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ABSTRACT

This document has been prepared to assist program administrators and practitioners in planning and implementing cooperative (co-op) programs in high technology occupational areas. Information focuses on the key elements, strategies, and procedures of successful co-op programs. The guide contains nine chapters and is based on a review of the literature, discussions with educators and business representatives, and reviews of databases and case studies. Chapter 1 examines the training-related problems that respond positively to effective cooperative training programs in high technology fields and provides definitions of relevant terms. Chapter 2 discusses pertinent findings from the literature review, including cooperative education and its benefits, how the needs of high technology industries affect cooperative training programs, and the components necessary to a quality cooperative program. Chapter 3 draws from case studies to discuss the educational and economic benefits of cooperative programs, addresses what is needed to develop a quality program, and provides ways to identify potential cooperative training sponsors. Chapter 4 examines guidelines for developing cooperative program policies, while chapter 5 reviews project findings on ways to enhance the learning experiences of co-op students. Chapter 6 addresses special population and equity issues as they relate to cooperative education. Chapter 7 discusses strategies for marketing co-op programs to employers, to students, and to the community. Chapter 8 examines the importance and components of effective evaluation of co-op programs. Chapter 9 takes a close look at the importance and methods of interpreting and presenting the results of program evaluation. Appendixes contain sample program materials and resource lists. (KC)

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Research and Development Series No. 263

PREPARING FOR HIGH TECHNOLOGY: SUCCESSFUL CO-OP STRATEGIES

Stephen J. Franchak
O. H. Michael Smith

U.S. DEPARTMENT OF EDUCATION
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1960 Kenny Road
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FOREWORD

This document has been prepared to assist program administrators and practitioners in planning and implementing co-op programs in high-technology occupational areas. Information focuses on the key elements, strategies, and procedures of successful co-op programs.

This project was conducted by the National Center for Research in Vocational Education, The Ohio State University, under contract with the Office of Vocational and Adult Education. The National Center wishes to acknowledge the leadership provided to this effort by Dr. Robert E. Taylor, recently retired Executive Director. The study on which this document is based was conducted in the Evaluation and Policy Division under the direction of N. L. McCaslin, Associate Director. Appreciation is extended to those who assisted in conducting the study and developing the final report: Idas Halasz, Associate Director for Organizational Development, for her assistance in conducting the case studies; and Morgan Lewis, Research Scientist, and Frank Pratzner, Senior Research Specialist, for their review and critique of the draft report. We are also indebted to Connie R. Faddis, editor at the National Center, and Michael Neuman, Associate Professor, Capitol University, who provided technical editing.

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Acting Executive Director
The National Center for Research
in Vocational Education

EXECUTIVE SUMMARY

The rapid rate of technological change, the cost of new equipment, and the need to keep occupational instructors up to date have encouraged cooperation between educational institutions and the private sector to facilitate training. This is particularly true in high-technology training programs that require sophisticated equipment beyond the budget constraints of most schools.

Many secondary and postsecondary institutions recognize that cooperative education resolves many problems of high-technology training. By combining classroom training with actual on-the-job experience at training stations in high-technology companies, co-op programs develop the high-level technical, conceptual, interpersonal, and employability skills needed by today's high-technology industries.

This publication is intended to provide State and local educators with guidelines for upgrading existing co-op programs in high-technology fields and for implementing new ones.

The study undertook six major tasks: (1) analyze and synthesize what is known of co-op programs by reviewing previous studies, (2) conduct information collection via case-study interviews, (3) integrate data and information collected, (4) identify elements of model co-op programs, (5) identify procedures for implementing an exemplary co-op program, and (6) prepare a report (this publication).

Information and data collection involved the following activities:

- Review of the literature
- Discussions with selected State research coordinating unit directors and staff, National Postsecondary Alliance members, and Cooperative Work Education Experience Association members
- Discussions with other knowledgeable persons at such events as the annual conference of the American Association of Community and Junior Colleges, the National Research Coordinating Unit Association and Curriculum Coordination Centers meeting, and the National Vocational Education Dissemination and Utilization conference
- Telephone discussions with individuals representing the National Alliance of Business, AFL-CIO, the U.S. Chamber of Commerce, and other pertinent organizations
- Discussions with labor and management representatives from such companies as Worthington Industries and General Motors (Columbus, OH)
- Reviews and analyses of National databases, such as the National Longitudinal Survey of Labor Market Experience (Youth Cohort), High School and Beyond, and Class of 1972

- In-depth interviews of eight case-study sites (i.e., Albuquerque Vocational Technical Institute, NM; Cincinnati Technical College, OH; Guilford Technical Community College, NC; Holyoke Community College, MA; Lane Community College, OR; Okaloosa-Walton Junior College, FL; Orangeburg-Calhoun Technical College, SC; and Utah Technical College at Salt Lake City, UT)

Chapter 1 examines the training-related problems that respond positively to effective co-op training programs in high-technology fields and provides definitions of relevant terms. Chapter 2 discusses pertinent findings extracted from the literature review, including cooperative education and its benefits, how the needs of high-technology industries affect co-op training programs, and the components necessary to a quality co-op program. These components include up-to-date planning information, replicable model training programs, availability of pertinent curriculum materials, industry advisory councils, good relationships with existing training programs at the school, adequate student interest and enrollment, availability of relevant jobs for placement, and availability of appropriate equipment/software for training. Finally, the chapter reviews what previous studies have revealed about the need for co-op programs in high-technology areas.

Chapter 3 draws from the case studies and other information to discuss the educational and economic benefits of co-op programs. It goes on to address what is needed to develop a quality co-op program and provides insights into ways to identify potential co-op training sponsors. Benefits accrue to co-op students by providing a small income (via wage or salary from the part-time co-op job), building work-related contacts, developing more realistic perceptions of the world of work, and developing occupationally specific skills and knowledge through hands-on experience in a real work environment. Benefits also accrue to employers (many of whom use co-op participation to improve high-technology training in their area and to help recruit new employees), to the school (through better contacts with business and industry, improved program content and training experiences, and access to state-of-the-art equipment), and to the community (by aiding local economic development).

Key elements and procedures in implementing an effective co-op program are numerous. Some examples include using job rotation at the company training station, placing co-op students in jobs that match their abilities and occupational objectives, integrating students effectively into the work environment, designing the instructional process jointly between school and employers, developing training plans that facilitate training in specific competencies, developing a systematic process to make co-op program design responsive to local labor needs, promoting industry involvement in the co-op program, ensuring co-op experience of sufficient duration to benefit both students and employers, conducting appropriate evaluation techniques to ensure effective training experiences, keying student assessment to specific objectives of the training program, maintaining close working communications between industry sponsors and program faculty, and so forth.

Chapter 4 examines guidelines for developing co-op program policies. Pertinent policies should address the following four key program components: (1) an advisory council defined either as policymaker or advisor to policy-making, (2) the role of the school faculty in planning and implementing the program, (3) the responsibilities for leadership and administration of the program, and (4) the roles and relationships of the top-level school administrators regarding the co-op program. Other policy concerns include learner objectives, selection of training sites, commitment to programs, identification of co-op students, structure for learning, diversity of experiences, student access to various employment levels, criteria for academic credit, employment credit, paid experiences, legal requirements, worker protection, preparation of educational personnel, preparation of workplace personnel, and program evaluation.

Chapter 5 reviews project findings on ways to enhance the learning experiences of co-op students. Many successful programs engage in six related activities: (1) sensitizing students to the overall life-style of the occupation or profession for which they are being trained; (2) involving students in the selection of the company training site at which they will work part-time; (3) ensuring that students receive optimum job exposure during their training/work experiences (e.g., student rotation to same organization, same department; to same organization, different departments; to different organizations, same department; or to different organizations, different departments); (4) ensuring that the co-op students learn about the impact of the product(s) or service(s) on which they work; (5) ensuring that students receive an appropriate diversity of job experiences that will develop their job skills, transferable skills, career knowledge and options, and so forth; and (6) monitoring and evaluating the co-op experience.

Chapter 6 addresses special population and equity issues that must become part of co-op program planning. These issues include recruitment, selection, training delivery, and placement at co-op work sites.

Chapter 7 discusses strategies for marketing co-op programs to employers (who may serve as program sponsors or advisory committee members), to students, and to the community at large. The chapter reviews approaches that have benefitted existing co-op programs and offers a number of examples and checklists to assist in developing an effective marketing plan.

Chapter 8 examines the importance and components of effective evaluation of co-op programs. As a key to consistent program quality, evaluation for co-op programs must address quality assurance (formative evaluation) and impact assessment (summative evaluation). A practical evaluation plan will address (1) identification of the relevant decision makers and information users who will need the evaluation results, (2) development of the evaluation objectives, (3) identification of the evaluation subjects, (4) selection of the appropriate evaluation methodology, and (5) selection of an existing instrument or development of a new one. The chapter then reviews the basic approaches of two qualitative evaluation methodologies, participant observation and unobtrusive measures, and discusses the pros and cons of each.

Chapter 9 takes a close look at the importance and methods of interpreting and presenting the results of program evaluation. Evaluators must target the type and amount of information they present to the needs of the various audiences. For the general public, a one- to three-page report of highlights is usually best. For educational administrators, employers, and other selected audiences, a one-page executive summary and list of conclusions and recommendations are usually appropriate. For educational planners a detailed technical report will probably be needed. Information packaging—that is, language level, selection of information to be presented, use of charts and graphs, and so forth—should match the technical savvy and information needs of the audience.

A number of appendixes provide supplementary information of interest to co-op program developers and administrators, including the objectives and procedures of the current study reported herein, the case-study sites' technology programs, materials of the Technical Scholars Program at Guilford Technical Community College, materials of the Cooperative Education Program Evaluation at Utah Technical College at Salt Lake and Holyoke Community College, a policy statement from Lane Community Colleges, a descriptive summary of the Orangeburg-Calhoun Technology College Co-op program in a nuclear power industry, and a list of associations that may serve as co-op program resources.

Overall, the project found that the benefits, key elements, and useful procedures for successful high-technology co op programs are similar to those of co-op programs in other occupational areas. This generic nature of high-technology cooperative education facilitates the implementation of these programs within the educational institution. However, high-technology occupations present a unique challenge to educators to remain current and relevant because of the rapid rate at which technological applications change. Some occupations are expanding, others are being "deskilled," and still others are being abolished.

CHAPTER 1
INTRODUCTION

Overview of the Problem

Technological change, cost of new equipment, and the need to update instructors have encouraged cooperation between public vocational education and the private sector. This cooperation is particularly valuable in high-technology programs that require up-to-date, sophisticated equipment beyond the budget constraints of most postsecondary institutions. This need for improved cooperation between education and industry is highlighted by Brooking (1984). He states:

> to survive economically, U.S. must keep pace with advances in technology—computerized numerical control, robotics, CAD/CAM, microcircuits and microprocessors, etc. The sense of urgency shared by industrial leaders and economists has dramatized the need for an appropriate and immediate response to this challenge in both the industrial and educational cummunity. (p. 3)

One way postsecondary institutions address these constraints is through cooperative education. By using high-technology training stations for part of the students' educational experience, postsecondary institutions can provide training in the technical and employability skills required by high-technology industries. Unfortunately, only a small percentage of postsecondary vocational-technical students have the opportunity to participate in cooperative education programs offering such high-quality educational experiences. The National Center for Education Statistics showed that only 9 percent of 1980-81 postsecondary cooperative education enrollments were in technical occupational program areas.

The National Academy of Sciences and the American Vocational Association have both called for expansion of cooperative vocational education programs (Craft 1984), but growth has been slow in technical program areas. This is in spite of the value of cooperative vocational education recognized by the General Accounting Office, the National Manpower Institute, and the National Association of Secondary School Principals (Blachke and Steiger 1976; Lloyd 1981).

More information is needed (1) to determine which postsecondary institutions need to offer co-op programs so their numbers may be increased and (2) to ascertain how to make such programs successful. Only in this way can schools broaden such students' educational opportunities and serve the needs of employers, as well.

Purpose and Organization

This study examines the history and current state of postsecondary cooperative education programs in high-technology occupations. Information was drawn from a review and synthesis of the literature, case-study interviews with 141 people involved in high-technology co-op programs

at 8 sites, and telephone conversations with over 30 people across the country involved in the delivery, administration, and research of such programs. (For an overview of the study's objectives and procedures, see appendix A.)

This document synthesizes this information, focusing on the following areas:

- Economic and educational benefits of high-technology co-op programs as they apply to students, employers, educational institutions, and the community
- Key elements of successful programs
- Strategies and techniques for implementation

This information is intended to aid practitioners and administrators of high-technology co-op programs in setting up, operating, and improving their own co-op endeavors.

Definition of Terms

Key words are used throughout the report, such as **cooperative education** and **high technology**. Although these words are used in a variety of ways and have many meanings for many individuals and groups, all have strong similarities. The following definitions are derived from the Carl D. Perkins Vocational Education Act (P. L. 98-420), as well as other pertinent sources:

- **Cooperative (co-op) education** means a method of instruction of occupational education for individuals who, through written cooperative arrangements between the school and employers, receive instruction (including required academic courses and related occupational instruction) by alternation of study in school with a job in an occupational field. The two experiences must be planned and supervised by the school and employers so that each contributes to the student's education and employability. Work periods and school attendance may be on alternate half days, full days, weeks, or other periods of time needed to fulfill the cooperative program requirements. (Federal Register 1985, p. 3632)
- **High technology** means state-of-the art computer, microelectronic, hydraulic, pneumatic, laser, nuclear, chemical, telecommunications, and other technologies. These technologies are used to enhance productivity in manufacturing, communication, transportation, agriculture, mining, energy, commercial, and similar economic activity and to improve the provision of safety and health care.
- **Allocated time** is the amount of time the training station supervisors expect the student t work.
- **Basic skills** are reading, mathematics, and oral and written communication skills used in connection with the performance of a job. Examples of basic skills are calculating, speaking, listening, reading, and writing.
- **Employability skills** encompass knowledge of the world of work, work values or attitudes, and job search and career development skills.
- **Engaged time** is the time the student attends to work tasks in a particular area, using technical, basic, or employability skills.

- **Job-seeking, maintaining, and advancing skills** are those skills concerned with locating and obtaining job placement, both initially and on an advanced basis. Examples are (1) learning new job skills to get a different job or another position within the present firm and (2) developing a resume.

- **Knowledge of the world of work** is knowledge that contributes to a cooperative education student's understanding of how jobs are structured and how people prepare to engage in work. Activities in this area include becoming familiar with current and future job opportunities and understanding the implied social and personal requirements of specific jobs.

- **Task** is a measurable element of work from a larger occupational duty, usually performed by a single worker in a short span of time (Humbert and Woloszyk 1983).

- **Task analysis** is a sequential listing of the tasks necessary to the performance of a clearly defined, specific job. Task analyses are useful for classification and instruction (Humbert and Woloszyk 1983).

- **Technical skills** are those work tasks of varying degrees of difficulty that require proficiency, ability, or dexterity as well as complex or highly complex cognitive understandings (Finch and Crunkilton 1979). Examples are knowledge of procedures and proper care for and use of tools, equipment, and facilities.

- **Training agreement** is a written agreement that outlines the responsibilities of the student and employer. It is approved by the student, employer, faculty-coordinator, or director of cooperative education.

- **Training plan** is an educational plan often used in conjunction with a training agreement. Included are specific job tasks to be learned on the job and in the educational institution, along with an organized plan for the orderly acquisition and progression of job, duties, and tasks (Humbert and Woloszyk 1983).

- **Training sponsor** is an individual directly responsible for supervising students' on-the-job learning experiences (Humbert and Woloszyk 1983).

- **Training station** is the work site at an organization providing on-the-job training experiences for students enrolled in a cooperative education program (Humbert and Woloszyk 1983).

- **Work values or attitudes** are those qualities, as seen by employees, that reflect a viewpoint about the value of work and esteem for the employer and co-workers and that affect the employees' performance of a job. Examples are punctuality and competence.

Numerous resources and rationales for planning and implementing cooperative education already exist. Many research agencies, colleges and universities, and secondary schools have developed concepts and techniques for use in such ventures. Many textbooks also help to train co-op coordinators and others involved in the administration and operation of co-op education. This publication attempts to identify in one volume the most salient concepts and techniques that relate to cooperative education in high technology programs.

Organization of this Publication

The publication is divided into nine sections. Chapter 1 introduced the purpose and terminology. An analysis and synthesis of previous studies is presented in chapter 2. Chapter 3 highlights the benefits of co-op education for students, employers, educational institutions, and communities. It also presents the strategies of designing successful high-technology co-op programs. Chapter 4 offers ideas for developing policy guidelines. Chapter 5 presents ideas for enhancing the students' learning experiences at the training sites. Chapter 6 addresses special population and equity issues in such co-op programs. Marketing the high-technology co-op venture is discussed in chapter 7. Chapter 8 suggests procedures for evaluating co-op programs and explores critical evaluation issues and problems within the context of high-technology occupational areas. Finally, chapter 9 presents ideas for developing feedback mechanisms.

CHAPTER 2
AN OVERVIEW OF RELATED STUDIES

This overview of studies related to cooperative education addresses four relevant areas. The first section describes cooperative education and outlines its benefits. The second section reviews the impact of high technology on cooperative education. The third section examines the components of effective cooperative education programs, both in general and in high-technology areas. The final section looks at the need for co-op programs in high-technology areas and the problems of responding to that need.

Cooperative Education and Its Benefits

The Carl Perkins Act (P. L. 98-420) in 1984 defined cooperative education as a method of instruction of vocational education. Defined in this way, co-op education is one of several types of experiential education that take place beyond the confines of the traditional classroom. This broad context clarifies both the advantages of co-op education and some alternatives to it. According to Malak, Spirer, and Land (1979), the six key components of experiential learning are (1) academic credit, (2) participation, (3) payment, (4) program planning, (5) administrative supervision, and (6) the role of the experiential programs in the school curriculum (p. 9).

Sexton (1977) examines how different types of experiential education differ in their basic objectives. Table 1 shows how Sexton compares the objectives of co-op education with the other types of experiential education. The strongest co-op objectives include vocational education emphasis, financial compensation, performance of real work, emphasis on career preparation, and emphasis on relatedness of student experiences to the career area.

Heermann (1975) notes a revealing dichotomybetween co-op programs in vocational education and in the general education (or Antioch) model. Vocational education co-op is a highly structured and specialized career program directed at the development of an occupational skill. By contrast, the Antioch model stresses personal development and exploration along with career exploration, but with no specific occupational skill development. Table 2 summarizes the contrast between co-op programs in general education and in vocational education, based on Heermann's analysis.

Researchers have noted a wide variety of benefits derived from co-op programs. Crowe and Adams (1979) identified eight co-op program goals that help develop the student's occupational competency: (1) career decision making, (2) good work habits, (3) placement, (4) responsibility and leadership, (5) problem-solving skills, (6) attitude development, (7) financial benefits, and (8) skill training. Hagans (1979) points out that co-op programs also benefit parents, community/school relations, and the teaching/learning process.

TABLE 1

OBJECTIVES OF SEVEN TYPES OF EXPERIENTIAL EDUCATION

	Strong Academic Objectives	General Academic Objectives	Vocational Academic Objectives	Academic Supervision	Financial Compensation	Volunteer—Community Services	Real Work Performed	Career Relatedness	Career Preparation Objectives	Career Exploration	Personal Awareness Objectives	Cultural Objectives	Total
Cooperative education	3	3	10	3	10	1	10	8	9	3	5	1	67
Internship (Preprofessional)	10	3	10	10	7	5	10	8	9	5	5	1	83
Internship (General education)	10	9	5	10	5	5	10	5	5	7	7	5	83
Field experience	10	9	3	10	2	5	3	3	2	3	8	7	65
Cross cultural	9	9	3	7	1	5	5	3	3	2	9	9	65
Policy research	10	8	5	10	1	5	6	5	3	3	3	3	62
National Youth Service	3	1	3	3	8	2	10	5	3	5	5	5	53

SOURCE: Sexton (1977, p. 15)

KEY: 1 - never an objective
3 - infrequently an objective
5 - sometimes an objective
7 - most often an objective
10 - always an objective

TABLE 2

CHARACTERISTICS OF TWO COOPERATIVE EDUCATION MODELS

Characteristic	Vocational Education Model	General Education Model
Institutional Practice	Many high school programs operate under this formula, as do some community colleges and most technical institutes.	Numerous colleges (2- and 4-year) and universities (including preprofessional, professional, and graduate programs) operate under this formula.
Program Objective	To foster technical and conceptual skill development in an area of occupational specialization in order to prepare students to accept positions of responsibility in the world of work.	To stimulate the student's intellectual career and personal development in response to a wide range of student needs.
Coordinator Function	To coordinate job training in the area of the student's career objectives with correlated classroom studies designed to foster vocational skill development.	To provide a variety of work experiences in response to the student's educational needs (personal, career, or intellectual).
Organizational Placement	Coordination is decentralized by combining the function of coordinator and vocational instructor in high schools and some 2-year college programs, but a centralized staff department frequently provides for the co-op service in 2-year collegiate programs.	A centralized department provides coordination in most 4-year and many 2-year colleges—occasionally with liaison or part-time participation of faculty.
Federal Funding	Matching State and Federal monies created through vocational education legislation (i.e., nonbaccalaureate programs).	Funded through the Higher Education Act of 1965 (P.L. 96-374).
Work-Study Sequence	Students typically alternate work periods on a half-day or term (quarter or semester) basis.	Students typically alternate work and study each quarter or semester in these programs but may carry study and work schedules concurrently with reduced work and study loads.

SOURCE: Heermann (1975, p. 10).

