the Nassau field trial with one exception. Computer forms with pre-entered student

names were not provided to guidance counselors.* However, for use during the past year only RRI and BOCES officials developed a new form for reporting placement data which reduced the efforts normally required of guidance personnel to report placement information. The data provided by guidance counselors were entered into the SEED data base and aggregated in accord with reporting requirements. SEED was then used to produce a placement report. Placement data submitted to the BOCES by local school districts were also aggregated by SEED, and a placement report for these data was also generated.

C. Follow-up Studies

From the placement data, SEED generated lists of graduates, mailing labels, and decks of pre-punched cards for student graduates. The mailing labels were used to send follow-up survey forms to the graduates. (The mailings were followed up with phone calls when necessary.) When the forms were returned, the data were entered on the students' cards and

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* Placement data are reported for students who graduated in the prior academic year. These students had not yet been entered in the SEED-maintained data base. Thus, computer forms for guidance counselors could not be generated. However, students enrolled during the year that the field trial was conducted are included in the SEED-maintained data base. Therefore, during the forthcoming year, it will be possible to make use of the data base to produce placement forms for guidance counselors, and generally to make the reporting of placement information far more efficient.

merged into the student data base. After a sufficient proportion of the students had responded, SEED was used to aggregate the follow-up data in accord with regional needs and state requirements.

D. Summary of the Field Trial

Nassau BOCES administrators indicated that even this limited use of the Reporting and Evaluation System resulted in a substantial saving of time and a reduction of the difficulties associated with meeting state reporting requirements. When the System is in full operation, even more reporting functions will be included. Further integration should result in even more savings of the time and effort of personnel. In addition, the processes set up for efficient reporting will also produce efficient program evaluation.

Definite cost data were not compiled for the field trial since they would hardly be indicative of the cost of the System when it is in full operation. However, it was apparent to BOCES and RRI personnel that the integration of many operating functions using a centralized reporting and evaluation system was exceptionally cost-effective. The time which occupational educational personnel were able to save was worth substantially more than the sum of EDP charges associated with data base operations and charges for the fulfillment of reporting requirements.

V. A Strategy for Statewide Implementation

The Nassau field trial demonstrated that the Reporting and Evaluation System meets the system specifications set forth in Section III A of this report. Thus, it is reasonable to conclude that the System has been developed to the point where it is realistic to consider statewide implementation. Although it would not be possible to install the System at all locations in the immediate future, an incremental implementation strategy may be followed which will result in complete statewide implementation eventually.

The strategy consists of adding system functions at the Nassau County BOCES (where the System is already installed) while simultaneously beginning to install the System at an increasing number of other locations. This approach permits the experience and capability gained at Nassau BOCES to be applied effectively to installation at other locations.

The following tasks are recommended to the State Education Department in order to pursue this general approach to system implementation.

A. Feasibility Study of the Implementation of the Reporting and Evaluation System in the Big-Six Cities

The administration of occupational education in the large urban areas of the State is somewhat different than the administration of occupational education in BOCES, local school districts or community colleges. Although the Reporting and

Evaluation System will be applicable to the needs of urban educational agencies, it may be necessary to adapt some of the operational details of the System to the more complex administrative processes that exist in the cities.

B. Adding System Functions at the Nassau BOCES

The System is already installed at the Nassau County BOCES, and was used during this past year (in the field trial) to fulfill state-mandated reporting requirements. During the forthcoming year, it would be desirable to increase the number of functions which the System can perform.

The System should be augmented in ways which will encourage local school districts to participate in its use. For example, local districts may be interested in obtaining system-provided "state of occupational education reports" designed for the many local groups interested in publicly supported occupational education. The report might include:

- placement information;
- follow-up reports, including reports on occupational graduates who have obtained job-related employment or who are participating in employer training programs;
- enrollment reports, including reports of participation in occupational programs by each regional school district;
- special reports on new programs and on programs which are coordinated with local-district program offerings;

- reports on adult education programs;
- reports on students in special education courses, broken down by student age and type of handicap; and
- reports on the work experiences of occupational graduates.

C. Installation of the System at New Locations

The incremental implementation approach requires that the System be installed at several new locations during the forthcoming year. Since regional occupational educators seem to be concerned about reporting requirements, it would be sensible to begin implementation in each new region with the system's capability to meet reporting requirements. As the demand for system services increases, the data base that is built for reporting purposes can be used to perform program evaluations and analyses.

D. Procedures for Efficient System Implementation

In order to bring about efficient system implementation, standard implementation procedures need to be developed and written materials, describing the System and its utilization, need to be developed. Specifically, the following products are considered by RRI to be sufficiently important to warrant development during the next year:

1. A system guide.

A simple guide to the Reporting and Evaluation System would be designed. This guide would illustrate what

the System does, explain the advantages to be expected from its use, and provide some guidelines for locally integrating currently discreet administrative processes (e.g., enrollment, attendance, placement, transcript production) now being performed at BOCES, community college, and school district locations.

2. A user manual.

Since many individuals would require information from the System's data base, the development of standard procedures for using the System is an important component of system implementation. The manual would include instructions for requesting data summaries, analyses, updates and so on. The manual would also contain instructions for filling out and filing a standard information request form with Management Control.

E. Procedures for Inter-regional Communication

Once the System is installed at two or more locations, experience in the use of the System and in the resolution of problems can be effectively consolidated only if there are formal communication channels. Thus, in the initial stage of system implementation, the following should be developed:

1. An information exchange.

Experience with the System could be consolidated through an exchange of information in which participating personnel are informed of system developments, and different

ways of using the system to fulfill various reporting and evaluation tasks are shared. For example, when efficient methods are found for obtaining occupational enrollments from school districts and for entering this information in the System's data base, these methods should be shared with all locations using the System through an information exhange. The information exchange would also serve as a vehicle for informing local occupational educators of new capabilities and procedures at the management control level.

2. Software exchange.

A variety of software will be required to support local system functions. Much of this software already exists and is available. For example, standard scheduling and attendance packages are already in use at Nassau County BOCES, and would need little if any revision to be applied effectively at other locations. Thus, as the Reporting and Evaluation System is implemented, it would be useful to have regular bulletins produced describing programs under development, and containing up-to-date lists of available software. The bulletin should serve to eliminate duplicate efforts in software development.

F. Subsequent Implementation

After the communication products described in Sections V D and V E are developed, implementation can be carried out at a faster pace since the regions themselves will be able to

participate directly in implementation. Furthermore, after the feasibility study for implementation in Big-Six cities is completed, system use may be substantially expanded by installation in New York City, or in other large urban areas not currently subscribing to the occupational services provided by the BOCES system.

VI. References

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