Walsh and Breglio (1976) note that, at the postsecondary level, participants in cooperative education are likely to earn substantially more than their nonparticipating counterparts. The greatest benefits accrue to co-op students trained in manufacturing, marketing and distribution, and health care areas. The authors also found that "racial differences favored whites at the secondary level and minorities at the postsecondary level among participating students" (p. 18). At the secondary level, males were more likely to be working than females, but at the postsecondary level, no differences were found between males and females.

On a dissenting note, Lewis et al. (1976) found that from a strictly monetary point of view, it often cost a school less to invest in non-work-experience programs. However, the study did find numerous other benefits of co-op education such as improved career development, occupational knowledge, job-training relatedness, perception of school and jobs, satisfaction with school, and employer satisfaction. In a later study, Lewis, Gardner, and Seitz (1983) provide additional economic evidence to support co-op programs:

> Students acquire experience on current equipment in actual production settings. Schools do not need to purchase expensive equipment and consumable supplies. Employers have an opportunity to screen potential employees and to contribute to the development of a well-trained work force. (p. 21)

Wood (1979), in comparing experiential learning to classroom learning, found that experiential learning was more effective in three important areas for the student:

- Internal connection (integration within the self of interests, abilities, ambitions, life-style, beliefs, commitments) enabling a person to find a working answer to the question, "Who am I?"

- External connections (integrations between such parts of the world as natural reality, political reality, social reality, economic reality, and cultural reality) enabling the student to answer the question, "What's going on here?"

- Transactional connections (the link between what's happening within the self and what's happening in the outside world) enabling the student to answer the question, "Where do I fit?"

Wood maintains that co-op programs frequently pay too little attention to academics or career exploration and therefore neglect the "more substantive outcomes relating to self-discovery, environmental awareness, and lifelong learning skills" (p. 36). Brailsford (1982), however, concludes that

> there is much evidence to support the contention that participation in a cooperative education program is beneficial to the student in terms of career development, at least as it is measured by employment rate, length of time needed to secure full-time employment, the rate of placement in training-related jobs, job satisfaction, and earnings. (p. 11)

Technology and High Technology

Technology is often thought of as a process whereby inputs are converted in to outputs primarily by machines (Child and Mansfield 1972; Pugh et al. 1969; Woodward 1965). But Gerwin (1981), citing Lawrence and Lorsch (1967) and Miller and Rice (1967), has broadened the definition:

> Technology refers to the means utilized to accomplish a task. It may be manifested in machine processes, computer programs and other explicit procedures, but also in performance programs stored in individual memories. (p. 5)

An even broader definition is supplied by Cutcliffe (1981):

> Technology is a social process in which abstract economic, cultural, and social values shape, develop, and implement specific artifacts and techniques that emerge from the distinct technical problem-solving activity called engineering. (p. 36)

High technology, on the other hand, typically refers to the "most sophisticated, esoteric, and often the most recently advancing technological knowledge, skills, and hardware application" (Dyrenfurth 1984). In this context, high technology "cannot have a constant meaning" ("High Technology and Overview" 1983, p. 4), because new discoveries and applications are constantly being introduced (as table 3 suggests).

TABLE 3
STAGES OF TECHNOLOGY

Low Technology	Medium Technology	High Technology
Drawing	Mechanical drafting	Computer-aided design
Manual calculators	Electronic calculators	Microcomputers
Manual typewriters	Electric typewriters	Word processors
Hand tools	Machine tools	Computer numerical control
Biology	Microbiology	Genetic engineering
Basic electricity	Digital electronics	Laser electro-optics

SOURCE: "High Technology and Overview" (1983, p. 4).

According to Minshall (1984), the term **high technology** applies both to workplaces and processes:

- **High technology** signifies high-growth occupational areas in which technological applications are rapidly changing job knowledge and skill requirements in terms of an arbitrary percentage of a worker's useful working life.

- **High technology** refers to (1) products, processes, and applications stemming from the latest scientific and technological developments, (2) utilization of high-level machine intelligence and information decision capability, and (3) the extension of human manual and intellectual capacities through the use of computer technology and the application of sophisticated physical principles. (pp. 29-30)

Minshall also includes in his definition such quantitative descriptors as research and development expenditures, occupational structure, educational attainment, operational requirements, and other activities.

Employment Opportunities in High-Technology Areas

A number of problems arise in estimating how many jobs are likely to be created by high technology. The first relates to the variety of definitions of high technology. Levin (1984) suggests that "it is essential to differentiate between high-technology occupations and high-technology industries" (p. 7). For example, focusing in on the high-technology industries reveals relatively few jobs at the technical levels. The majority of those jobs are for "semi-skilled operatives" (ibid.; Minshall 1984). Alternatively, a focus on the so-called low-tech firms such as textile manufacturers, insurance companies, banks, real estate firms, and firms that utilize computers reveals a significant proportion of skilled or at least semiskilled technical jobs.

According to Etzioni (1984), some of the growth in high technology areas has resulted from reclassification of the traditional manufacturing sector. Part of the projected shift is also a result of statistical redefinition rather than economic transformation. For example, printing and publishing occupations have been redefined as information occupations rather than as manufacturing occupations, their former identity. The computer field is defined as a knowledge industry, yet the hardware area (as distinct from software) is increasingly one of routine manufacturing.

Nevertheless, high technology is certain to continue to have a major impact on occupations, if for no other reason than its effects on many occupations in areas not normally regarded high-technology industries. (Lemons 1984; Levin 1984; Lewis, Fraser, and Unger 1984; Minshall 1984). These authors project that only 7 percent of the actual jobs in the near future will be in high-technology areas. However, if the past is any indication, this percentage may be understated:

- Fifty percent of our labor force today is in industries that did not exist when the United States was founded.

- One-third of the items in American supermarkets did not exist 10 years ago.

- Ninety-eight percent of all homes in the United States today have TV sets, and 40 percent have 2 or more.

What, then, are the industries and occupations most likely to be affected by the continuing growth of high technology? The Battelle Research Corporation (1982) lists a large number of promising new technologies (see table 4 for the complete list). Exceptionally rapid growth is expected to occur in the following areas:

- Electronic computing equipment

- Communications equipment

TABLE 4

ORDERED LIST OF PROMISING NEW TECHNOLOGIES

New Technology	Screening Matrix				
	Timelines	Employment	Technical	Societal	Composite
Semiconductors	3	3	3	3	12
Microprocessor applications	3	3	3	3	12
Computer software	3	3	3	3	12
Electronic information/communication systems	3	3	2	3	11
Genetic engineering	3	2	3	3	11
Fiber optics	2	3	3	3	11
Automation (robotics)	3	2	3	2	10
Medical diagnostics	3	2	2	3	10
Medical instruments	3	2	1	3	9
Bioengineering	3	2	2	2	9
Satellite communications	1	2	3	2	8
Pharmaceuticals	1	3	2	2	8
Pollution control and hazardous waste management	2	1	2	3	8
New materials development	2	2	2	2	8
Photovoltaics	2	2	1	2	7
Coal gasification and Liquefaction	2	2	2	1	7
Biomass	1	2	2	2	7
Manufacturing processes	3	1	2	1	7
Ultrasonics	2	1	2	1	6
Acoustics	2	1	2	1	6
Waste energy recycling	2	1	1	2	6
Building materials and processing	1	2	1	2	6
Direct coal combustion	2	1	1	1	5
Wind conversion	2	1	1	1	5
Geothermal energy	1	1	1	2	5
Materials recycling	2	1	1	1	5
Enzymatic processing	1	1	2	1	5
Food technology	1	1	1	1	4
Agronomy	1	1	1	1	4
Mineral extraction technology	1	1	1	1	4

SOURCE: Battelle Research Corporation (1982, p. 2-108).

NOTE: Each technology was assigned a value of +1 = some prospects; +2 = moderate prospects; or +3 = excellent prospects, for each of the 5 criteria. The technologies were then ranked by composite score.

- Office machines
- Electronic connectors
- Surgical and medical instruments and related appliances
- Semiconductors
- Electronic components
- Oil field machinery
- Medicinals and botanicals
- Optical instruments and lenses
- Biological products
- Electrically related instruments

Other high-technology fields likely to expand considerably through the 1980s and into the 1990s include dental equipment, industrial controls, industrial furnaces, and x-ray equipment. The single most important growth industry in the United States falls in the service category—computer programming and other software services. A number of new industries will also be reaching the implementation stage in the late 1980s and 1990s. Hull and Pedrotti (1983) identifyed six characteristics common to high-technology occupations:

- They require a broad knowledge of math, computers, physics, chemistry, electricity, electronics, electromechanical devices, and fluid flow.
- They involve heavy and frequent computer use, including knowledge of practical applications of programming.
- They change rapidly and require lifelong learning.
- They are systems oriented and involve working with systems that have electronic, electromechanical, electrical, thermal, optical, fluidal, and microcomputer components.
- They require a fundamental understanding of a system's principles, as well as practical skills in designing, developing, testing, installing, troubleshooting, maintaining, and repairing the system.
- They require substantial employee flexibility and adaptability (pp. 28-31).

Although the growth of high-technology employment opportunities may seem staggering, the projected number of positions to be created by 1990 (see table 5) is actually small when compared to the number of positions that will be created by the 20 occupations with the largest absolute growth in employment (see table 6).

TABLE 5

JOBS IN 1990

Occupation	Demand	Starting alary
Computer		
Office-business info processor	270,000	$20,000
Distributive info processor	140,000	20,000
CAD engineer	450,000	14,500
CAD techician	300,000	18,000
Modeling and simulation technician	300,000	25,000
Graphics input artist	150,000	18,000
CAD parts cataloguer	125,000	11,000
CAM technician	120,000	30,000
Technological		
Geriatric social technician	610,000	15,000
Housing rehabilitation technician	500,000	14,000
Emergency medical technician	400,000	16,000
Robot production technician	400,000	15,000
Laser technician	360,000	15,000
Hazardous waste technician	300,000	15,000
Battery technician	250,000	12,000
Materials utility technician	210,000	15,000
Genetic engine techician	200,000	10,000
Holographic inspector	160,000	20,000
Bionic-electronic	120,000	21,000

SOURCE: The Vocational Studies Center, High Tech in Vocational Ed Training Program as reported in *Manpower Comments*, September 1983, p. 8.

Implications for Cooperative Education Programs: Skills and Principles for High Technology

Goetsch (1984) states that the high-technology revolution presents a challenge that neither education nor industry can solve alone (p. 17).

High technology will have important implications for cooperative education programs, both in terms of the skills required in the workplace and the principles guiding the educational programs. One obvious implication is that the new technology will require training forecasters to reconsider the

demand for various job skills. Levin and Rumberger (1983) maintain that job requirements in new technology areas may actually be lower than at present:

> Past technological innovations have tended to reduce the skill requirements of jobs. Moreover, the skill requirements of jobs in the U.S. economy as a whole appear to have changed very little over the last 20 years despite the growth of professional and technical employment. (p. 6)

Present and future technologies promise a similar impact.

TABLE 6

TWENTY OCCUPATIONS WITH LARGEST ABSOLUTE GROWTH IN EMPLOYMENT, 1978-90

Occupation	Growth in Employment (In Thousands)
Janitors and sextons	671.2
Nurses' aids and orderlies	594.0
Salesclerks	590.7
Cashiers	545.5
Waiters/waitresses	531.9
General clerks, office	529.8
Professional nurses	515.8
Food preparation and service workers, fast-food restaurants	491.9
Secretaries	487.3
Truck drivers	347.6
Kitchen helpers	300.6
Elementary schoolteachers	272.8
Typists	262.1
Accountants and auditors	254.2
Helpers, trades	232.5
Blue-collar worker supervisors	221.1
Bookkeepers	219.7
Licensed practical nurses	215.6
Guards and doorkeepers	209.9
Automotive mechanics	205.3

SOURCE: Carey (1981, p. 48).

Whatever the entry level of requisite skills, the range of skills needed is likely to be broader. According to Minshall (1984),

> increasingly, workers will be required to have a wider range of skills and to learn how to deal with materials, new types of equipment, and different management structures. Also, it is no longer realistic to think that workers will have one occupation or job during their lifetime; rather, many workers may have to be retrained three or four times. Those workers who reject retraining or who fail to increase their skills will be likely candidates for the pool of unemployment that may develop.
>
> . . . In the past, technicians did not have sufficient knowledge to move from one technical position to another. Now, this is changing. The future worker's overall training will need to be knowledge-based rather than skill-oriented. . . . In short, between 1980 and 1990 and especially between 1990 and 2000, a number of major qualitative changes will take place. Individuals will need greater technical and academic training; employees will require good abilities in language and mathematics; they will have to develop increasing familiarity and comfort with computers and evolving technologies as high technology brings about a rapid swing away from many unskilled and semi-skilled positions. (pp. 47-48)

Levin (1984) agrees that students (both secondary and postsecondary) will need good basic skills in order to be prepared for change:

> Within the labor market context, this basic foundation should emphasize the knowledge required to learn and perform in a changing work environment. Included should be skills in logic, analytic reasoning, scientific knowledge, with emphasis on reading, writing, listening, interpretation of written or spoken material, and proficiency in one or more foreign languages. (p. 26)

Reconciling the diverse views of researchers and futurists on the skills needed by high-technology occupations constitutes a challenge to those who guide cooperative education. An even greater challenge, however, is posed by the responsibility to help guide the direction of the emerging technologies. In the past, employers determined how a particular technology would be employed; increasingly, that responsibility is falling to others:

> While the influence of technology on work is inevitable, its impact on the level and composition of jobs in our future economy is not. The influence of technology will depend on what technologies are developed, but its impact will depend on how it is employed. And that, in turn, depends on who controls the technology. Computer-generated medical analysis, for example, is unlikely to displace the need for physicians or their higher status in the work world because they control how the technology is employed. Most workers cannot. (Levin and Rumberger 1983, p. 13)

The issues of selecting and directing high technology will be at the heart of curriculum content and the orientation of cooperative education programs. The issues call for widespread acceptance of the concept of "participatory technology," which Dyrenfurth (1984, citing Carroll 1971) defines as follows:

> This term refers to the inclusion of people in the social and technical processes of developing, implementing, and regulating a technology, directly and through agents under their control, when the people included assert that their interests will be substantially affected by the technology and when they advance a claim to a legitimate and substantial participatory role in its development or redevelopment and implementation. The

basic notion underlying the concept is that participation in the public development, use, and regulation of technology is one way in which individuals and groups can increase their understanding of technological processes and develop opportunities to influence such processes in appropriate cases. (p. 647)

This important issue must be made explicit to educators so they can make decisions that do not merely satisfy the current and short-term needs of industry for employees. The life goals of the students must also also be satisfied, and the adaptative and productive capacities of organizations with which they become associated must be improved.

Quality Components of Cooperative Education Programs

To some extent, successful co-op programs in high-technology areas will be those that prepare their students with flexible skills and a vested interest in the appropriate use of the emerging technologies. Much research suggests, however, that the effectiveness of a co-op program depends on a variety of other factors as well. A number of social and economic elements, some beyond the control of the institution, come into play such as the following:

- The reputation of the institution in the community and in the eye of the employers, which has an impact on the type of students attached to the program and the availability of adequate co-op sites
- The relationship of the institutional decision makers and coordinators with the employers
- The general or sector economic conditions and the company's particular financial condition (Benson 1982; Lloyd 1981)

There is no body of literature specifically defining the key indicators of quality in co-op programs. However, Leske and Persico (1984) summarized the key findings of a number of relevant studies (see figure 1). These studies relate specifically to youth cooperatives; however, the issues related to successful cooperatives are generic and also apply to postsecondary co-op programs.

Narrowing the focus to the ideal high-technology curriculum in postsecondary institutions, Pratzner and Russell (1984) list nine prerequisites:

- Up-to-date planning information
- Model tra ing programs
- Availability of materials
- Industry advisory councils
- Relationship with existing programs
- Student interest and enrollment
- Availability of jobs
- Instructor availability and preparation
- Equipment/software availability and cost

Students

1. Programs should be balanced in enrollment with respect to age, sex, race, and socioeconomic status.
2. Students selected for the program should be highly motivated. (There is some disagreement in the literature on this item)

Administration

3. The administration is responsive to the needs of the program, individuals and businesses connected with the program.
4. The administration takes responsibility for program placement.

Staff

5. School staff should resemble racial balance of the community.
6. Teacher-coordinator is provided with extended time when and if needed.
7. Teacher-coordinator teaches the related class.
8. Flexible salary scales exist for vocational education teachers.
9. There is appropriate coordinator and student ratio and coordinator work load.
10. All staff have valid teaching licenses in their specific vocational area.
11. Each staff member meets the vocational education work experience requirements of the State.
12. The coordinator is implementing the goals of the total educational program.
13. Staff members obtain help from other teachers in recruiting and selecting students.
14. Coordinator has a rapport with youth.

Facilities

15. A private area exists for the coordinator to counsel with students.
16. Adequate space, equipment, and instructional materials are provided for the coordinator to carry out responsibilities.
17. Transportation to jobs is available.
18. The cooperative staff has adequate control of facility and equipment utilization.

Instructional and Training Materials

19. Class schedules allow students flexibility to participate in directed work experience.
20. Reading level of materials matches student's reading level.
21. Competencies, objectives, and number of hours of instruction are appropriate for the learning of the specific occupations.
22. Instruction and training materials are current and meet prevailing business needs.

Figure 1. Quality indicators for a cooperative vocational education program: school components.

23. Students are provided with meaningful laboratory and project experiences that allow them to apply knowledge and skills learned in the classroom.
24. Competencies exist to ensure acquisition of basic education skills.
25. Instruction and training in affective work competencies is available.
26. Instruction and training in career exploration and decision making is available.
27. Student youth organizations are available and utilized.

Special Programs

28. Counseling services are available.
29. Job placement services are available.

Program Planning and Evaluation

30. A comprehensive training plan is used to direct the achievement of learning experiences and to determine learning performance.
31. Students are kept informed of their skills and knowledge achievement via a comprehensive training plan directed by the cooperative coordinator.

Figure 1 — continued

SOURCE: Leske and Persico (1984, p. 70-71).

The following sections discuss these needs for successful high-technology co-op programs in more detail.

Up-to-date planning information. It is critical to have access to specific and timely information about technology in order to reduce the potential for costly mistakes during the planning process. In discussing the findings of Faddis, Ashley, and Abram (1982), Pratzner and Russell (1984) raise several key questions:

- Is the technology generic? That is, is it applicable to many users' needs (e.g., minicomputers) or is it highly specific and useful to a limited group of users (e.g., laser welding)?
- Are larger organizations likely to be early adopters of the technology or will small firms adopt it first?
- How rapidly is the innovation being adopted in other regions?
- Is the relative cost of innovation high or low?
- Are local conditions (e.g., labor costs, type of industry, age of existing technology) favorable to rapid adoption in the near future?
- Will the adoption of a new product or process increase or decrease the amount of training required of workers and technicians?
- Will the adoption tend to increase or decrease job opportunities in the local region?

Model training programs. The existence of training programs at other postsecondary institutions or in business and industry settings can "provide valuable information and insights into the planning process itself and the whole range of implementing decisions and actions" (Pratzner and Russell 1984, p. 5). Additionally, institutions might pursue alliances for the purpose of sharing the costs of developing new programs and courses in new technology areas.

Availability of materials. Finding high-quality curriculum materials will facilitate the curriculum planning and adaptation process. Initially, these materials may only be available in business and industry settings.

Industry advisory councils. Three forms of advisory groups can be important to postsecondary institutions. The first is high-technology industry councils, State government task forces for high-technology development, and State economic development programs focused on attracting high-technology industries. These groups can help bring together the private sector and postsecondary institutions and enable them to plan and coordinate the needed training for new industries. A second form is the high-technology advisory council formed at the institutional level to "provide industry-wide perspectives on current and future technological and related occupational directions and thereby assist in long-range planning" (ibid., p. 7). The third form is the actual program advisory committee.

Relationship with existing programs. Many co-op programs grow (or could grow) out of a nucleus of existing programs. For example, co-op programs in robotics, computer-aided design, computer-aided manufacturing, automated manufacturing systems, production management, and communications technology are growing out of traditional electronics, drafting, machining, quality control, manufacturing processes, automotive, and management programs, respectively (Abram et al. 1983a). Because many of the programs cut across traditional disciplines, it is frequently difficult to assign them to a specific department. Placement decisions for the new co-op programs should be made after adetermination of which department(s) meet the specific needs or desired outcomes, program accreditation, the ability and availability of the faculty to retrain and design the programs, and the relationship of the new program(s) to existing courses (Abram et al. 1983a).

Student interest and enrollment. Student interest and actual enrollment are critical to the success of co-op programs. As much data as possible should be obtained from student interest surveys and other sources. Care must be taken to determine "passing interest versus genuine commitment to following through with a training program—i.e., taking a few courses versus pursuing a degree" (Pratzner and Russell 1984, p. 10).

Availability of jobs. No course of study should be implemented without determining both the relevant job availability and the expected growth in the future. These projections are difficult to make because current methods of labor market forecasting are limited in such a rapidly changing field (Taylor, Rosen, and Pratzner 1983).

Instructor availability and preparation. Because of the newness of many high-technology industries, there is often a scarcity of experienced instructors. Decisions must be made about developing inservice training programs for instructors, perhaps in collaboration with industry. This is particularly desirable for instructors who previously taught in areas with declining enrollments or with very slow growth rates (Abram et al. 1983b). Program planners may also consider hiring experienced industry personnel as part-time instructors. On occasion, industry may donate the services of its staff.

Equipment/software availability and cost. Although co-op programs reduce equipment needs for training, they do not eliminate the need entirely. In discussing the findings of Abram et al. (1983a), Pratzner and Russell (1984) cite several important factors to consider concerning the need for training equipment:

- Alternative ways of acquiring equipment (e.g., purchase, lease, consignment, time-sharing with industry, grants)
- Maintenance and service contracts and other special requirements, such as space needs, noise control, climate control, and so forth
- Ratio of equipment to students
- The economy of equipment that is adaptable to changes and expansion
- Retrofitting of existing equipment in some technological areas (p. 13)

The Need for Co-op Programs In High-Technology Fields

Cooperative vocational education has been promoted as a desirable way to bring relevancy to formal classroom instruction and to enhance the learning experience for students. Vocational educators believe that co-op programs enhance students' future productivity on the job while also clarifying their career decision-making process. Other aspects of co-op programs benefit employers, including the availability of a more cost-efficient (student) labor force and the increased recruitment of long-term employees.

Robert Worthington (1983), former Assistant Secretary for Vocational and Adult Education, U.S. Department of Education, recognized the need for cooperative vocational education efforts between schools and the private sector in order to prepare employees for jobs in newly created technologies. He notes that schools will benefit by providing quality education on the cutting edge of the new technology, and the private sector will benefit by getting qualified employees at less cost for recruiting and training.

William C. Friday, president of the University of North Carolina, believes that cooperative education can support and complement university efforts to prepare students for successful living in a high-technology society (Friday 1984). He notes that a majority of the microelectronics industries in the Research Triangle area (Durham-Chapel Hill, NC) have well-established coop programs and are currently working with universities throughout the State.

David Rooke, executive vice-president of the Dow Chemical Company, believes that co-op programs provide a short-cut between theory and practice that brings students up to speed better and faster than any other type of education program (Rooke 1984). Dow Chemical currently employs 325 co-op students from 60 schools across the country.

Despite their advantages, co-op programs in high-technology industries are not widespread. Developing and implementing workable programs in new areas are often difficult. Specific difficulties include developing curricula, obtaining qualified instructors, obtaining program approval, and locating reliable training stations. Useem (1981), in a study of Silicon Valley high-technology and education linkages, summarizes this lack of responsiveness by stating, "The stepped-up tempo of change which characterizes high-technology industry intrinsically makes it difficult for schools to react in a satisfactory way" (p. 17).

In a review of 10 collaborative arrangements between postsecondary vocational education institutions and companies manufacturing or using advanced technologies, Abram et al. (1983a) found that because of the revolutionary nature of many technological changes, there is often no existing cadre of experienced workers or technical experts from whom information and advice can be gleaned to aid in program development. Schools attempting to devise programs for new technology areas often find that they must draw on experts from outside their local area or State.

Abram et al. (1983b) also found several problems in recruiting or upgrading instructors for the new programs. One major problem is the scarcity of experienced instructors in emerging or changing technologies, where few experts exist. Another problem is that many potential instructors are lured away from teaching positions by more lucrative careers in business and industry.

The existence of State department approval procedures and funding patterns that require occupational demand statistics to justify the need for the new program is a third major problem area (ibid.). If a school tries to create a training program early, anticipating the demand for trained technicians in a technology that is just emerging or being adopted in business and industry, the labor market data may be insufficient—or nonexistent—for program approval. If a school delays in developing a high-technology training program, however, its slow response may delay local companies from adopting new technology crucial to higher productivity. Delays in school response may force some companies to develop their own training programs, which can result in drawing away potential instructors (and students) from public institutions.

The National Center has recognized the need to assist in the development and implementation of workable high-technology co-op programs. The National Center publication *Preparing for High Technology: Thirty Steps to Implementation* by Abram and others (1983b) reviews the planning and implementation of such programs.

This publication provides information on cooperative education to support that need in developing and implementing effective co-op in high-technology occupational areas.

CHAPTER 3
DESIGNING COOPERATIVE EDUCATION SYSTEMS

To me, the paradox of cooperative education's staying power, contrasted with its lack of widespread acceptance, is an intriguing situation. In trying to understand this apparent contradiction, I can only conclude that up to now, cooperative education has worked only where it was needed and wanted. In other words, cooperative education has survived and indeed, prospered in those situations where educators and students saw a void in the educational process at about the same time that business and industry recognized the shortcomings of graduates from traditional higher learning settings. Each had the need that the other could fill—the relationship was not only natural, but synergistic.

—Co-op Employer, Cincinnati Milacron, Inc.

The current study—drawing from the literature, from case site interviews, and from telephone interviews with many people experienced in the design and operation of cooperative high-technology training programs—uncovered many reasons for school administrators and practitioners to invest time and effort in developing co-op programs. This chapter briefly reviews those reasons. It goes on to examine the kinds of problems that may emerge in developing a co-op program and the key elements and procedures that enable a program to succeed despite the problems. It then addresses what is needed to develop a quality training station at a co-op work site and provides insights into ways to identify potential training sponsors.

Educational and Economic Benefits

Many benefits result from cooperative education in postsecondary high-technology programs. These benefits accrue to students, employers, institution, and community.

For students, the overriding benefits are the experiences that ease the transition from school to work. By performing successfully in a co-op program, students develop a more positive self-concept and a more realistic attitude toward work by experiencing it firsthand. Also, students' attitudes toward school often improve when they experience the relevance of what they learn in the classroom to what they do at the work site.

Associations with co-workers at the work site build the interpersonal skills that students need to function effectively. They experience production schedule problems or customer complaints that require teamwork to solve. Also, they must adjust to co-workers, customers, and supervisors at a variety of levels. The primary economic benefit for students participating in a co-op program is their wage or salary. This income often subsidizes either the students' education or the standard of living of their families.

Students also learn about their job and co-workers. If the company offers jobs to co-op students upon graduation, graduates' decisions are based on their total co-op experience rather than simply on an interview or on one visit to the place of employment. Such understanding helps students make better career choices and job decisions.

Benefits for employers, like those for students, are both educational and economic. From an economic standpoint, employers generally get student workers with some training at a reduced wage or salary and do not have to provide these workers with a full benefit package. Also, employers can use this co-op work time to screen potential full-time employees in the actual work setting. The co-op situation does not obligate employers to hire student workers upon completion of the training if they do not satisfy the employers' hiring requirements. Thus, co-op programs reduce the likelihood of hiring the "wrong person" and eliminate the need to fire hirees who are not able to perform on the job.

Another benefit for employers is the opportunity to assist in the development of the co-op training program. The information shared with the educators responsible for the co-op program can be used to update or modify the program. Thus, employers contribute to the betterment of the community through involvement with the school.

Occasionally, co-op students may provide new knowledge about processes or equipment that can benefit employers. Not all employers have access to state-of-the-art equipment or processes, whereas certain schools may. Students trained in such schools may convey valuable information and experience to co-op employers.

Another benefit to employers is that co-op students often boost morale or motivation among supervisors and co-workers, who enjoy contributing to students' learning or skill development.

Schools benefit from co-op programs through contact with industrial firms, which help the institutions determine what training programs will serve the local labor market and what program content is needed. As a recruitment device, schools can advertise that the co-op program provides not only "real work experience" during training but also paid employment that can ease the expense of going to school. Financially, co-op arrangements allow schools to offer current skill training on expensive, state-of-the-art industrial equipment (at the work site) that would otherwise not be available. Patterson and Mahoney (1985) note that the benefits of cooperative education often exceed the better publicized, income-generating programs that colleges have established with local business.

The benefits that accrue to the community from co-op programs include economic development and improved quality of life. The collaboration involved in setting up and operating a co-op program improves the economic base of the community. The school becomes better informed about the needs of the specific businesses and industries in the labor market area and can then customize its curricula or program offerings to meet those needs. This collaboration, as well as "labor at cost," also helps attract new industries to the community. Finally, the community benefits from the additional tax revenues from co-op students' wages or salaries and from students' spending their wages on local goods and services.

Problems in Developing a Successful Co-op Education System

Many problems are involved in developing and operating a successful system for high-technology co-op programs. Although not unique, they vary in degree and definition. The following sections present some of the problems most common to high-technology co-op programs.

The problems are categorized according to a framework, developed by Heermann (1975, pp. 44-50), of four general types of problems facing cooperative education. These include (1) the effect of labor market factors on the development of occupational opportunities, (2) the impact of the placement on student life, (3) the educational validity of the program, and (4) the subtleties of cooperative education administrative practice.

Labor Market Factors

Economic realities affect the number of training stations available for any co-op program. Wilson and Lyons (1961) state that an employer's decision to take on student trainees is conditioned in part by the state of the economy. The eight case studies show that the number of training stations can be maximized by co-op staff who are aggressive and conscientious in coordination efforts with employers. Nevertheless, co-op programs often face employment restrictions imposed by contracts or union regulations.

Student Placement Factors

The overarching task of the co-op program staff is to place students in jobs that reflect the needs of the students, the institution, and the employers. Many factors make this task difficult, including student preference for a particular job, the degree of challenge offered at a particular training station, the geographic proximity to the students and the co-op coordinator, the elimination of certain student activities because of work obligations, the needs of employer for student trainees, class schedules that must be convenient to students during study periods, and (most important) the balance between employers' and students' needs (Heermann 1975). Another critical factor is that many individuals consider it expensive for the schools to finance co-op placement coordinators when they are not generating student credit hours. For those schools that provide credit hours for co-op, this concern is minimized or eliminated.

Education-Validity Factors

The major issue in this category is the educational value of training station experience. The challenge to validity manifests itself in many forms. One is the possible mismatch of the student's learning objectives with the employer's objectives. A lack of variety in co-op work tasks may also compromise the educational value of the co-op experience. Some students may see their practical experience at the work site as more important than their academic or classroom experience. Butler and York (1971b, p. 12) state that one of the most critical potential defects of cooperative education is that employers view the student essentially as a part-time worker, while the student expects the experience to have educational significance.

Ensuring that students' placement in co-op jobs reflects the needs of students, school personnel, and employers requires a continuous flow of information among those three groups. The training sponsor or co-op coordinator should employ time-use studies to take a representative sampling of students' co-op experiences at the beginning, middle, and end of the training station assignment or at critical learning times as defined in the training plan (see Franchak, Norton, and Desy 1985). Additionally, the information on training station experiences can serve as the focal point for discussions in the co-op related instructional class. This attention to collecting and using information in the co-op related class can positively affect the student placement rate.

To ensure that the co-op effort has educational validity, employers, students, and co-op coordinators must participate actively in the total effort. Wallace (1970) recommends that training sponsors be selected from those "who expect to sacrifice the usual productivity for educational significance, and who show a willingness to use their production as a vehicle for learning" (p. 26). Meyer, Klaurens, and Ashman (1969) recommend a training sponsor development program that focuses on four important teaching tasks: preparing the learner, presenting the material, applying the learning, and checking on learning. This program should be developed in cooperation with

students, faculty coordinators, and all employers involved as training sponsors. Periodic review should ensure that the information is current, that the program reflects the combined needs of all participants, and that the co-op experience is educationally valid.

Administrative Factors

Administrative support to the co-op program encompasses a number of elements. A lack of commitment from the school president, vice-president, deans, program chairs, faculty, or community leaders can lead to an ineffective co-op education program (Billings 1970). Administrative breakdowns in co-op education sometimes also result from poor communication among coordinators, instructors, and employers (Barlow 1963).

Recent reports on education have emphasized the importance of basic skills. Rumberger and Levin (1984), in a review and analysis of employment skill requirements in high-technology industries, indicate that employers look for workers with a strong background and training in the basic skills. Too often, however, both educators and employers misinterpret this to mean that learning can take place only in the classroom.

"Employer dissatisfactions have been experienced with regard to co-op ed: dissatisfaction with the work of co-op students" (Johnson 1969, pp. 68-69). Wilson and Lyons (1961) note other employer dissatisfactions, including co-op students who switch firms from work period to work period rather than remaining with the firm for the entire educational program, students who reject full-time employment with the firm after graduation, and co-op programs among schools in the area having different academic starting dates.

Heermann (1975) states that a number of these administrative problems are caused by communication breakdowns, failure to select an effective co-op coordinator, and unfair or unclear assignment of work loads.

Heermann concludes that community college co-op programs have the potential to provide new and important benefits for students, employers, colleges, and communities. Clearly, however, merely providing such programs does not automatically secure the desired ends. Problems with staffing, communication, student campus life, employer relations, and quality occupational opportunities must be carefully identified and eliminated.

Key Elements and Procedures

An integration of information from the current study and existing reports has led to the following list of key elements and procedures for establishing a successful co-op program:

- **Key element.** Job rotation at training stations for co-op students in a given program area.
- **Procedure.** Develop a formal agreement that ensures cooperation between the employer(s) and the school's co-op program coordinator. The coordinator should become familiar with the training stations and understand the uniqueness of the occupation's technological content. The coordinator, training sponsor, and co-op student(s) should work together to define and specify appropriate job rotation experiences in a jointly prepared training plan.

- **Key element.** Cooperation within the school and community to ensure awareness of the opportunities available through co-op programs to students and employers.

- **Procedure.** Develop a formal program advertising plan using a variety of media such as newsletters, newspapers, brochures, radio, and television. Conduct conferences involving local private sector agencies such as the chamber of commerce, manufacturers associations, and service agencies such as Kiwanis and Lions.

- **Key element.** Co-op placement that matches student abilities and career or occupational objectives.

- **Procedure.** Develop a formal assessment system for gauging students' abilities and interests. Develop a management information system for the collection, storage and retrieval of information on students, individual training stations, and labor market area.

- **Key element.** Effective integration of co-op students into the work culture.

- **Procedure.** Arrange for all potential co-op students (with special arrangements for handicapped and disadvantaged)to visit offices, plants, community agencies, and other organizations to learn about jobs and the world of work. Review and discuss basic knowledge about the particular work culture in which the students will train. Preparing students for the work environment is extremely important to increase the probability that the working aspect of the co-op program will be a successful learning experience. This orientation should focus on school and work values, human relations on the job, student and employer expectations, workplace rules, and the student work evaluation process. Key persons involved in this process should include the co-op students, the faculty coordinator, and the training sponsor or supervisor.

- **Key element.** A systematic instructional design process that is a joint effort between the school and employer.

- **Procedure.** Create or adapt a systematic instructional design process. Build upon—rather than duplicate—nonschool work experience activities. This is primarily the responsibility of the co-op coordinator in conjunction with the employer(s). Program implementation, monitoring, and review should be a joint effort.

- **Key element.** Specific competencies to be achieved through the co-op experience.

- **Procedure.** Develop an effective training plan that spells out measurable objectives. The plan should be developed as a working agreement among the co-op students, the training supervisor, the high-technology faculty representative, and the co-op coordinator.

- **Key element.** Postsecondary school responsiveness to the training needs that exist in the labor market area.

- **Procedure.** Develop a formal system to provide information on training needs in the labor market area. Contact both labor and management to determine employer and employee needs for future curriculum development. Information system mechanisms should foster good communication and good public relations with the school and all organizations or agencies involved in the labor market. Such mechanisms may include advisory committees, periodic surveys of industry, and analysis of newspapers, journals, and pertinent association reports.

- **Key element.** An online directory of co-op employers in high-technology occupational industries or having high-technology training stations.

- **Procedure.** Conduct periodic surveys of high-technology industries to determine suitable training stations and willingness of employers to become training sponsors. Invite potential training sponsors to become involved in school activities (e.g., serve on advisory committees). Conduct follow-up studies or surveys of students to determine their ratings of specific job sites as appropriate training stations.

- **Key element.** Co-op training experience of sufficient duration to benefit student and employer.

- **Procedure.** Conduct surveys of employers, students, and co-op coordinators to determine appropriate time intervals for students to be involved in a co-op experience. The objective is to determine the maximum length of time that students should be placed at the co-op training station to achieve a specific level of learning.

- **Key element.** Adequate time for effective training station placement.

- **Procedure.** Bring together all persons necessary to provide the best fit between student needs and employer or training sponsor needs. This is primarily the responsibility of the co-op coordinator. The coordinator needs adequate time to find and make good placements.

- **Key element.** Comprehensive evaluation of efforts by the school, students, and training sponsors to ensure that an effective learning environment exists within the co-op experience.

- **Procedure.** Identify or design an evaluation model. Adapt or design appropriate methods for the evaluation process that support the evaluation objectives of the co-op program. Identify, train, and involve key persons in the evaluation process. Schedule evaluation activities, conduct the evaluation, analyze and report results, and work with relevant persons to disseminate results.

- **Key element.** Mechanisms that monitor specific parts of the co-op program in high-technology program areas so that programs will benefit students.

- **Procedure.** Include cooperative education as a part of the instructional design process. Establish a formal system that identifies key points for monitoring. Identify the persons most appropriate for conducting the monitoring process.

- **Key element.** Co-op personnel who constantly seek new opportunities to meet the varied needs of students.

- **Procedure.** Develop a systematic mechanism for needs assessment. Schedule visitations, both formal and informal, with students and employers in order to identify and validate the varied needs of the students. This schedule could include time-on-task observations of students at the training stations or formal discussions with employers and students. A questionnaire, checklist, rating scale, or other instrument may be used. Visitations may also serve to increase career opportunities through job development and facilitate access to further career training.

- **Key element.** Student assessment related to specific instructions and objectives of the high-technology co-op program.

- **Procedure.** Establish goals and objectives that meet the needs of all co-op students. Write precise instructions and objectives that relate the co-op experience to the specific high-technology program area. Involve program faculty, co-op training sponsors, and students, both current and former. The co-op coordinator should organize this effort. Develop a time line to conduct the assessment at the most critical points in the program.

- **Key element.** A co-op coordinator or faculty coordinator who conducts regular visits to students at the training stations.

- **Procedure.** Develop a formal visitation schedule or plan. Working with training sponsors and students, develop a plan that identifies key periods or times during the co-op experience for visitations. Develop an agenda or observation schedule that addresses the reason for the visit, types of things to be observed or discussed, and the expected outcome.

- **Key element.** Publicity on the benefits of co-op high-technology experiences for students, the institution, employers, and the community.

- **Procedure.** Form a committee of students, employers, community members, and school representatives to develop procedures for collecting benefit information. Include this procedure as a part of the needs assessment and process or product evaluation phases.

- **Key element.** An effective class of related instruction.

- **Procedure.** Develop a curriculum for related instruction that involves employers, students, and faculty members. Use individual students to address co-op experiences in the formal class. Conduct regular evaluations to ensure that the class is relevant to students' needs. Make sure that classroom activities improve the knowledge and skills that students need on the job.

- **Key element.** A mechanism and criteria for determining when experience is best acquired in the high-technology classroom/lab or when it is best acquired at the training station.

- **Procedure.** Conduct a nominal group technique session involving training sponsors and current and former students.

- **Key element.** Congruence between the goals of employers (training sponsors) and school personnel for co-op, in high-tech program areas.

- **Procedure.** Develop a mechanism for periodically identifying goals. Conduct a discrepancy evaluation and present the results to both groups. Review and discuss. Modify or eliminate goals that conflict with achieving the objective of the co-op high-technology program.

- **Key element.** A mechanism to teach students to continue learning and to adjust to changes in the work environment.

- **Procedure.** Infuse quality of work life or workplace concepts into the classroom co-op curriculum. Work with training sponsors, co-op coordinators, students, and faculty to develop concepts, instructional strategies, and time lines for infusing these learning activities into the curriculum.

- **Key element.** Attend to the need of special student populations participating in co-op programs.

- **Procedure.** Reduce or eliminate artificial barriers to employment for the disadvantaged and handicapped (e.g., bonding requirements, tests, interview stress, physical arrangements). Provide counseling to give these students a realistic view of the work environment. Provide support services to assist them with job interviews.

Identifying Training Sponsors

One of the most critical tasks in implementing a successful high-technology co-op program is identifying training sponsors to support the program. A definitive plan to meet this need should have specific objectives that guide and direct the program. For example, two objectives might be the following:

- To assist vocational personnel in identifying the necessary skills for entry-level jobs in the community

- To establish rapport with industries to obtain their support for cooperative education and to facilitate their understanding of the needs of the school and students

To achieve these objectives, a number of strategies can be implemented. For example, a mail survey could be conducted in the summer or early fall to achieve the first objective. This survey would identify industrial firms receptive to a high-technology co-op program. A potential list of employers would then be developed, using such existing information sources as the chamber of commerce, the State employment division, State occupational coordinating councils, and the records of follow-up studies of graduates in high-technology occupational areas. Active involvement in professional associations and organizations can provide a base for developing rapport with industry personnel. See appendix E for a list of representative associations.

CHAPTER 4
DEVELOPING POLICY GUIDELINES

Because many factors and persons directly or indirectly influence the functioning of high-technology co-op programs, clearly defined policies are essential for a quality program. Brustein (1985) defines program *quality* as follows:

> Quality refers to programs that are pertinent to the workplace, new technologies and programs that respond to state and local occupational needs, programs that are technologically and educationally sound, and programs where the entry and exit to another program or the job market flows smoothly. (p. 173)

Only through the development of a well-defined policy and adherence to that policy can a *quality* co-op program be achieved.

A review of the eight case studies for this project reveals that quality programs exist at those institutions where a policy statement is clearly established and where efforts to implement the policy are deliberately carried out. Policy is shaped at the top administrative levels, and established mechanisms ensure its implementation at the classroom and training station levels.

Although many good co-op programs already exist, maintaining high-quality learning opportunities presents a continuing challenge. This section reviews important policy issues in cooperative education, suggests ways to develop or improve policy, and presents ideas for developing mechanisms to ensure that policy is carried out at all levels.

Policy Concerns

The following are some policy concerns for cooperative education in high-technology areas, adopted from the eight case studies and from the work of the Experiential Education Advisory Panel (1979) and Wendel, Henry, and Gilbertson (1980):

- The implications of vocational education legislation and labor legislation for schools with co-op programs, their staff, participating employers, and co-op students
- The effects of current Federal and State administrative policies on cooperative education
- The procedures used to implement such policies within and between the educational and private sector structure
- The strategies for increasing the number of students, employers, faculty, and administrators involved in cooperative education
- The relationship between cooperative education in high-technology areas and other programs with respect to policy formulation, implementation, and outcomes

- The influence of training programs for school staff and employers on increasing participation in cooperative education programs

- The extent to which school or industry procedures for needs assessments, accreditation, and certification include cooperative education concerns and goals

- The development of valid measures of the effectiveness of cooperative education

Components for Policy Statements

Wendel, Henry, and Gilbertson (1980) confirm that clear, written policies are essential in operating a co-op program. A policy statement guides discretionary action and expresses what the school expects of those to whom it gives responsibility and authority for a program. Furthermore, the policy statement provides a framework for developing appropriate rules and regulations for both school and employers. Finally, it guides the administrators of the co-op program in decision making. Policies, in essence, should govern four key components of a co-op program:

- An advisory council or committee with a role defined as either making policy or advising

- The role of the faculty in planning and implementing the program

- The responsibilities for leadership and administration of the program

- The role of the top-level college administrators (i.e., president, vice-president, deans) and their relationship with the administration of the co-op program

The Experiential Education Advisory Panel (1979) recommended the following 15 components for a definitive policy statement for a cooperative education program:

- **Learner objectives** based on cooperative education goals and written in measurable terms that reflect the shared understanding among all participants.

- **Selection of training sites** on the basis of their potential for providing relevant learning activities that satisfy the needs of the student, the employer, and the school.

- **Commitment to programs** by students, institution, and industrial firms over given periods of time. The nature and extent of this commitment should be agreed upon in the planning stages by personnel in the institution and the industrial firms.

- **Identification of co-op students** and their involvement in determining their assignments. Their decision to participate should be based on a clear and shared understanding of certain factors: (1) the skills, knowledge, and attitudes the learner is expected to develop; (2) the learner's need, readiness, and capacity for developing them; and (3) the availability of resources and opportunities.

- **Structure for learning** that provides meaningful work site experiences, including opportunities for interpretation and discussion with full-time workers in the high-technology occupational areas.

- **Diversity of experiences** in learning and work.

- **Student access to various employment levels** within the industrial firm.

- **Criteria for academic credit** agreed upon in the planning stages by teaching faculty, administrators, employers, and the agency granting the credit. (See appendix G for one example of a policy statement relating to credit.)

- **Employment credit** for experience in co-op education programs as approved by an advisory committee and supported by labor and management.

- **Paid experiences** cooperatively decided upon by all parties within the context of the appropriate laws, regulations, and collective bargaining agreements.

- **Legal requirements** for the co-op students that are thoroughly understood by program coordinators, faculty, school administrators, and training sponsors and supervisors.

- **Worker protection** ensured by a co-op advisory council or committee. If the number of co-op students in the industrial firms threatens to displace workers while a program is in effect, reductions in the number of co-op students (or other program modifications) should be made according to terms agreed upon in the planning stages.

- **Preparation of educational personnel** for the work settings, the potential of the learners' experiences, and their own roles in assisting the co-op students. Both the school and the training sponsor should assume responsibility for the training, compensation, and recognition of all personnel who implement the program.

- **Preparation of workplace personnel** by the training sponsor for their roles in cooperative education. Collaboration between these workers and the program staff should be systematically maintained for the duration of the program.

- **Evaluation**, developed by planning staff and advisory council, that is a continuous process involving all participants. (pp. vi-vii)

These policy issues are also supported by an analysis of experiential learning and information obtained from the eight case studies of co-op programs.

Key Policy Guidelines

When the preceding issues are addressed in the creation of policy, it is important to keep in mind the following five guidelines:

- Flexible approaches to a policy issue are desirable.

- Solutions to any issue should be arrived at through collaboration.

- Policy issues are wide ranging and vital to those affected, creating diverse interests.

- A policy guideline should take into account the impact on all groups involved.

- Policymaking accommodates both democratic expectations of constituencies and the ultimate merits of the outcomes of policy decisions. (ibid., p. 5)

The most crucial step in analyzing policy is defining the problem. A continuous evaluation process can assist in this. Ackoff (1974) states that "successful problem solving requires finding the right solution to the right problem. We fail more often because we solve the wrong problem than because we get the wrong solution to the right problem" (p. 10).

In summary, a framework for addressing policy analysis for co-op programs includes the following:

- Setting the agenda
- Setting the goal
- Developing alternatives
- Selecting alternatives
- Developing the program
- Implementing the program
- Evaluating the implementation
- Evaluating the policy results

The co-op advisory council or committee should take leadership in this process. The results will provide the basis for developing relevant policy for a quality co-op program.

CHAPTER 5
ENHANCING CO-OP LEARNING

The first benefit [of a co-op program] is in the curriculum; it creates a better educational environment through greater dialogue. It also affects the maturity of the student, as the student has to have a good work attitude to survive the program. The student has an opportunity to experience both the interview process and to work in an environment in which he or she would like to work. It also, at an early stage, helps the student decide if this is the area in which they would really like to work, at a time when they can still make lateral adjustments.

—Faculty Coordinator, Cincinnati Technical College

This quotation captures a major strength of co-op training programs. Mixing work and classroom experiences enhances the learning process. A difficulty arises, however, when attempts are made to structure the program experiences to meet specific predetermined goals.

High-technology occupations present a unique training challenge because of the rapid pace at which technological applications change. Some occupations are expanding, others are being "deskilled," and others are being abolished. On the National and community level, some factories are closing down; others are relocating. Many laid-off employees are being retrained, but jobs are being replaced by robots with increasing frequency. A massive shift is underway from an economy dominated by manufacturing industries to one dominated by information and service industries.

With this level of occupational instability, skill development may no longer be the primary function of cooperative education. Schools with co-op programs and the companies with which they interact are also beginning to look at such concerns as career development, longevity, flexibility, core theoretical and skill grounding, communicative ability, problem-posing and -solving skills, teamwork and interpersonal skills, and an understanding of (or at least a sensitivity to) organizational dynamics, politics, and culture.

In addressing these issues, many schools engage in six categories of co-op related activities. These activities were found at the eight case-study sites and do not characterize any one particular school. The categories, discussed in the following sections, are as follows:

- Life-style of the occupation or profession
- Site selection
- Student job exposure/experience
- Product and service impact awareness
- Planning learning activities
- Monitoring and evaluating the co-op experience

Life-Style of the Occupation or Profession

Career choices affect the life-style that an individual is likely to lead. Different jobs are valued differently in our society; some have more status and societal acceptance than others. Some jobs are viewed as dead end and others have growth potential. Some jobs are likely to survive with adaptations, whereas others become obsolete.

Salary and conditions differ across jobs and across companies. The kinds of friends, neighbors, schools, organizations, and clubs available to a person all depend to a large degree on the career choices that person makes. These are the kinds of issues to which institutions are beginning to sensitize their students. Clearly a greater attempt must be made to match individual goals with the potential benefits of career choices. Co-op programs can expose students to these issues, both formally in the classroom and informally in interactions with former graduates, employees, company personnel, and fellow students.

Site Selection

From the student's perspective, this process of choosing a co-op work site involves two steps: (1) learning about the organization and (2) preparing for the interview.

Several institutions encourage students to find out as much as they can about an organization. They also suggest that students try to choose a co-op site where they would like to work after graduation. In selecting a site, the following six features of the company are recommended for investigation:

- Job stability/security potential if employed
- Transferability of skills and likely demand
- Training and promotion policies
- Types of benefits
- The value given to the job experience at a particular company by another company
- The company's record on and sensitivity to special population issues (for persons who would be regarded as a member of this category)

As schools work with companies and begin to build up a co-op program dossier, they encourage students to research the information for themselves. Past student reports are made available. Addresses and phone numbers of former and upper-class students are shared to provide perspective.

A second area of student activity is preparation for the placement interview. This is essentially a two-phase process of (1) identifying what the company looks for in a new applicant and (2) holding interview practice sessions with peers and instructors to develop poise, confidence, and a factual grounding in the company's philosophy and history, as well as in the specific requirements of the job in which the student seeks placement.

Student Job Exposure/Experience

The purpose of the co-op placement must be clarified to the satisfaction of the student, the institution, and the company. Schools sometimes start out with one type of placement (e.g., job shadowing or career exploration) and, as the relationship with a participating company matures, may jointly develop another form of placement that more closely reflects the desired student learning objectives. There are also instances when a company uses a more comprehensive placement and exposure strategy. This generally occurs when the company considers the co-op placement as a means of recruiting new staff.

Four possible scenarios of how job exposure operates are as follows:

- **Same organization, same department.** In this instance the student returns to the same work organization and the same department for every placement for each experience during the 2-year degree program. This scenario is generally used when the company plans to employ the individual upon graduation. Here the student gains an in-depth knowledge of the particular department, its equipment, and its ways of doing things. Additionally, the student becomes known and accepted by the other employees.

- **Same organization, different departments.** Two variations of this approach are practiced. The first occurs when the company exposes the student to the whole organization so the trainee acquires a holistic understanding of how all the work areas function together to produce the final product(s). The second version of this approach allows the student to identify the preferred work area in terms of personal likes and skills. The student is then placed in that area, is allowed to gain greater skills, and—if a position is available at graduation—is usually offered a position in the area.

- **Different organizations, same department.** Here the school's philosophy is that the student should experience differences in the same occupation by working at varied organizations.

- **Different organizations, different departments.** In this placement option, the program attempts to give the student an understanding of how different companies operate within a particular occupational area.

The first two options are the most common types of placement. In these instances, students work in the organizations in which they want employment after graduation. The employer also uses the co-op program as a recruitment method. The second option—same organization, different departments—is a better approach than the first but is not easily attainable. In some instances the schools themselves do not pursue it for fear they may lose the placement slot; in others the change to the second option is made after a good working relationship is established between the company and the school. This change is often a direct result of good experiences the companies have with the students.

In a number of cases, companies using the co-op program as a recruiting tool want to place persons in the areas where they are best suited. Such companies may develop the second placement option themselves. Generally, larger organizations with in-house training departments are more flexible in their approaches to co-op placements.

Student placement requires considerable attention because so many objectives must be met. The school must first "sell" the co-op idea to the company. To a large extent, a company's flexibility in meeting the students' needs (e.g. grasping the the implications of career decisions and gaining the necessary entry-level skills) depends on the organization's philosophy on its own human resources development. Those companies that view their employees as assets will generally invest in training and developing them. Such companies are the best candidates for meaningful student training sites.

In some instances, school officials are so happy to get co-op placements at a company that they hesitate to pursue a varied placement experience for the students. Varied placement should be explored, however, if cooperative education is to be meaningful. Strategies can be developed for dealing with different types of companies. Some companies will be amenable to the more flexible—and desirable—types of placement experience; others will require a long period before they will support the desired form of placement. Schools must develop a "game plan" to encourage companies to support varied placement because otherwise the co-op program will neither meet student needs nor live up to the tenets of quality cooperative education.

Placement procedures should clearly specify the objectives of the co-op program, and they should relate the training and job exposure stipulations to those objectives. Student progress reports should also conform to those objectives. Although there is no one best way to accomplish this, all three parties—the company, the school, and the student—must participate in forming and monitoring the placement experience.

Product and Service Impact Awareness

In the highly competitive environment of high-technology industries, product quality, dependability, and customer satisfaction have become the critical factors for company viability and growth. Co-op programs stress these factors in the training and orientation of students at work sites. Accuracy has come to be more valued than speed. Students are encouraged to ask questions when they are uncertain and to verbalize the processes in order to ensure mutual understandings. Communication skills are also valued; introverts may be at a disadvantage.

In some co-op programs, students analyze the relationship between the company and the community, as well as the views that various groups have about the products, services, processes, or environmental impacts of the company. Focusing on these issues not only serves as a values-clarification exercise, it also promotes the longevity of the company, as well as that of the particular product that the student may be hired to help produce.

Planning Learning Activities

Successful co-op experiences include more than the job-specific tasks that students perform. Students have the opportunity to explore alternative career options. Students can also identify their transferable skills, explore career options, and obtain information for beginning a job search campaign. They can also set a new career direction, clarifying their life/work goals or weighing alternatives. The information that students obtain through co-op experiences can help them construct personal profiles that will be useful in making career decisions.

In related classroom instruction, the teacher—working with a career or vocational guidance counselor—can assist students to develop their profiles through selected tests, self-assessment exercises, and class presentations. As a result, co-op students can gain a better understanding of their own uniqueness and be ready to take the next step in developing a personalized career plan.

The development of employability skills is also important and often underemphasized. These skills are used in the job search, which is basically an individual marketing campaign. An important part of that campaign is developing a resume that reflects the knowledge and skill acquired in school and at the co-op training station. The resume must focus attention on the student's most positive and applicable background experience and characteristics. It should include a cover letter that brings the resume to life. These two tools must convince a potential employer that this person is an applicant to be interviewed.

An effective co-op program will provide students with the opportunity to discuss resume types and formats, context and use, and the design of effective cover letters. Students should develop and write their own resumes and cover letters and have them critiqued by the instructor, the training sponsor, and others. After reviews and revisions, the students will have a finished product that can be used in a job search.

Another employability skill that a good program develops is interviewing. In any interview, the person must sell strengths and downplay weaknesses without being nervous. The person must also describe interests and long- and short-term goals. Co-op students, by virtue of their training station experiences, should have more confidence in convincing a potential employer that they are the best persons for their positions. Co-op students' training station experiences can easily include practical experience in the interviewing process. Students can be coached in general techniques for interviewing. The training sponsor can have the student practice those techniques with co-workers or other supervisors and then provide feedback on the interview context, verbal communication, and body language.

Another important skill is decision making. In the high-technology workplace, quick and effective decisions are essential. Co-op students need to know more about how they, as individuals and in groups, should make decisions and how they can enhance their decision-making skills. At the high-technology training station, students have the opportunity to take an inventory of various decision-making styles and to consider the practical applications of these styles. Students can learn systematic decision-making techniques as well as spontaneous or intuitive methods for reaching decisions. They can address such questions as whether decision making in laser technology differs from that in robotics or biotechnology and what the similarities or differences are. Training stations in high-technology areas lend themselves to revealing these unique decision-making requirements. Another employability skill that can be learned effectively in a co-op program is knowledge of the world of work. Co-op programs provide students with learning experiences that can help them expand their knowledge of work alternatives and choose work opportunities that increase their chances of attaining job satisfaction.

Another work environment skill is stress reduction. In a high-technology environment, stress abounds. Because stress can adversely affect performance and behavior in the workplace and elsewhere, training sponsors should recognize sources of stress in co-op training stations and should educate co-op students to understand and address the problem. Obviously, stress takes different forms in different high-technology occupations.

A final employability skill appropriately learned in a co-op training program is entrepreneurship. Many opportunities for self-employment exist in high-technology industries. A significant number of self-started high-technology firms have begun in the last 10 years. Equally significant are the number of failures.

Learning that is vital to entrepreneurship often does not and cannot take place in the classroom. Co-op students in high-technology training stations are in a strategic position to learn first-hand these vital self-employment skills. Two important learning objectives for training stations

could be (1) to determine the student's own self-employment potential and (2) to develop a personal plan of action for a small high-technology business start-up. Specifically, training sponsors can provide a learning environment to help students with the following entrepreneurial learning activities:

- Evaluate co-op students' interests in seeking self-employment.
- Discover what skills co-op students have acquired through life experiences and education, both in the classroom and at the co-op training station, and identify those areas where they might need further technical assistance.
- Enable students to analyze their own financial bases for starting a small business in a high-technology area.
- Enable students to test their business ideas with consumers in the competitive market.
- Enable students to develop a business plans.
- Enable students to learn about resources available to small business owners.
- Enable students to decide on their next steps.

A final skill that co-op programs can offer to students is coping with potential job loss. Economic downturns and technological changes are major causal factors in job loss among those employed in high-technology occupations. Training sponsors can help students anticipate the realities of losing a job and avoid seeing it as the "end of the world." Information on why and how termination takes place and what to do after that traumatic event can be invaluable. An understanding of how firing is communicated and how people turn a job loss into a positive step forward is also best conveyed at the training station.

Monitoring and Evaluating the Co-op Experience

Many co-op programs have found that the effectiveness of their evaluation process is enhanced if it is timely and related to specific job activities. Ongoing work site interaction among students, supervisors, and co-workers is encouraged, as is positive feedback when students perform the job well.

Good programs provide coaching when errors are discovered. Students are urged to discuss issues with co-workers and supervisors. Some co-op programs have weekly sessions where students discuss concerns and approaches among themselves, with the coordinator serving as facilitator. Social as well as technical competency is the goal of the monitoring and evaluation process.

Monitoring and evaluation are critical because here the skill development and the socialization of the student are actually molded. Generalized evaluations of a particular area serve only to summarize the overall performance of a student in that area and are not used as developmental instruments.

CHAPTER 6
SPECIAL POPULATION AND EQUITY ISSUES

Special population and equity issues are difficult to deal with at an institutional level because the concerns extend far beyond those of recruitment, training, and placement of students. Societal norms, structural barriers, bias, prejudice, and denial of these factors constitute parts of a problem that must be confronted both in the school setting and at the workplace.

Current job realignments brought on by the technological and information revolution make equity a critical issue. Many unskilled and semiskilled jobs typically held by special populations are being lost or upgraded. Technical institutions have a special responsibility and opportunity to become leaders in realigning opportunities for these persons. Co-op programs in high technology represent an ideal setting for grappling with the attitudinal and structural accommodations needed in both institutions and workplaces.

Under the Carl Perkins Act (P. L. 98-420) and previous vocational and education acts, special populations have generally been defined as the handicapped, the disadvantaged, women, dislocated workers, individuals with limited English proficiency (LEPs), and persons in correctional institutions. Programs in elementary or high schools often address the needs of LEPs, and correctional institutions address those of the incarcerated. The other categories overlap considerably in the problems to be overcome, though the solutions may be different.

The following section identifies some of the issues that must be actively dealt with in each of the stages of the cooperative education process (i.e., recruitment, selection, training delivery, and placement). Although these issues are generic to education overall, the quickened pace of technical education—both in trying to remain relevant and convincing business to make workplaces available—tends to relegate special population and equity issues to the "back burner." Interestingly, however, some employers specifically request co-op students from the special populations group.

Recruitment

The following approaches are recommended for facilitating recruitment of special populations into co-op programs:

- Action plans should be formulated to aim advertising and recruitment activities at special population groups.

- Recruitment and advertising in all media should present members of special populations in a positive and responsible light, free from bias and stereotyping. Images of a woman seated at a typewriter with a white male standing over her, in however pleasant a setting, convey a prevailing paternalistic stereotype. The absence of a minority or handicapped person in a picture demonstrating the use of high-technology equipment may reinforce the notion that members of those groups should not apply. The American Psychological Association has prepared general guidelines for avoiding sexist language in its journal articles. These guidelines may be useful in preparing co-op recruitment materials.

- The targeted advertising and recruitment material should highlight what has been done to accommodate special population students. Pictures of persons in wheelchairs, for example, could illustrate ways in which the facilities have been built or modified to enable full participation of the handicapped.

Selection

The criteria for selection, testing, and interviewing of co op students should relate to actual performance in the program and avoid subjective perceptual biases. For example, interpersonal skills and the work ethic may be critical to success at the work station, but disadvantaged students may not have been exposed to these expectations in their environments. If these social expectations can be taught, then program selection criteria should not exclude persons who need this form of socialization. Instead, the selection process should identify the particular needs of the candidates and make recommendations for specific types of training, exposure, and monitoring.

Training Delivery

Training issues such as the level of inclusion and exclusion of special population students, types of activity assignments and involvement, teacher expectations, and student acceptance and friendship give life, substance, and meaning to these students' campus and work site training experiences. Tangible and subtle cues are critical for effective learning. It is in the interest of the program to provide a positive atmosphere for all its students. Because this is an internal perceptual matter (what may seem positive to an administrator or teacher may be viewed negatively by a handicapped or disadvantaged student), methods of nonthreatening dialogue, interaction, and monitoring of students should become an integral part of the way things are done in the co-op program.

There is no instant recipe for this approach. Some programs may include a counseling component; others may encourage involvement and communication among administrators, teachers, and students. Whatever approach is adopted, the underlying climate or culture of the institution is the key to effective co-op learning experiences for special population students.

Placement

The unique advantage of co-op education is the opportunity it provides for students to sample the real world of work in a nonthreatening, supportive environment. These two aspects are of particular importance for special population students. Care must be taken to assess the areas where such students may need assistance. Supportive mechanisms must then be built into the placement activity by both the institution and the work site. These placement activities should be viewed as a learning experience for all parties concerned—the students, the co-op coordinator, the company's employees, the supervisors, and the personnel administrators. In such close working environments, unstated or unquestioned bias, prejudice, and stereotypes are exposed and put to the test in any number of ways (e.g., types of assignments, degrees of involvement, types and quality of interpersonal interaction on and off the job, actual and perceived fairness in monitoring activities and performance, rate of progress, and so forth).

No set formula exists to overcome these barriers. It is important, however, that students understand what is happening and develop the resilience to deal with inequity in ways that do not jeopardize their jobs.

While a school cannot change the world, all parties benefit if the workplace employees and management also learn from the experience of hiring special population students. Mutual understanding will not only shape a better work site for future students, it will also create a better work environment and perhaps even more tolerant human beings.

An idea that is being used by some postsecondary schools to promote the training of special populations is the conducting of a technical scholars program. This program is designed to provide technical education and training demanded by advancing technology. One advantage identified by postsecondary schools and companies sponsoring technical scholars is the placement and training of women and minorities in previously nontraditional jobs. For a more detailed description of the program, refer to appendix C.

Conclusion

There are no hard and fast rules to help co-op programs deal successfully with special populations. The first requirement is a sensitivity to the unique issues that arise when working with special populations. Another requirement is an aggressive approach to handling and resolving issues. This involves promoting dialogue, interaction, and understanding of all parties concerned in order to meet the desired objectives. In this way, special population and equity issues become part of the operating culture and philosophy of the co-op program and perhaps also of the companies with which it interacts.

CHAPTER 7
MARKETING THE CO-OP PROGRAM

Co-op has to be accepted by the staff and faculty as being a valuable experience for the students; it is number one. You have to sell your academic advisors that it's a valuable experience and they sell it to the teachers, and they sell it to the students, and, of course, you have to sell it to your industry that it's a valuable experience. Some of them are very cold at first. They say that it is more trouble than it's worth, but once you get them to sign off and they have one good person as a co-op that has some good experience, they will ask for more.

—Administrator, Albuquerque Technical-Vocational Institute

Developing strategies to communicate a co-op program's availability and content to prospective users is the key to its survival. Cooperative education is distinct from other forms of education in that it has to convince both potential students and employers of its benefits. A working definition of marketing and public relations activities for a co-op program—or any other—is as follows:

> Marketing is the analysis, planning, implementation, and control of carefully formulated programs designed to bring about voluntary exchanges of values with target markets for the purpose of achieving organizational objectives. It relies heavily on designing the organization's offering in terms of the target market's needs and desires, and on using effective pricing, communication, and distribution to inform, motivate, and service the markets. (Kotler 1975, p. 5)

This definition highlights the interactive nature of the marketing process between the marketers and the consumers, namely, schools and employers and students. In this process the needs of the groups are identified and strategies for reaching them are formulated. For co-op programs, the strategies include staff visitations, participation in organizations, and the development and dissemination of material, advertisements, and publicity.

Traditional marketing approaches are reactive—the consumer's needs are identified and the organization develops or adapts products to satisfy those needs. By contrast, the co-op programs in this study found that the nature of their product and service requires them to be more proactive in their approach.

For employers, cooperative education is not the normal course of activities. Companies are generally preoccupied with their market share and profitability. The only time they may be interested in students is when they need new employees. Employers, then, need to be convinced of the benefits of taking a more long-term view of human resource development, such as providing co-op experiences for students.

Students, on the other hand, frequently have inadequate and romanticized notions of high technology. Because high technology is so fast-paced and rapidly changing, students have to be shown the requirements of and opportunities in its occupations. The more innovative programs in the study have developed ways of interacting with the high schools, student organizations, parents and the youth-oriented culture in order to market co-op education effectively.

Marketing Strategy to Employers

In several co-op programs, marketing potential is a part of their culture. When committees are formed or lecturers hired, the persons recruited for service are highly respected in their areas of expertise. In part, the programs want to expose these individuals to the programs' offerings so that these people may become, if not ambassadors, at least pleasantly disposed toward the program.

On the basis of their placement policy, successful programs usually target specific organizations, either local, broadly based National or international. The majority of the programs use only local placement arrangements because their programs are primarily designed to serve local needs.

At unionized work site locations, programs involve union officials on committees and in program design in order to avoid conflict with union member employment, layoff, and retraining issues. Union representatives not only forestall adversarial relations with management, but they also understand the co-op program, explain it to their members, and occasionally encourage potential members to enroll.

A number of direct strategies recruit employers: invitations to school functions (e.g., graduation ceremonies or career day exhibitions); visitations to company sites by staff members, generally the co-op coordinators; and student tours of the company facilities. Indirect strategies also help. For example, co-op program staff members are encouraged to become active in community and professional organizations. Some schools pay for the memberships and encourage faculty to write articles in related publications.

Co-op programs often promote activities that generate free publicity about their quality, excitement, and contribution to the community. They cultivate relationships with members of the media to facilitate and encourage human interest stories and coverage of such activities as visits or speeches by dignitaries or celebrities as well as fairs, career days, exhibitions, and creative and cultural activities. Programs in smaller, more rural communities have generally been more successful in gaining free publicity.

Figure 2 summarizes the key points of a co-op program marketing strategy to employers.

Marketing Strategy to Students

The successful strategies for attracting and developing a continuing support base to attract co-op program students have involved a long-term, multifaceted approach. In marketing to students it is important not only to convince the potential candidates of the benefits of the program but also to influence parents and friends to support the choice. Employability of the graduates is a more crucial factor than the other merits of the program or institution. Furthermore, for parents and students who cannot afford the tuition, a co-op program provides money earned at the job site that can be used to subsidize the cost of the program.

The key requirements for marketing to potential co-op students are to (1)inform them of career opportunities and precollege requirements, (2) show how relevant practical experience coupled with the necessary theoretical foundation helps to obtain their career objectives, and (3) demonstrate the benefits of earning while learning.

Successful case-study programs' marketing to students tended to concentrate on high schools, parents, and advertising. Their approaches for these groups are discussed next.

High Schools

Most colleges with co-op programs have close relationships with local high schools, particularly the administration, career counselors, science and math teachers, parent-teacher associations, and student organizations and clubs. College staff, primarily co-op coordinators, seek to establish personal relations with representatives of these groups. Staff visits, career day participation, invitations to high school students to visit the college, help with curriculum design, and visits from graduates of co-op program to their former high schools to tell their success stories all are part of the ongoing activities of the successful co-op programs.

Objective: To develop desirable training site locations

Plan: Identify and prioritize desirable locations

Concurrent Activities:

1. Select key top executives of organizations and union officials (when appropriate) to involve in planning and advisory activities of the program or institution.
2. Use the goodwill generated in #1 to produce additional placement sites by—
   - staff visitations,
   - student tours of the prospective facility,
   - career days, and
   - invitations to functions.
3. Devise a variety of indirect promotional strategies by networking via staff membership in community and professional organizations.
4. Develop public relations (free publicity) by—
   - writing or promoting articles in related journals, magazines, and newspapers,
   - cultivating good relationships with the media, and
   - creating excitement, activity, and quality products and services.

Figure 2. Marketing strategy to employers

Advertising and Public Relations

Public relations is also an important method of informing parents and potential students about the co-op program. Public relations, as mentioned earlier, employs a variety of community-interest activities to obtain free publicity for the program. Frequently, potential students and/or their parents are invited to an event at the institution sponsoring the co-op program. Other public relations activities include generating media coverage of human interest stories of individual achievement or group efforts on behalf of a charity, or reports of a celebrity or dignitary visiting or contributing to the institution or program. Any activity that conveys a positive public image of the institution or program is encouraged.

Advertising is targeted more to particular audiences than is public relations. Advertising considerations should include—

- the specific audience desired;
- the purpose, content, layout, and design or format of the message;
- the cost, timing, and circulation life of the medium;
- the impact and viewer recall of the message; and
- the appropriateness of the particular medium for reaching the desired audience.

Magazines have a longer life and circulation than newspapers, whereas radio and television have a short life. But television has the most impact and newspapers carry the least. Additionally, co-op newsletters may be distributed to potential students and empolyers. These newsletters can be used to provide information on various aspects of co-op in high-technology occupational areas. For example, appendix H, a diary of a co-op student, is an example of that type of information.

The Marketing Process

The case-study programs developed marketing strategies that differ in specifics but have similar process elements, as shown in figure 3. Although the items in the figure are numbered consecutively, some marketing activities occur concurrently or in a different order, depending on contextual peculiarities. The important point is that in devising a marketing strategy, a co-op program must investigate and consider each activity.

1. **Identify target audiences:**

   1.1 Employers (work sites)

   1.2 Parents

   1.3 Potential co-op students

   1.4 Feeder schools

2. **Identify method(s) of reaching the targeted audiences:**

   2.1 Direct and/or indirect

   2.2 Marketing:

      2.2.1 Timing

      2.2.2 Cost

      2.2.3 Life of medium

      2.2.4 Impact and recall of medium

      2.2.5 Media preferences of targeted audiences

      2.2.6 Layout, design, content, presentation format

      2.2.7 Brochures, posters, information booklets, fliers, handbooks, and so forth

   2.3 Public relations:

      2.3.1 Visitations

      2.3.2 Human interest stories (individual & group)

      2.3.3 Campus-based activities

3. **Identify needs and interests of the target groups:**

   3.1 Employers: dependable source of employees, good corporate citizen

   3.2 Parents: good career choice for child; good learning environment

   3.3 Potential co-op student: meets or helps identify career choice, good learning environment—relevant theory and work experiences mixed with fun

   3.4 Feeder schools: interaction and information sharing with administrators, counselors, scinece and math teachers, student organizations, parent-teacher associations

Figure 3. The marketing process elements

4. **Assign responsibility:**

   4.1 Centralized or decentralized function

   4.2 Internal or contracted functions

   4.3 Advisory groups

5. **Obtain evaluation and feedback:**

   5.1 Monitoring of specific activities

   5.2 Target and audience surveys

   5.3 Focus group sessions

   5.3 Informal interaction with target audiences

   5.3 Suggestions

6. **Develop budget**

Figure 3—continued

CHAPTER 8
EVALUATING THE CO-OP PROGRAM

Introduction

Evaluation of educational programs has drawn increased attention because of the recent reports on the quality of education. "The prediction commonly heard in the 1960s that formalized program evaluation was a fad and soon would disappear proved false, and there are strong indications that this field will continue to grow in importance, sophistication, and stature" (Maduas, Scriven, and Stufflebeam 1983, p. 18).

Evaluation of cooperative education programs in high-technology areas is an emerging feature of the total co-op education process. The maintenance and growth of quality co-op training depend on a number of key factors, and evaluation is one of them. Often, however, program staff view evaluation as a compliance activity, one that involves the laborious collection of data merely to fulfill legislative or administrative requirements. It is also frequently seen as an activity that takes place only once. Such views of evaluation are not peculiar to cooperative education but exist throughout all of education and other sectors as well.

Tyler (1980, p. 14) concludes that although significant progress is being made in developing program evaluation procedures for cooperative education, critical problems are still unresolved. What solutions present themselves? Four major strategies are available to serve co-op program personnel concerned with effective evaluation:

- Defining the need for evaluation
- Identifying appropriate methodology for comprehensive evaluation systems
- Developing expertise in evaluation practices
- Developing strategies and procedures for effective use of evaluation results

These strategies are in no way intended to be all inclusive.

Perspectives on Evaluation in Cooperative Education

Mason and Haines (1972) state that improvement of cooperative programs must be based on a systematic, appropriate evaluation involving both informal and formal investigation. Figure 4 presents a comprehensive evaluation model that can be adapted for evaluating co-op programs in high-technology areas.

Program evaluation requires an organized search for strong and weak aspects of the endeavor. Among the tools of evaluation are program reviews with instructors, reviews with State staff members for reimbursable programs, follow-up studies of program graduates, preparation of

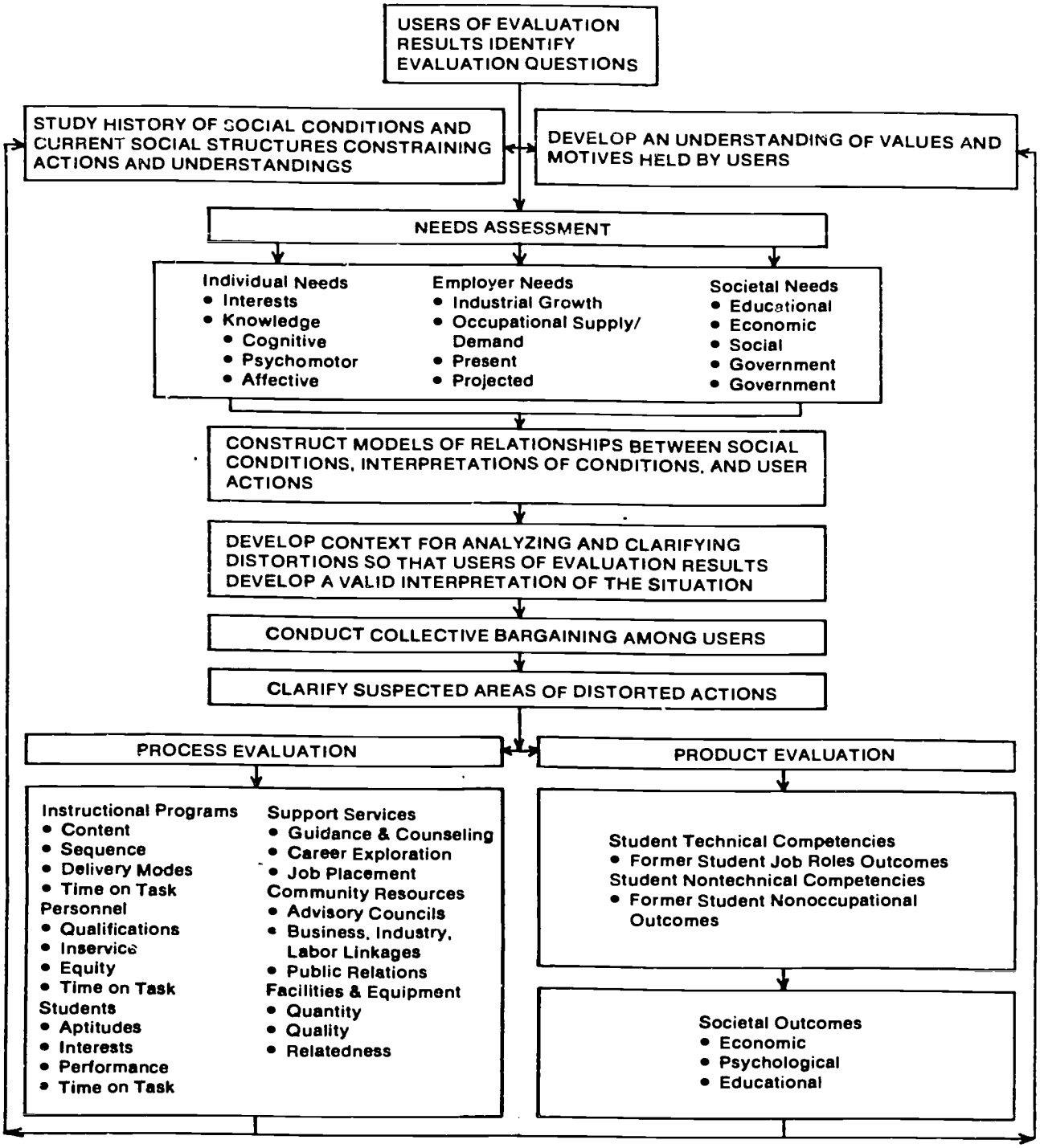

Figure 4. An evaluation model for co-op in high-technology occupational areas

descriptive annual reports for school administration and program advisory committees, preparation of reports for school accreditation teams, and evaluations carried on by private educational research organizations hired by the school board.

Heermann (1975) identifies a key challenge that confronts co-op program staff: carrying out a systematic measurement of how successful the program is. Important indicators of success include lower attrition, improved academic performance, and higher wages for co-op students when compared with those of other students. Other important (but less easily obtained) data include those on student learning and career development, the assimilation of disadvantaged students into the larger society, the passage of community college levies, student attitudes toward work and education, and various employer perceptions about training, student performance, and the educational parameters of co-op programs. The task of identifying areas for research may logically be made by National associations of vocational, cooperative, or community college educators. This task should include a systematic National evaluation plan and a grass roots effort based in the institutional research activities of individual schools.

Evaluation Focus and Principles

Underlying all cooperative education in high-technology areas is a requirement for excellence. A co-op program working on the cutting edge of technology must integrate critical self-examination into ongoing activities and resulting products.

Every co-op program needs to develop, test, and refine a variety of systematic quality control and impact assessment procedures. These procedures should address the distinct projects and activities of the program as well as the overall quality of the school. For the purposes of co-op programs, **quality assurance** and **impact assessment** are key terms that guide the evaluation plan. They can be defined as follows:

- **Quality assurance** is the process of ensuring the quality of activities conducted and deliverables completed.

- **Impact assessment** is the process of documenting the impact of the work, products, and activities under contract.

Moreover, quality assurance involves formative evaluation-gathering information for improving the quality of program products and activities while they are still under development. In co-op programs, quality assurance means incrementally improving the quality of program services, information, products, and training during their developmental stages. Quality assurance can use variety of techniques, including internal reviews, external reviews, and developmental testing.

The quality of co-op activities should be evaluated using the following criteria:

- **Usefulness.** Products and activities present relevant information in a useful manner.

- **Equity.** Products and activities avoid stereotypic treatment of individuals on the basis of sex, handicap, race, age, or other special needs.

Impact assessment, on the other hand, is summative evaluation, collecting information to document the impact of completed products and activities. Impact implies that a program has brought

about change of some type. In educational or employment and training programs, changes in individuals' knowledge, skills, attitudes, behaviors, or practices are indicators of impact. In essence, assessing the impact of a co-op program requires searching for changes—both intended and unintended—that could be the outcome of program activities.

Assessing impact, especially for programs as complex and multifaceted as co-operative education in high-technology areas, poses many inherent methodological and conceptual challenges. The first requirement is a pragmatic plan for documenting impact. The proposed approach defines impact as including three phases: the earlier phases of (1) **distribution** and (2) **use** of products and activities as well as their later (3) **effects** on people, practices, and organizations. This definition allows incremental measurement of impact and results in a more useful and dependable impact database.

Specifically, the impact of a co-op program depends on how well it meets the following criteria:

- **Involvement.** Products and activities promote widespread involvement of diverse user groups (e.g., students, companies).
- **Use.** Products and activities promote different levels of primary use as well as secondary use (e.g., acquiring job-specific skills as well as human relation skills).
- **Capacitation.** Products and activities improve the knowledge, skills, and attitudes of students.
- **Program improvement.** Products and activities enhance the quality of vocational education instruction, programs, policies, and services.
- **Organizational development.** Products and activities improve the capacity of organizations to build systems, incorporate technologies, and develop staff.
- **Satisfaction.** Users react positively to the products and activities provided.
- **Cost-benefit and -effectiveness.** The unit cost of products and activities is reasonable, considering their effects and benefits to users.
- **Leadership.** The co-op program staff maintain visibility in the educational, employment, and related fields, as evidenced by publications, presentations, and recognitions.

The quality control plan for a co-op program should promote accountability as well as the improvement of future work. Both quality assurance and impact assessment procedures should continually seek more efficient ways to perform the program's scope of work.

Some Basic Evaluation Considerations

Maduas, Scriven, and Stufflebeam (1983) state that attempting to evaluate something formally requires the evaluator to come to grips with a number of abstract concepts, such as value, merit, worth, growth, criteria, standards, objectives, needs, norms, client, audience, validity, reliability, objectivity, practical significance, accountability, improvement, process, product, formative, summative, costs, impact, information, credibility, and—of course—evaluation itself.

In any specific evaluation, the evaluator must define and clarify for others the following:

- The audiences and information required
- The particular object to be evaluated
- The purposes of the study
- The inquiry approach to be employed
- The concerns and issues to be examined
- The variables to be assessed
- The bases for interpreting findings
- The standards to be invoked in assessing the quality of the work (ibid.)

Patton (1978) regrets that the "emergence of evaluation research has not meant a corresponding utilization of findings for rational decision making" (p. 22). A recent review of literature (Alkin, Daillak, and White 1979) shows that there is great dissatisfaction with the lack of impact and usefulness of evaluation information. As Carol Weiss (1972) says,

> evaluation research is meant for immediate and direct use in improving the quality of social programming. Yet a review of evaluation experience suggests that evaluation results have not exerted significant influence on program decisions. (pp. 10-11)

Alkin, Daillak, and White (1979) identified three major categories of factors influencing the ultimate use of evaluation findings: (1) characteristics of the organization, (2) characteristics of actors in the system (i.e., evaluators and decision makers), and (3) characteristics of the evaluation. According to Patton (1978), a number of specific factors in the evaluation process account for ineffective utilization of evaluation data: fuzzy program goals, lack of methodological rigor, uncertain findings, lack of staff, little program cooperation, inconsistent State and county data-processing systems, unclear decision-making hierarchies, political undercurrents, the attempt to cover too much, and inappropriate timing. Thus, it can be seen that although effective use of evaluation information is influenced by numerous variables, the evaluator's technical skill, ingenuity, and creativity are important determinants. To a considerable degree, the evaluator determines what happens to the results of evaluation.

The following sections discuss some basic evaluation considerations critical to the effective use of evaluation data on former co-op students' satisfaction with their training and their jobs. The considerations include (1) identifying relevant decision makers and information users, (2) writing the objectives of the study, (3) determining the respondents, (4) choosing the appropriate research design, and (5) deciding whether to design a new instrument or to select an existing one.

Identifying the Relevant Decision Makers and Information Users

Evaluation studies are designed primarily to provide good information for decision making. They have six major purposes:

- To contribute to decisions about program installation
- To contribute to decisions about program modification
- To obtain evidence to rally support for a program
- To obtain evidence to rally opposition to a program
- To contribute to the understanding of basic psychological, social, and other processes
- To contribute to decisions about program continuation, expansion, or certification (Anderson et al. 1975, pp. 3-4)

The Joint Committee on Standards for Educational Evaluation (1981) recommends that evaluators "acquaint themselves with their audience, ascertain the audience's information needs, gear studies to these needs, and report the information clearly when it is needed" (p. 13). Three important questions, therefore, evolve: (1) Who are the relevant decision makers and information users? (2) What type of information do different audiences need? and (3) When do they need the information? These questions must be answered satisfactorily before proceeding with the evaluation because they are basic to the formulation of the evaluation objectives and the use of the evaluation information.

No simple, universal rules exist for answering the questions. Different types of organizations have different types of decision-making hierarchies, political undercurrents, and persons responsible for decision making. Thus, it is helpful to view information needs for program accountability, decision making, and improvement at different organizational levels: school, district, State, and Federal. Morris and Fitz-Gibbon (1978) recommend consulting the following sources:

- State and Federal mandates and legislation
- Local and National concerns identified in editorials, articles, and legislation
- Parental concerns as voiced in letters, PTA and parent advisory meetings, and conferences
- Community concerns voiced by business organizations, pressure groups, and the like
- School records and reports such as attendance, discipline, career choices of graduates, and test scores
- College requirements and employers' requirements for graduates
- Teachers' reports and comments
- Former students' requests and comments

- Project proposals, final evaluation reports, and program descriptions of other projects in the same curriculum area

- Other schools that have developed programs in the area of interest (pp. 23-24)

Figure 5 is designed to help co-op program evaluators identify the relevant decision makers for the program.

Writing the evaluation objectives is one of the most important parts of an evaluation study. The objectives specify the desired outcomes, thereby providing direction in terms of the data to collect, the time to collect them, the method or methods to employ, and the types of analysis and presentation to use for the data.

In writing objectives, the needs of the target audiences are crucial. To ensure that the objectives adequately reflect the intended outcomes, a list should be drawn of the specific information needs of the target audience, with similar items grouped together in categories. These lists can then be translated into objectives.

Objectives may usually be classified into two categories: broad and specific. Broad objectives express the major purpose of the evaluation; specific objectives express the specific intended outcomes of the evaluation. Several specific objectives may constitute one broad objective. If specific objectives are written in measurable, concise, and clear statements, they can serve as the basis for questions in the data collection instruments. The example in figure 6 illustrates how a list of the specific data needs of different audiences may be translated into broad and specific objectives. After the objectives have been written, they should be reviewed by completing the checklist in figure 7.

Instructions: Examine the figures below and list the appropriate decision makers and information users for each phase of the vocational education program.

Phase of Cooperative Program	Decision	Type of Evaluation	Appropriate Decision Makers and Information Users
Phase 1. Planning	Does the Co-op Education Address Top Priority Needs?	Needs Assessment	1. ____ 2. ____ 3. ____
Phase 2. Implementing	How Can the Co-op Education Be Improved?	Formative Evaluation	1. ____ 2. ____ 3. ____
Phase 3. Recycling	Has the Co-op Education Had An Impact?	Summative Evaluation	1. ____ 2. ____ 3. ____
	Is the Evaluation Accurate and True?	Evaluation Audit	1. ____ 2. ____ 3. ____

Figure 5. Determining appropriate decision makers and information users.

SOURCE: Adapted from Adams and Walker (1980).

Data Needs

Student Satisfaction:

1. Local appliance manufacturer—wants to know the satisfaction of co-op students with the new analog testing equipment that was donated.

2. Local school board—expresses interest in knowing the satisfaction of co-op students with the new prototype instructional materials in technical occupations.

3. Local company officials—want to know the training satisfaction of students who were in the high-technology co-op programs.

Job Satisfaction:

1. Parents—express interest in knowing the job satisfaction of former co-op students who are employed in the new high-technology firms in the community.

2. Management of new high technology firms in the community—want to know the satisfaction of their employees who were former co-op students relative to the various aspects of their jobs.

Objectives

Board Objectives:

To assist target audiences in decision making and planning by providing them with information on the following:

1. Former co-op students' satisfaction with their training:

   A. To measure the satisfaction of co-op education students on the new analog testing equipment donated by XYL Company.

   B. To measure the satisfaction of co-op students in technical programs with the prototype instructional materials.

   C. To determine the satisfaction of co-op students with cooperative education services.

2. Former co-op students' satisfaction with their jobs.

Specific Objectives:

1. To determine the job satisfaction (relative to pay, fringe benefits, working conditions, status) of students in the newly established high-technology firms in the community.

2. To evaluate the levels of satisfaction among co-op education students who are employed in the newly established high-technology firms in the community.

Figure 6. Translating data needs to evaluation objectives: an example

Instructions: Take time to review your objectives by answering the questions below:

Yes	No	Questions:
		1. Do the objectives reflect the needs of the following information users and decision makers?
☐	☐	• Co-op program coordinator
☐	☐	• Teachers
☐	☐	• Local school administrators
☐	☐	• Business and industry
☐	☐	• Labor
☐	☐	• State education agency
☐	☐	2. Do your broad objectives express the major purposes of your evaluation study?
		3. Are your specific objectives—
☐	☐	• Clearly written (i.e., they are free of words that are ambiguous, indefinite, or imprecise)?
☐	☐	• Concisely written (i.e., short and direct sentences)?
☐	☐	• Measurable (i.e. the objectives are stated in performance terms)?

Figure 7. Review of evaluation objectives

Determining the Respondents

Once the evaluation objectives have been written, the next tasks are (1) to determine what relevant population(s) can furnish data to meet the objectives and (2) to identify the specific respondents from whom the data will be gathered. The objectives should be studied and a list made of different groups of former co-op students. The number of students in each group and the needed data should be indicated. From this list it should be possible to determine the relevant populations (i.e., groups of former students) for the evaluation. Table 7 offers an example.

TABLE 7

SAMPLE TABLE OF EVALUATION RESPONDENTS AND CORRESPONDING DATA NEEDS

Former Cooperative Vocational Student's Electrical Technology, 1979-80	Number of Students	Data Needed
Total no. of graduates for program year	150	• Satisfaction with the team teaching • Satisfaction with the new textbooks
Graduates employed by electronics companies in the community	50	• Job satisfaction in terms of their pay, fringe benefits, and working conditions

As shown in table 7, two types of information are needed from all former co-op students. For those who are employed by the new companies, however, additional information must be collected on job satisfaction.

After determining the relevant populations, the next task is to identify the specific respondents of the study—that is, the former co-op students from whom data will be collected. The decision depends upon several factors: objectives of the study, characteristics of the population, and resources available. In cases where the population is small (e.g., 25), all students may be surveyed. On the other hand, if the population is large (e.g., 1,000), it becomes very expensive to gather data from all members. In this case, a few respondents (e.g., 50) selected at random from the total population may be used. The information collected can be used to represent the answers of the whole population.

Alreck and Settle (1985) suggest a number of random samples that are often used:

- **Simple random.** Assign to each population member a unique number; select sample items by use of random numbers.
- **Systematic.** Use natural ordering or order population; select random starting point between 1 and the nearest integer to the sampling ratio (N/n); select times at interval of nearest integer to sampling ratio.

- **Cluster.** Select sampling units by some form of random sampling; ultimate units are groups; select these at random and take a complete count of each.

- **Stratified cl· .er.** Select clusters at random from every sampling unit.

- **Repetitive multiple or sequential.** Two or more samples of any of the above types are taken, using results from earlier samples to design later ones or to determine if they are necessary.

If a decision has been reached to select a random sample, the evaluator needs to determine what sample of the population will best serve the evaluation objectives. Sampling as it relates to vocational education follow-up studies is further treated in depth by Franchak and Spirer (1978). The checklist in figure 8 is designed to help determine the sampling plan.

Choosing the Appropriate Evaluation Design

After writing the evaluation objectives and selecting respondents, the next task is choosing an appropriate evaluation research design. In doing this, the evaluator needs to consider the objectives of the evaluation, the questions that need to be answered, the characteristics of the population, the time available to conduct the study, and the human and financial resources available. Additionally, the various rules and regulations that protect individuals' rights must be considered, for they set the ethical parameters for the methodologies that are available to the evaluator.

For example, if a local co-op advisory council wished to know the relative influences of co-op versus other education on program graduates' job satisfaction, the perfect design would involve conducting a true experiment. Students would be randomly assigned to co-op versus noncooperative education programs and would subsequently be placed in identical jobs in the same sponsor organization. It is unlikely, however, that an evaluator will or should have the freedom to make these assignments.

As an alternative, an ex post facto evaluation design may be utilized. The job satisfaction of a group of co-op graduates would be compared to that of co-workers in similar jobs in the same organization. This procedure would entail selecting (or having the employer select) one nonprogram graduate for each co-op program graduate in the sample. This approach would begin to control for the effects of job and organizational characteristics, but individual characteristics (e.g., values, age, experience, and so forth) would not be controlled because of nonrandom assignment to groups. Despite these problems, the ex post facto design is probably the best of the feasible evaluation designs for the proposed study.

As another example, suppose a local superintendent wants to assess the effects of specific characteristics of the co-op program. When the purpose is to evaluate a specific aspect of a co-op program, the ideal design is to run parallel programs differing only in that one aspect and assign students randomly to the two programs. Although this experimental design may be difficult to implement, it is not impossible, particularly where there are multiple co-op classes and where assignment to classes is controlled by the administrator. The strengths of a true experiment cannot be overemphasized, because any differences in subsequent job satisfaction can be directly attributed to differences between the programs.

An alternative design involves nonrandom assignment to the experimental and control groups, producing a nonequivalent control group evaluation. For example, when two classes differ on the

Groups	Total N	Decision			
		Total Enumeration	Simple Random	Cluster	Strati-fied
			(Check One)		
A. Types of High-Technology Programs					
1. CAD technician	____	☐	☐	☐	☐
2. CAM technician	____	☐	☐	☐	☐
3. Robotic production technician	____	☐	☐	☐	☐
4. Laser technician	____	☐	☐	☐	☐
5. Genetic engineering technician	____	☐	☐	☐	☐
6. Holographic inspector	____	☐	☐	☐	☐
7. Bionic-electronic technician	____	☐	☐	☐	☐
B. Special Populations					
1. Handicapped	____	☐	☐	☐	☐
2. Disadvantaged	____	☐	☐	☐	☐
3. Minority	____	☐	☐	☐	☐
4. Limited English Proficiency	____	☐	☐	☐	☐
5. Women	____	☐	☐	☐	☐

NOTE: Depending on the objectives of your study, you may want to group your respondents by U.S. Department of Education six-digit code.

Figure 8. Determining your sampling plan

characteristic under study but have been placed by nonrandom assignment, a number of differences exist besides the one of interest. Another possibility is to study two groups of students, one that went through the program before a change and another, after the change.

Both examples produce groups that differ on variables other than the one under study. The characteristics of the students or the availability of good jobs may change over time, or the students may self-select themselves into the two different classes on the basis of extraneous factors or their knowledge of the design element being evaluated. Biases such as these may mask or overpower true effects or produce differences that are not due to the variable being studied.

A design that is generally stronger than the nonequivalent control group is an interrupted time-series design. If a change in the program is planned, then this design requires taking periodic measures before and after the change. Any significant differences in the pattern of the data from before the change and the pattern of the data from after the change can be used as evidence of the effects of the change. With an adequate time line, the only threat to conclusions based on this design would be other events occurring at the time of the change that might have caused the effects. It is possible to reduce this possibility by closely monitoring the program to make sure no other changes occur when the focal change is implemented.

The interrupted time-series design is most useful where measures can be easily taken on a regular basis. For example, it is possible to use class attendance, scores on weekly standardized quizzes, and student reaction to the course in this design. Job satisfaction, however, may be more difficult to measure, primarily because before and after measures of job satisfaction cannot be taken from the same set of students. Rather, each student graduates from a program taught either before the change or after the change. This destroys the advantage of the interrupted time-series design, for subjects can no longer act as their own control group. Accordingly, if a true experiment is not possible, a nonequivalent control group design is the best one to use when examining the effects of co-op programs on job satisfaction. The foregoing examples illustrate the fact that, in all instances, the evaluator's methodological principles need to be tempered by the realities of the situation.

Another important consideration in choosing a methodology is data timeliness. Information should be available when needed by the target audience. In some instances, therefore, a less desirable methodology using only "soft" data may have to be selected because of constraints on available time and resources. As Patton (1978) points out,

> the challenge in selecting an evaluation method is to do justice to the question by providing the most valid and reliable answers possible with the resources available. (p. 237)

Some evaluators may find it difficult to sacrifice their research integrity for political reasons, but they should keep in mind that "some systematic information is better than none" (ibid., p. 185).

Deciding Whether to Design an Instrument or Select an Existing One

The next task, after choosing an evaluation research design, is to decide whether to design a new instrument or select an existing one. When faced with designing an evaluation of a co-op program, consider the benefits of selecting an existing survey instrument. If the instrument has been used and fully evaluated elsewhere, items will probably be well written and bad items will have been eliminated or revised. See appendix G for examples of instruments used for evaluating co-op in high technology occupational areas.

Existing instruments should not be blindly selected, however. There are no standard instruments for measuring training satisfaction, job satisfaction, or any other construct. Many often-used instruments have severe problems, such as poorly written items or inadequate response modes. Further, although published norms may provide a useful comparison, there is no guarantee that the samples making up the norm are representative of the population of the co-op program sample or that they are even within the same population.

Finally, an existing instrument may not appropriately address the question being asked—a particular concern when gauging training satisfaction or job satisfaction, for which no complete list of dimensions exists. Furthermore, the dimensions chosen from the existing instrument may not precisely tap the variable affected by co-op education. For example, satisfaction with promotion opportunity is a common dimension of job satisfaction. The co-op program may be expected to affect satisfaction with career opportunity, however, and not necessarily affect satisfaction with promotion opportunity within one's current organization (which may be more strongly affected by the availability of openings). Although the existing instrument may seem to measure the desired outcome, even such small differences can result in inaccurate conclusions.

A closely related point is that many existing measures of job satisfaction include global dimensions. For example, the well-known Job Descriptive Index (JDI) has many strengths and has been valuable in many studies, but its dimensions are fairly broad. For example, does dissatisfaction with the work mean that the respondent is dissatisfied with the amount of challenge, responsibility, feeling of accomplishment, or variety or enjoyment of the activities themselves?

Summary

Unlike research studies designed primarily to add to the body of knowledge, evaluation studies are designed primarily to provide information to decision makers. Thus, no effort must be spared to ensure that the evaluation data are used. In writing the objectives of a study, determining the respondents, and choosing the appropriate evaluation design and instrument, the evaluator should be guided at all times by the specific information needs of relevant decision makers and information users.

The two most common methods of data collection in evaluation surveys are mailed questionnaires and interviews. These methods make it possible to quantify and generalize results and to present evaluation findings to information users. However, the low rate of use of qualitative evaluation methods has been the subject of increasing criticism (Wolf et al. 1979). One reason is that results tend to be oversimplified and are sometimes misleading. An evaluation report based purely on quantitative data often lacks a holistic view of the co-op program under review.

Qualitative evaluation methods should be used, where appropriate, to complement or supplement quantitative measures. Complex situations are better understood when considered in terms of the dynamics of their social processes. Use of qualitative as well as quantitative measures provides a better understanding of the multiplicity of causes associated with given outcomes in vocational education (McCaslin 1978) and acknowledges that there are "multiple realities and multiple perceptions and interpretations" (Wolf et al. 1979, p. 35). As Bogdan and Taylor (1975) put it,

> qualitative methodologies refer to research procedures which produce descriptive data: people's own written or spoken words and observable behavior. This approach . . . directs itself at settings and the individuals within those settings holistically; that is, the subject of the study, be it an organization or an individual, is not reduced to an isolated variable or to a hypothesis, but is viewed instead as part of a whole. (p. 4)

Two Qualitative Evaluation Methodologies

This section examines participant observation and unobtrusive measures—two qualitative methodologies—that may be appropriate in measuring the training and job satisfaction of former co-op program students. These data collection techniques do not require contact with the individual and include such approaches as observation (direct or video), physical trace measures, and research of archives or records (Kester 1979).

Participant Observation

The use of participant observation techniques is relatively new in vocational education evaluation. A review (Mertens et al. 1980) of 1,500 studies on the effects of vocational education shows that qualitative methods for measuring training satisfaction and job satisfaction are virtually never used.

Participant observation is traditionally the anthropologist's methodology. The term is synonymous with field observation, qualitative observation, ethnographic techniques, and direct observation. All refer to a condition in which the researcher is immersed in the system under study while in the process of data collection. Three advantages to this technique are cited by Bouchard (1976):

> [First,] it focuses the researcher's attention on the behavior of individuals rather than simply on their verbal interview or test-taking behavior. . . . A second advantage is that it tends to force the researcher to look at the whole [person], the whole organization, and the whole [social and physical] environment in an integrated way . . . [and third,] it puts the . . . [evaluator] in the context of discovery. (p. 385)

Evaluators are warned, however, that "the price of doing fieldwork is extremely high, not in dollars . . . but in physical and mental effort" (Bogdan and Taylor 1975, p. vi). It is often necessary for an evaluator to lead two lives simultaneously, "as a participant in whatever little world is under study while, at the same time, attempting to make sense out of the world as an observer" (ibid.). The following sections detail the two most common methods of the participant observation technique.

The unknown observer. In this situation the observers do not identify themselves. They assume incognito roles and remain unknown to many (if not all) members of the setting (Lofland 1971). These individuals may take jobs and so join the group for the purpose of collecting data. In this situation, gathering data on job satisfaction as unknown observers may be the most effective method.

Lofland (ibid.) points out two primary advantages of unknown observer techniques:

- Richer materials are provided. As one of the group, the observer becomes friends with some members and therefore is quite likely to be entrusted with their intimate thoughts and feelings, a situation that is unlikely if the observer is known.

- It is possibly the only way to gather information. Certain settings may not be amenable to other data-gathering methods, so being an unknown observer may seem better than doing nothing (p. 94).

There are also three disadvantages of unknown observer techniques:

- Ethical questions arise. Objections have been raised about the morality of observing and analyzing people without telling them. However, some sociologists feel that "as long as reports conceal names, locations, and the like, thereby preventing the analysis from being used against the participants, there is no harm done" (ibid., p. 94).

- There may be limitations on observation. The observers play specified roles and so may be cut off from valuable channels of communication of information. Additionally, since much of the observers' time is spent performing a role, they are constrained from doing observational work, including jotting down notes.

- Biased viewpoint may result. It is possible that the observers may "selectively expose [themselves] to the data or selectively perceive them and, worst yet, shift over time the calibration of [their] observation measures" (Webb et al. 1966, p. 114). Further, it may be difficult for the observers to disengage or disentangle themselves from their emotional involvement.

The known observer. Formal or informal permission is often needed from gatekeepers to allow observers to visit the employees in their working environment for the purpose of collecting data. Both the employer and the employees (i.e., former co-op students) know that observers will be visiting them to collect information. There are both advantages and disadvantages to this method. Two advantages are as follows:

- There is greater freedom to collect information. Since the observers do not have an "extant role in the setting, there is a greater degree of freedom for [them] to move, observe, and ask questions" (Lofland 1971, p. 95). The observers can freely take notes and schedule time.

- There are fewer ethical problems. Since the subjects know that they are being observed, no deception is involved and few questions on ethics arise.

Four disadvantages of the known observer technique are as follows:

- Observation may be superficial or marginal. Unlike the case of unknown observers who become the members of the group under study, "it can become quite evident to the known observers that, although they are in the world, they are not truly a part of it" (ibid., p. 97).

- Observers may develop involvement bias. The observers who become personally involved with the problems of employers or employees are likely to be less objective and, like the unknown observers, suffer from a biased viewpoint effect. Writing an objective report and analysis becomes difficult.

- Observers may affect the environment. The known observers can produce changes in behavior among the observed groups, thus affecting the validity of the data recorded. As a strategy, Webb et al. (1966)suggest that the observer contaminant be permitted to wear off and that analysis of data start subsequent to the time when the effect is negligible.

- Problems of acceptance may arise. The observers may be viewed as intruders or, worse yet, as tools of management sent to spy on the employees. If this happens, it becomes difficult for observers to get honest reactions.

Strategies for successful observation. Successful observation requires a good observer, a person with the necessary personal and technical skills. Thorough planning and preparation are also important. The observer must match the general and specific requirements of the social settings where observation is to take place. Sometimes this is a difficult task because of the diversity of personalities among those being observed. Under no circumstances, however, may observers have personality styles that make it difficult for them to blend with the observed group.

In addition to certain personality requirements, a good observer needs certain special skills for successful observation. These include an ability to listen, to make notes (both mental and written, on and off the field), and to write reports (see table 8). Observers should know what to look for. Thus, evaluators hiring inexperienced observers need to pay particular attention to their training. There should be adequate practice before inexperienced observers are assigned to actual field work.

TABLE 8

SOME RULES OF THUMB IN PARTICIPANT OBSERVATION

Entering the Field	• In the initial stage of the fieldwork, it is not advisable to challenge the behavior or statements of subjects or to ask questions that are likely to put them on the defensive.
Establishing Rapport	• Observers should conduct themselves in such a way that events occurring during their observations do not significantly differ from those occurring in their absence. • Probably the easiest way for observers to gain rapport with their subjects is to establish what they have in common with them. • To participate in activities of the subjects is helpful.
Developing Relationships	• Researchers should refrain from developing close relationships with individual subjects while they do not have a good grasp of the nature of relationships in settings. • Where it is essential for them to establish rapport with a few selected subjects initially, they should be willing to withdraw from those relationships as circumstances demand.
Asking Questions	• Questions should be asked in such a way as to enable the subjects to talk about what is on their minds and what is of concern to them, without forcing them to respond to the observer's interests, concerns, or preconceptions.
Field Notes	• Field notes should be recorded after each and every observation period, as well as after more casual contacts with subjects outside the setting. • Observers should develop a level of concentration sufficient to enable them to commit to memory everything they see, hear, smell, and think.

SOURCE: Ideas in making this table were taken from Bogdan and Taylor (1975).

Figure 9 provides a checklist to assist evaluators of co-op programs to examine their strategies for successful observation.

Unobtrusive Measures

As defined earlier, unobtrusive measures are data collection procedures that do not require contact with the respondents. Those approaches avoid contamination of the evaluation by avoiding reactivity—the data-biasing reactions of subjects or observers at work together at the training station. However, "lack of reactivity in a method does not mean that the data generated are [automatically] valid" (Bouchard 1976, p. 399). The following sections discuss three classes of unobtrusive measures: physical trace, archives, and measures gathered by hardware.

Instructions: Take time to review your strategies for improving observation data gathered by answering the following questions.

Yes	No		
			Personality Considerations
☐	☐	1.	Is the observer reasonably able to get along with the subjects under study?
☐	☐	2.	Do the observers like the subjects, even though they may not agree with their views?
☐	☐	3.	Can the observers know how to become inconspicuous and inoffensive in the setting?
			Technical Skills
☐	☐	4.	Do the observers know how to take good mental notes?
☐	☐	5.	Do the observers know how to translate mental notes into written notes?
☐	☐	6.	Do the observers know the technique of taking good written notes?
		7.	Were the observers trained in the following mechanics of making full field notes:
☐	☐		• Writing promptly?
☐	☐		• Writing effectively?
☐	☐		• Dictating, handwriting, or typing reports?

Figure 9. Strategies for better observations at cooperative education training stations

Physical trace. Physical trace techniques are the examination of physical evidence that gives clues of students' training satisfaction and job satisfaction. As Bouchard (1976) warns, however, "they are, therefore, most prone to misinterpretation and should be used with caution" (p. 399). Acting like a detective, the evaluator tries to identify physical evidence that leads to conclusions. Possible evidence of students' satisfaction with their training includes—

- wear and tear on instructional books and equipment,
- the number of books checked out, and
- the amount of consumable instructional materials used.

Archives and records. Documents and records can be very useful as sources of data to determine students' satisfaction with their training and job. However, evaluators should exercise "prudence and caution because these materials can never be taken at face value" (ibid., p. 400). For example, a record of leave of absence may not indicate the reason that leave was taken; a variety of causes, such as health problems, are possible. Some examples of documents and records to investigate are as follows:

- **Satisfaction with Training**

  —Letters from former co-op students

  —Attendance records at alumni meetings and reunions

- **Job Satisfaction**

  —Daily time record

  —Leave of absence records

  —Requests for transfer or promotion

  —Pay levels

  —Turnover rate

  —Record of strikes and grievances

Summary

The use of participant observation and unobtrusive measures is relatively new in co-op program evaluation. Studies by Halasz and Behm (1983), Halasz, Behm, and Fisch (1984) and Franchak, Norton, and Desy (1985) have shown that using these methods in collecting data can result in valuable information for program improvement. However, there is currently a growing trend to combine both qualitative data and quantitative data to provide better assessment and understanding of programs.

Participant observation and unobtrusive measures techniques require evaluators to recognize possible sources of internal invalidity and to apply appropriate controls. In addition, evaluators must be able to recognize the limitations as well as the strengths of data gathered by qualitative means.

CHAPTER 9
DEVELOPING FEEDBACK MECHANISMS

Data on the evaluation of co-op programs in high-technology areas are extremely important if schools are to meet the needs of employers and their own technical students. However, minimal attention appears to be given to the interpretation and presentation of such data, which may prevent the data from being used. This section describes techniques for reporting and displaying evaluation data in order to increase their use for accountability, decision making, and program improvement at the State and local levels. (For a more in-depth treatment of this subject, see Franchak and Kean 1981.)

Data and Information Presentation

At the outset it is important to distinguish between evaluation data and information. Mercer and Koester (1978) offer such a distinction:

> Information comes from data, which are logical representations of measurements, observations, and computations. Logical is here defined as orderly, intelligible, objective, and capable of forming accurate relationships based on principles and rules of reason. (p. 85)

The authors add that not all data are information, that is, not all data are capable of being assigned a useful meaning.

As discussed earlier, the assessment of co-op graduates' training and job satisfaction is a complex undertaking. The process of data and information interpretation is equally difficult. This process consists of taking the information resulting from the data analysis and subjecting it to expert scrutiny. The result should be a clear explanation of the displayed information in terms that are comprehensible to decision makers and other information users.

The interpretation and presentation of data are best performed by professional staff, the evaluator, or a data analyst. Top educational administrators at the State and local levels must be confident that the evaluators know co-op programs, are credible and competent, are familiar with the problems facing the administrators, and have a deep concern for the target audiences.

Equally important is the need for the evaluators or data analysts to view these data as an integral element of a comprehensive management information system (MIS). The data, however, constitute only one element of information in an MIS. For example, a preliminary step in organizing the data in an MIS is deciding which program area (e.g., agriculture, technology, health) by function (e.g., personnel development, teacher inservice, curriculum development) serves the needs of a specific education agency at the State or local level.

Evaluators may present the data and information in a variety of forms, depending upon the user they wish to reach: (1) the general public; (2) education planners; (3) educational administrators; and (4) other target audiences such as the board of education, program advisory committees, and legislature. Each of these audiences has different needs. The general public does not usually require a detailed report. A one- to three-page report highlighting the evaluation results may be sufficient. Educational administrators and selected audiences may be interested only in a one-page executive summary and a list of conclusions and recommendations. Educational planners, by contract, may need a detailed technical report to enable them to recommend or develop specific strategies for program changes.

Reporting Recommendations

In reporting on the evaluation of a co-op program, evaluators commonly make the mistake of distributing the same report to all audiences. For a report to be effective, it must target not only the audiences, but also their information needs—accountability, decision making, or program improvement. Yet frequently, evaluators will distribute hundreds of copies of a final report with 50 or more pages. This practice is not only costly but also of questionable value.

The general public needs straightforward summary information and is likely to be confused by technical data and a glut of information. Administrators, on the other hand, simply do not have the time or technical expertise to review the entire contents of a report in order to recommend policy action or determine program decisions. As a result, the administrators may never even read the report. Only the educational planners, classroom/laboratory instructors, and counselor/placement personnel may need to have all the detailed information. Thus, a consideration in presentation strategies must be the length of the report.

In a study to determine appropriate reporting formats for educational decision makers, Brickell, Aslanian, and Spak (1974) state that

> top officials and management staff were more likely to ask for short reports; program and project specialists were more likely to request medium or long reports in their areas of specialization. (p. 99)

Further, they conclude that differentiated responsibilities require differing lengths of reports, despite the preference for brevity. The authors' 3 recommended lengths of reports for decision makers are short (1 page), medium (10 pages), and long (100 pages).

Alternative evaluation reports for other users must be weighted in terms of the targeted reading audience. At the State level, all three reports might be prepared. If the State evaluators assess the program outcomes for all co-op students or a sample of the total population, they should also prepare statistical reports for each of the local programs in the study. At the local level, a detailed report and the executive summary should be the minimal requirements.

Preparing the Content and Information Packaging

Generally, evaluations of vocational programs are prepared for one of three types of functions: (1) public information or public relations, (2) administrative decision making, and (3) program decision making. Each of these uses requires a different strategy for content development and style of packaging, as discussed in the following sections.

Public Information/Relations

This function is one of keeping the general public informed about the needs and achievements of the co-op program. The information must be packaged in as simple and efficient a way as possible. Visual displays, such as charts and graphs, are highly recommended. As Starr et al. (1979) state,

> whether graphic or tabular techniques are used, three factors underlie satisfactory display of quantitative data: simplicity, clarity, and effectiveness. The graphic and tabular forms of data display must be easily read and understood, and must be presented in a manner which will facilitate ease of comprehension and retention. These purposes require consideration of: (a) the nature of the data; (b) the purpose of the display; (c) the medium for presenting the data; and (d) the audiences to whom the data are presented. One or all of these factors may be pertinent to any situation where data are presented or displayed. (p. 61)

After the visual display is completed, it should be examined carefully with the following four questions in mind:

- Does it convey the intended message?
- Does it display the relationship clearly?
- Can it be displayed more effectively?
- Does it have visual appeal?

Although these are basic questions, evaluators and analysts seldom address them. They thus risk failing to communicate effectively with the public.

Administrative Decision Making

Many decision makers do not have time to do extensive reading and analysis. Therefore, it is a waste of time and effort to provide these individuals with extensive sets of unsynthesized data (for example, see table 9). Administrators are unlikely to analyze such complex data in order to solve their problems. Decision-making information that is provided to training sponsors and co-op coordinators should be synthesized and packaged in a practical form (see figure 10). Charts and tables of data should be clear and concise for immediate understanding. The responsibility for interpreting and packaging the information for administrators' use rests with the evaluator or data analyst.

Program Decision Making

For those concerned with the development and improvement of individual co-op program areas at the local and State levels, a detailed report and executive summary are minimal requirements. Depending on evaluation contract agreements, the raw data and processed information may also be prepared for individual schools and agencies.

Confidentiality must be maintained. At a minimum, schools should receive all information and data on their own programs as well as summary data for the local area and region as a whole.

Schools may be grouped according to such characteristics as size, demographics, or socioeconomic levels, but care should still be exercised in sharing the detailed data/information from individual schools with other schools. Keep in mind that Federal legislation protects the confidentiality of information and the privacy of individuals.

TABLE 9

SAMPLE TABLE OF JOB SATISFACTION CHARACTERISTICS BY DEGREE OF SATISFACTION WITH TECHNICAL PROGRAM

Characteristic	Count Row Pct Col Pct Tot Pct	Highly Satisfied	Satisfied	Dissatisfied	Highly Dissatisfied	Row Total
		1.00	2.00	3.00	4.00	
Salary	1.00	5	7	6	2	
		25.0	35.0	30.0	10.0	2.0
		15.6	12.5	28.6	18.0	16.7
		04.2	5.8	5.0	1.7	2.0
Fringe Benefits	2.00	5	8	4	3	
		25.0	40.0	20.0	15.0	2.0
		15.6	14.3	19.0	27.3	16.7
		4.2	6.7	3.3	2.5	
Supervision and Management	3.00	3	15	1	1	
		15.0	75.0	5.0	5.0	2.0
		9.4	26.8	4.8	9.1	16.7
		2.5	12.5	0.8	0.8	
Company Policies and Practices	4.00	4	11	3	2	
		20.0	55.0	15.0	10.0	2.0
		12.5	19.6	14.3	18.2	16.7
		3.3	9.2	2.5	1.7	
Working Conditions	5.00	7	8	4	1	
		0.35	40.0	20.0	5.0	2.0
		0.22	14.3	19.0	9.1	15.7
		0.06	6.7	3.3	0.8	
Potential for Advancement	6.00	8	7	3	2	
		0.40	35.0	15.0	10.0	2.0
		0.25	12.5	14.3	18.2	16.7
		0.25	5.8	2.5	1.7	
		0.07				
Column Total		32	56	21	11	12.0
		26.7	46.7	17.5	9.2	100.0

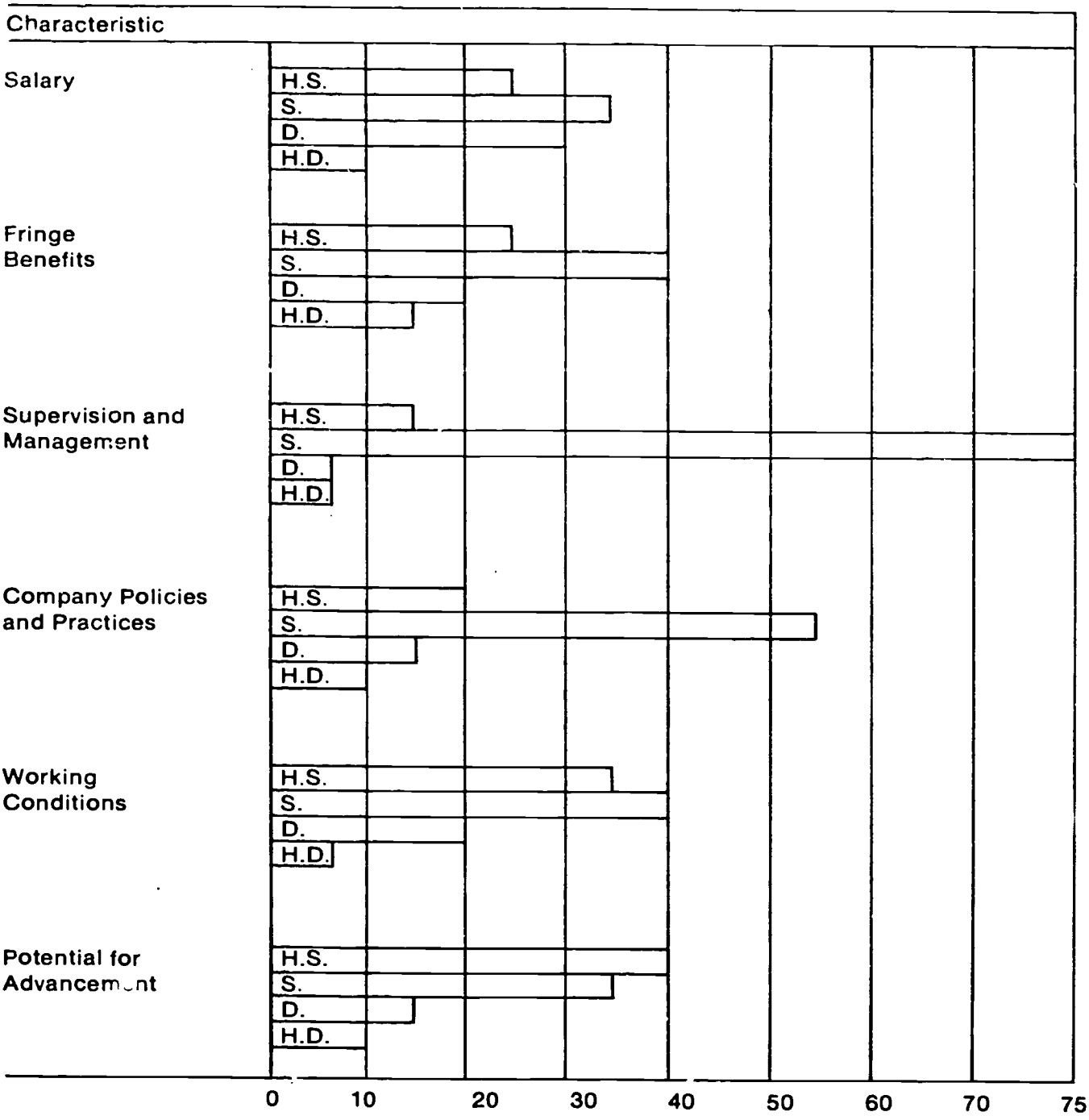

Figure 10. Example of decision-making information on degree of job satisfaction of former technical students by characteristic.

Summary

Interpretation and packaging of data and information on co-op student outcomes require strict attention to the needs and characteristics of the audiences for whom the information is intended. Figure 11 offers guidelines for organizing and formatting a report and for displaying graphs of data.

---

1. Include the survey instruments in all reports and presentations, if possible.

2. Set up local reports based upon local requirements, but also include information required by State and Federal mandates that relates to local programs receiving State and Federal support.

3. Break out and analyze data as much as possible, but not all information and analyses need be presented to everyone.

4. Make tabular summaries in the shortest possible form. Oral presentations are best with this type of information. Follow survey form design when making presentation: question 1, 2, 3, and so forth.

5. Prepare and present a copy of the report for each member of the audience during oral presentations, if practical. Be sure to present data in the form and content applicable to the particular audience.

6. Summarized reports are usually the best format for presentation to most groups; however, more definitive information is required in certain instances.

7. The comments section of a survey instrument is very important. This area many times reveals needs and shortcomings, especially if a particular comment is repeated several times.

8. Scan the comments section for the most frequently mentioned items, and make summaries for inclusion in reports and presentations. Refrain from using actual names (of teachers, administrators, and so forth) given in comments.

9. Do not attempt to include survey information from a student surveyed in the wrong curriculum area. For example, students are sometimes included in vocational surveys who may have taken only one vocational course and who are, in fact, pursuing college prep courses. Their inclusion in a vocational survey biases the information and increases reponse error.

10. Data tabulation and analysis methods must be appropriate, or nonuse of the data is assured.

11. Break out district data on a per-school or program-per-campus basis. Most administrators are interested in information about their institution and their graduates. Compare schools to county data, or program to program data; but avoid institution-to-institution comparisons.

12. Break out data by program, where applicable. This format is very meaningful for vocational reports and presentations. It gains teacher support for the activity.

SOURCE: Franchak and Spirer (1979, p. 127).

Figure 11. Factors to consider in preparing reports on former students' satisfaction with their training and job.

13. Compare and present data by courses and programs, not teachers. Many students react to questions about courses or programs by nature of their relationshp with a teacher, and this tendency biases the data.

14. Keep any sophisticated statistics in a separate section for those who wish to review them, but do not present statistics throughout the report. Rates of use will go down, especially in audiences with little or no background in research methodology.

15. Percentages, graphs, and charts are information display methods to which most populations best relate.

16. The main use of follow-up information, as it currently exists, is to disseminate general indications of the condition of an institution, district, or the like. Include an abstract of each report that summarizes these findings and gives a brief description of the information gathering/ analysis techniques.

17. Make sure reports appear neat, are printed on good quality paper, and are in readable form.

Figure 11. – continued

APPENDIX A

OBJECTIVES AND PROCEDURES OF THE STUDY

The study upon which this document was based had four primary objectives. They were as follows:

- To identify the perceived educational and economic benefits of postsecondary cooperative education programs in high-technology occupations
- To identify the elements for a model postsecondary cooperative education program in high-technology occupations
- To develop procedures that State and local educators should use to implement an exemplary postsecondary co-op program of this type
- To disseminate the information described in the previous objectives to practitioners in the field

Procedures

In conducting this study of cooperative education programs in high-technology areas, the staff used five general categories of high technology defined by Abram et al. (1983b):

- Advanced manufacturing technologies (including robots)
- Business office technologies (including word processors)
- Microelectronics technologies
- Computer applications technologies
- Health and biological technologies (p. 2)

The current study was designed to identify—

- perceived educational and economic benefits,
- elements of model programs, and
- procedures for implementing successful programs.

Examples of potential educational benefit from the use of co-op programs include increases in employability skills, job-specific skills, and decision-making skills and a reduction in dropouts. Similarly, potential economic benefits include increased earnings and reduction of youth unemployment.

In determining the elements of model cooperative education programs, the staff built upon the principles of cooperative education programs identified by Heinemann et al. (1982); Franchak, Norton, and Desy (1985); and others. These principles include the following:

- Work experiences should be productive.
- Work should relate to students' fields of study and career interests.
- Amount of time spent on work experience should be productive for student and employer.
- Standards of performance and assessment should be specified.
- Various levels of work experience should be included.
- Work experience should be related to student ability.
- Written training agreements should be used.

Design

The overall approach for conducting this study is presented in figure 12. This figure identifies the major components and activities comprising this effort, including the following:

- Analysis and synthesis of previous studies
- Case studies
- Integration of data and information
- Identification of economic and educational benefits
- Identification of key elements of cooperative education high-technology programs
- Development of procedures for implementation of successful postsecondary cooperative education programs in high technology

This approach provided the basis for synthesis and integration of the information. The analysis and interpretation determined areas of agreement and disagreement, identified areas in the information base requiring additional study, and provided a primary base of information for developing procedures for State and local education agencies to use in implementing exemplary cooperative programs. Table 10 presents the types of information that were collected in the initial phases of the study.

The analysis and synthesis of previous reports and documents began with a review of relevant literature gathered from the Educational Resources Information Center (ERIC) system, DIALOG, the research library of the National Center for Research in Vocational Education, The Ohio State

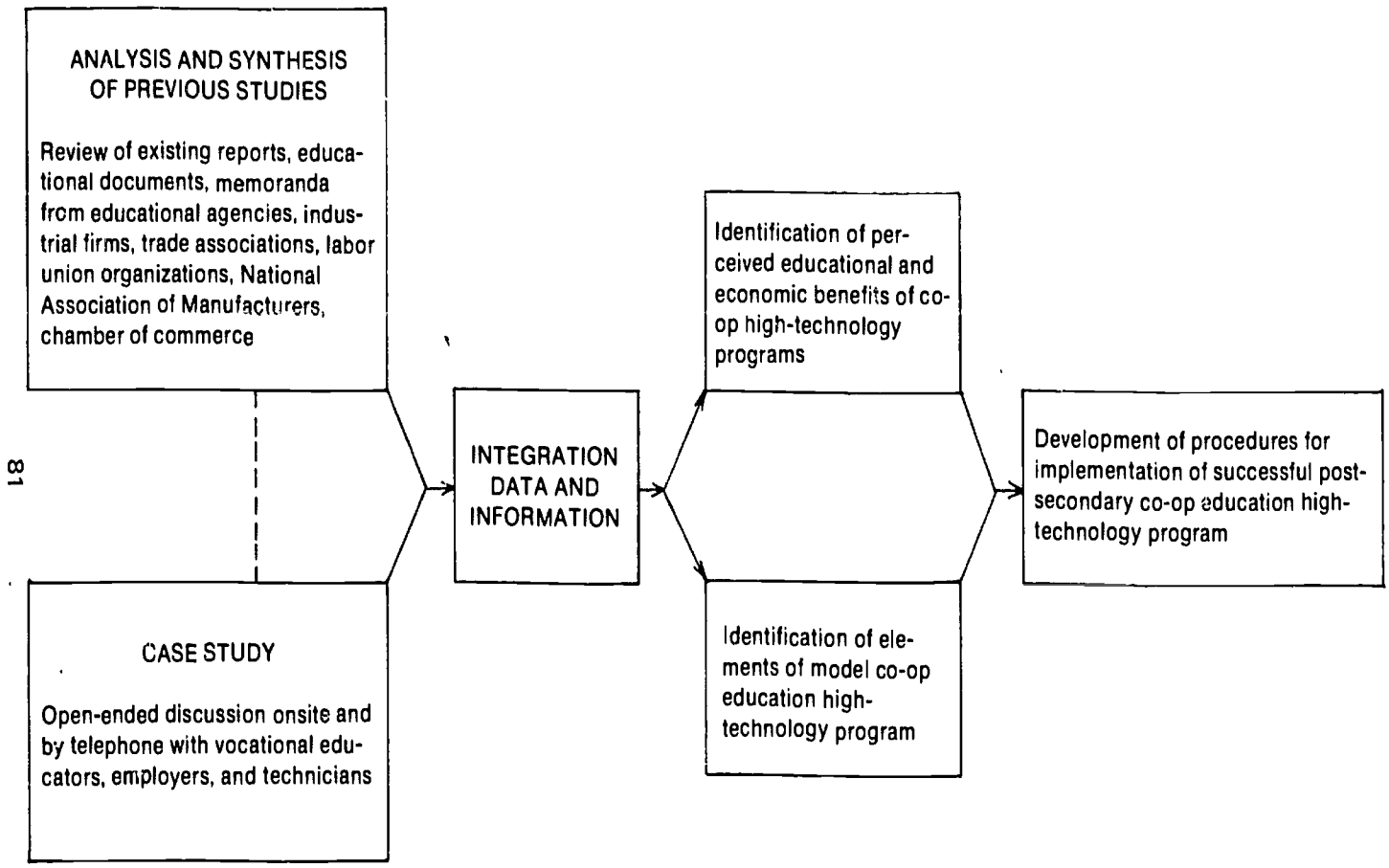

Figure 12. Task components and activities

University main library system, and selected National, State, and local agencies involved in postsecondary high-technology programs. Questions such as the following guided the analysis and synthesis:

- What relationships exist between high-technology development and postsecondary planning and programs?
- What occupational training for high-technology jobs is appropriate for postsecondary education programs?
- What level of involvement between postsecondary education and private industry is needed to foster co-op programs?
- What elements are necessary to develop successful co-op programs in high-technology areas?
- What educational and economic benefits accrue to the students participating in high-technology co-op programs?
- What are the major barriers and the most successful strategies and procedures for delivering successful co-op high-technology programs?

Using these questions, the task staff conducted a content analysis of such publications as *Preparing for High Technology: Strategies for Change* (Faddis, Ashley, and Abram 1982), *ERIC Update on Vocational Education for High Technology* (National Center for Research in Vocational Education 1983), *High Technology in the Community College: Conference Proceedings* (League for Innovation 1982), *Preparing for High Technology: A Guide for Community Colleges* (Long and Warmbrod 1982), *Preparing for High Technology: CAD/CAM Programs* (Abram et al. 1983a), and *Retraining and Upgrading Workers: A Guide for Postsecondary Educators* (Warmbrod and Faddis 1983).

In conducting the study, the staff held face-to-face and telephone discussions with directors of State research coordinating units and with members of the National Postsecondary Alliance. Other sources included trade associations, the National Alliance of Business, the National Association of Manufacturers, chambers of commerce, and the AFL-CIO. Additional information was collected at the eighth annual National Dissemination and Utilization Conference, the annual conference of the American Association of Community and Junior Colleges, the American Vocational Association annual convention, and other State and local vocational conferences.

Information on co-op programs was gathered during on-site visits to eight case-study community colleges. Other information was obtained through a review of literature and through telephone discussions with experts on cooperative education in high-technology program areas. Observations, interviews, and other data-gathering procedures (e.g., attendance at conferences, nominal group technique sessions) provided additional details. All of the information was subjected to a content analysis and formulated into guidelines for successful programs.

TABLE 10

INFORMATION RESOURCES

Types of Information	Analysis and Synthesis of Previous Studies	Case Studies
BENEFITS		
Educational		
• Occupational knowledge	X	X
• Career planning and choice	X	X
• Basic skills	X	X
• Decision-making skills	X	X
• Employability skills	X	X
• Dropout reduction	X	X
Economic		
• Earnings	X	X
• Income transfer	X	X
• Reduction of youth unemployment	X	X
• Reduction in underemployment	X	X
ELEMENTS		
• Training agreements	X	X
• Advisory groups	X	X
• Evaluation	X	X
• Related classroom discussion	X	X

Selection of Case Sites

The case sites selected for co-op programs in hightechnology areas were nominated as a result of—

- letters sent to 50 postsecondary State vocational education directors;
- letters sent to 42 community college members of the National Postsecondary Alliance;
- contacts by telephone and mail with officials of associations related to industry and education (including the National Alliance of Business, chambers of commerce, AFL-CIO, the Cooperative Work Experience Education Association, and the Cooperative Education Association);
- previous National Center studies relating to postsecondary industry education efforts and high-technology occupational education; and

- discussions with National Center staff and State and local persons involved in cooperative education and high-technology occupational education.

Criteria used in the selection process included these:

- Programs that appear on four or more lists of recommendations
- Programs that offer unique characteristics in program development such as industry-school linkage, attention to special populations, history of growth or succes, or National awards of excellence
- Programs that represent diverse State and economic constituencies

The mail request for nominations of cooperative education programs resulted in 21 nominations (41 percent response rate) from State officials for cooperative vocational education and 15 (30 percent response rate) from members of the National Postsecondary Alliance.

Figure 13 lists the case-study sites that were selected. Information on the sites' high-technology co-op programs appears in appendix B.

In-depth, open-ended discussions were conducted with representatives having designated roles in the selected postsecondary institutions and industries providing co-op training stations and in State and local organizations. These roles include the following:

- Chief executive or director of training or personnel at an industrial firm
- Commissioner or representative of a State postsecondary vocational education agency
- President or representative of a local chamber of commerce, trade association, or AFL-CIO local
- President or dean of occupational education
- Training instructor
- Employee-student or graduate of a co-op program

Topics that guided the open-ended discussions included (but were not limited to) the following: (1) a definition of educational institution or program context, economic environment, postsecondary school structure, and structure of State economic development; (2) institutional mission, internal organization, and funding pattern; and (3) program characteristics such as training agreements, facilities, evaluation, budget, selection and upgrading of instructors, and program training agreements with the private sector. These discussions provided a comprehensive base of information for identifying critical elements that make the programs educationally and economically beneficial. Additionally, specific procedures were identified for development, implementation, and dissemination of successful co-op programs in high-technology areas.

Case-study procedures were developed and a pilot study was conducted in the Columbus, Ohio, area. As a result of the pilot study, revisions were made in the procedures. Project staff conducted 8 site visits using these procedures and interviewed 141 persons, including school administrators, co-op instructors, counselors, former and current students, employers, and representatives

Albuquerque Technical-Vocational Institute
525 Buena Vista, S.E.
Albuquerque, NM 87106

Cincinnati Technical College
3520 Central Parkway
Cincinnati, OH 45223

Guilford Technical Community College
P.O. Box 309
Jamestown, NC 27282

Holyoke Community College
303 Homestead Avenue
Holyoke, MA 01040

Lane Community College
4000 East 30th Avenue
Eugene, OR 97405

Okaloosa-Walton Junior College
100 College Boulevard
Niceville, FL 32578

Orangeburg-Calhoun Technical College
3520 St. Matthews Road, NE
Orangeburg, SC 29115

Utah Technical College
4600 South Redwood Road
P.O. Box 31808
Salt Lake City, UT 84131

Figure 13. Case study sites

of community associations such as chambers of commerce. Table 11 shows the number of persons interviewed at each case-study site.

Data Analysis

The data analysis plan integrated data and information from the analysis and synthesis of previous studies with the case studies of the eight exemplary co-op programs. Content analysis (Krippendorff 1980) procedures were used in this process.

In designing the coding system for information analysis, staff used the guide questions presented earlier. Respondents or interviewees were categorized as practitioners, decision makers, or policymakers. The strategies and procedures that the casestudy sites used to implement successful co-op programs were also defined.

Staff selected the most promising procedures based on such criteria as utility, practicality, and cost-effectiveness. Then, using a nominal group technique session, staff and other selected individuals at the National Center developed procedures for implementation. These procedures were reviewed by four persons representing industry and vocational education in high-technology occupational areas. On the basis of this review, the procedures were revised and included in the final publication.

Once prepared, the initial draft of the final publication was reviewed by the National Center's Evaluation Division staff according to such criteria as conceptual clarity, identification of errors of omission, readability, usability, and scholarship.

As a result of the internal review, the draft was revised and prepared for additional reviews by individuals external to the National Center. These reviewers evaluated the document's readability, usability, adequacy of information, relevancy, and format. The reactions received from the reviewers guided the revision of this publication.

TABLE 11

NUMBER OF PERSONS INTERVIEWED AT EACH CASE SITE

	Administrators	Faculty and Coordinators	Professional Support	Former Students	Current Students	Employers	Others	TOTAL
Holyoke Community College Holyoke, MA	4	6	1	1	5	3		20
Cincinnati Technical College Cincinnati, OH	3	12	1	1	4	2		23
Albuquerque Technical-Vocational Institute Albuquerque, NM	4	2		2	2	2	2	14
Lane Community College Eugene, OR	3	5		2	3	3	1	14
Utah Technical College Salt Lake City, UT	3	6	1	6	6	4	2	28
Okaloosa-Walton Junior College Niceville, FL	4	3		1	2	2		12
Orangeburg-Calhoun Technical College Orangeburg, SC	2	4			4	3		13
Guilford Technical Community College Jamestown, NC	4	2	1	1	5	1		14
TOTAL	27	40	4	14	31	20	5	141

APPENDIX B

CASE-STUDY SITES' TECHNOLOGY PROGRAMS

Albuquerque Technical-Vocational Institute

Architectural Drafting Technology; Civil and Surveying Technology; Data Processing Technology; Electromechanical Drafting; Electronics Technology Instrumentation and Control Technology; Laser Electro-optic Technology

Cincinnati Technical College

Aviation Technology; Biomedical Engineering Technology; Civil Engineering Technology—Construction and Surveying; Computer-Integrated Manufacturing Engineering Technology; Electromechanical Engineering Technology—Process and Machine Control; Electronics Engineering Technology; Heating, Ventilation, and Air-Conditioning (HVAC) Technology; Mechanical Engineering Technology; Industrial Laboratory Technology—Industrial Laboratory; Industrial Laboratory Technology—Microsystems Programming

Guilford Technical Community College

Architectural Technology; Automotive Technology; Aviation Maintenance Technology; Civil Engineering Technology; Electronic Engineering Technology; Industrial Management Technology; Industrial Maintenance Technology; Mechanical Drafting and Design Technology

Holyoke Community College

Chemical Technology; Computer Electronic Technology; Computer Technology/Computer Information Systems; Electromechanical Technology

Lane Community College

Appliance-Refrigeration Technician; Automotive Technology; Aviation Maintenance Technician; Computer Programming and Operations; Construction Technology; Electronics Technician; Electronics Engineering Technician Program; Machine Technology; Technical Drafting; Welding Technology

Okaloosa-Walton Junior College

Air Conditioning, Refrigeration, and Heating Technology; Drafting and Design Technology; Electronics; Welding; Mechanics; Data Processing Technology

Orangeburg-Calhoun Technical College

Computer Data Processing; Electronic Instrumentation Technology; Engineering Graphics Technology; Mechanical Engineering Technology

Utah Technical College

Architectural Technology; Computer Science; Data Processing Electronics Technology; Engineering Technology; Semiconductor Technology

APPENDIX C

TECHNICAL SCHOLARS PROGRAMS
GUILFORD TECHNICAL COMMUNITY COLLEGE

GTCC

TECHNICAL SCHOLARS

GUILFORD TECHNICAL COMMUNITY COLLEGE

AN AFFIRMATIVE ACTION / EQUAL OPPORTUNITY INSTITUTION

TECHNICAL SCHOLARS PROGRAM

Recent advances in business and industry have created the need for individuals who possess a high level skill, technical education, and experience to meet the demands of today's technical sophistication. Projections indicate the need for these skilled individuals in the Piedmont area will expand as business and industry continue to grow.

Guilford Technical Community College and local business and industry leaders, recognizing this need, have developed the Technical Scholars program. Technical Scholars is designed to provide technical education and training demanded by recent advancements in specialized fields. The program is a three year plan offering selected students the opportunity to obtain classroom theory and practical experience with hands-on application. The result is on-the-job training and experience for high school graduates who otherwise would have difficulty locating employment in a technical field.

Initially, Technical Scholars will be selected from qualified applicants in the fields of Electronics Engineering Technology, Industrial Management Technology, or Mechanical Drafting and Design Technology. Other fields of study will be incorporated as the program is expanded in the future.

Each scholarship for the three year term is worth approximately $16,000.

TECHNICAL SCHOLARS POLICY

Sponsor Commitments: Participating companies agree to pay tuition, books, and fees at Guilford Technical Community College for each Scholar they sponsor in the Technical Scholars program. Each company has the option to consider tuition and supply compensation in a lump sum or to include it as part of the hourly rate.

Participating companies have agreed to provide 20 hours of work each week at an established rate of pay for this work.

1st year. . . . . $5.50 per hour
2nd year . . . . . $6.00 per hour
3rd year . . . . . To be determined at an annual review by the Companies

Compensation will be reviewed on an annual basis. During the final quarter of the third year, participating companies will review the students' progress and make a decision on extending an offer for full-time employment. Although it is hoped that a permanent employment relationship will develop, neither the participating company nor the individual Technical Scholar is obligated to continue the employment relationship upon completion of the program. The student agrees not to seek employment from other participating companies during the term of the scholarship.

Participating companies will offer the same fringe benefits to Technical Scholars as to other part-time employees.

Postage Will Be Paid By Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY MAIL
First Class Permit No. 2, Jamestown, N. C.

POSTAGE WILL BE PAID BY:

TECHNICAL SCHOLARS
GUILFORD TECHNICAL COMMUNITY COLLEGE
P. O. BOX 309
JAMESTOWN, N. C. 27282

BEST COPY AVAILABLE

ADVANTAGES TO COMPANIES SPONSORING TECHNICAL SCHOLARS

- An opportunity to interview and select technical scholars of the company's choice.
- A greater opportunity to hire and train women and minorities in heretofore non-traditional job opportunities.
- Immediate availability of employees. The company does not have to wait for the student to graduate before he/she becomes profitable to that company.
- A 90% probability of keeping the technical scholar as a company employee for years to come.
- A committed and loyal employee who owes his/her education and training to the sponsoring company.
- An employee who understands the theory of modern technology and has the capability of translating theory to practical application.
- An employee who understands the inner workings of the company and is less likely to be a "job hopper".
- Participation in a community effort to train local people for local jobs.
- Contact with other participating companies.
- Feedback and access to the instructors at Guilford Technical Community College plus participation on the Technical Scholars Advisory Board which monitors the program.

COMPANIES MAY SELECT SCHOLARS FROM THE FOLLOWING THREE PROGRAM OPTIONS:

ELECTRONICS ENGINEERING TECHNOLOGY
INDUSTRIAL MANAGEMENT TECHNOLOGY
MECHANICAL DRAFTING AND DESIGN TECHNOLOGY

(Upon sufficient requests, additional technical areas and business careers may be added.)

LOCAL SCHOLARSHIP SPONSORING COMPANIES ARE:

Allan-Bradley Company
Gilbarco, Incorporated
J. A. King Company
Newman Machinery Company
Mac Panel Company
Richardson-Vick, Incorporated
Roltech Industries, Incorporated
Volvo-White, Incorporated

Would you like further information on how the Technical Scholars Program can work for your company? You may contact the Technical Scholars Coordinator at Guilford Technical Community College, 292-1101 or 454-1126 or complete, detach, and mail the self-addressed, postage paid card below.

Expressing An Interest Is the First Step

Don't Delay-

Yes, I am interested. Please provide me additional information on THE TECHNICAL SCHOLARSHIP PROGRAM

Name _____

Mailing Address _____ Phone _____

City, State _____ Zip _____

Company _____

GUILFORD TECHNICAL COMMUNITY COLLEGE
An Affirmative Action/Equal Opportunity Institution

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APPENDIX D

COOPERATIVE EDUCATION PROGRAM EVALUATION: UTAH TECHNICAL COLLEGE AT SALT LAKE AND HOLYOKE COMMUNITY COLLEGE

UTAH TECHNICAL COLLEGE AT SALT LAKE
COOPERATIVE EDUCATION PROGRAM EVALUATION
BY PROFESSIONAL STAFF

Dear Colleague:

Please help us find out how we are doing--whether the co-op program is living up to your expectations and its potential. You can make a significant contribution to our total evaluation by completing this form. When finished, please return the form to TB 204 in the envelope provided. Many thanks for your help!

Please circle one of the four responses to the right of each statement. SA means "strongly agree," A means "agree," D means "disagree," and SD means "strongly disagree."

The first seven statements are designed to assess your philosophical attitude toward cooperative education.

1. The educational process at Utah Tech in improved when working students can integrate theory from the classroom with practice on the job. SA A D SD

2. The co-op program at Utah Tech is responsive to community and employee needs by providing better trained, more motivated employees. SA A D SD

3. Co-op allows the college to utilize the best of all possible laboratories--the resources and facilities of the business and industrial community--at no expense to the taxpayers. SA A D SD

4. Co-op students bring their fresh ideas and experiences from the work site to the classroom, which is enriching to the educational process and beneficial to teaching faculty and other students not involved in co-op. SA A D SD

5. Co-op significantly enhances the career planning and placement activities on campus because students who have participated in co-op are more employable, have usually made firm career choices, and are more stable permanent employees after graduation. SA A D SD

6. The co-op process establishes positive relationships between the college and the business community and fosters long-range public support of college programs. SA A D SD

7. The cooperative education program at Utah Tech makes a significant contribution to the instructional programs of the college. SA A D SD

8.	Cooperative education is well understood at Utah Technical College.	SA A D SD
9.	Utah Tech students who have participated in co-op seem well satisfied with their experiences.	SA A D SD
10.	My impression of the co-op program at Utah Tech is positive.	SA A D SD
11.	Those faculty members who are working as instructor-coordinators command the respect of their peers.	SA A D SD
12.	The co-op professional staff responds efficiently to inquiries.	SA A D SD
13.	The co-op office in TB 204 handles student referrals efficiently.	SA A D SD

Comments:

UTAH TECHNICAL COLLEGE AT SALT LAKE
COOPERATIVE EDUCATION PROGRAM EVALUATION
BY FACULTY

Dear Colleague:

Please help us find out how we are doing--whether the co-op program is living up to your expectations and its potential. You can make a significant contribution to our total evaluation by completing this form. When finished, please return the form to TB 204 in the envelope provided. Many thanks for your help!

Please circle one of the four responses to the right of each statement. SA means "strongly agree," A means "agree," D means "disagree," and SD means "strongly disagree."

The first seven statements are designed to assess your philosophical attitude toward cooperative education.

1. The educational process at Utah Tech in improved when working students can integrate theory from the classroom with practice on the job. SA A D SD

2. The co-op program at Utah Tech is responsive to community and employee needs by providing better trained, more motivated employees. SA A D SD

3. Co-op allows the college to utilize the best of all possible laboratories--the resources and facilities of the business and industrial community--at no expense to the taxpayers. SA A D SD

4. Co-op students bring their fresh ideas and experiences from the work site to the classroom, which is enriching to the educational process and beneficial to teaching faculty and other students not involved in co-op. SA A D SD

5. Co-op significantly enhances the career planning and placement activities on campus because students who have participated in co-op are more employable, have usually made firm career choices, and are more stable permanent employees after graduation. SA A D SD

6. The co-op process establishes positive relationships between the college and the business community and fosters long-range public support of college programs. SA A D SD

7. The cooperative education program at Utah Tech makes a significant contribution to the instructional programs of the college. SA A D SD

8. Cooperative educati[illegible] technical [illegible]. SA A D SD

9. I would be willing to serve as a co-op instructor-coordinator as part of my regular teaching load. SA A D SD

10. Utah Tech students who have participated in co-op seem well satisfied with their experiences. SA A D SD

11. My impression of the co-op program at Utah Tech is positive. SA A D SD

12. Those faculty members who are working as instructor-coordinators command the respect of their peers. SA A D SD

13. I would be willing to serve as a co-op instructor-coordinator over and above my regular teaching load if overtime pay is involved. SA A D SD

14. The co-op professional staff responds efficiently to inquiries. SA A D SD

15. The [illegible]e in 204 handles student referrals [illegible]ly. SA A D SD

16. I would be willing to serve as a co-op instructor-coordinator as part of my regular teaching load, provided this service was recognized as professional development credit by the college. SA A D SD

Comments:

UTAH TECHNICAL COLLEGE AT SALT LAKE
CO-OP PROGRAM EVALUATION BY ADVISORY COMMITTEE

Dear Advisory Committee Member:

We need to periodically evaluate how we are doing--to find out whether the co-op program policies, procedures, and personnel are meeting the needs of students and employers, and if we are continuing to provide a legitimate part of the instructional programs at Utah Tech. You can be of great help to us by completing this evaluation form. When finished, please mail in the enclosed postpaid envelope. Many thanks for your help!

Please circle one of the four responses to the right of each statement. SA means "strongly agree," A means "agree," D means "disagree," and SD means "strongly disagree."

1.	The written "Philosophy of Cooperative Education" is appropriate for Utah Technical College at Salt Lake.	SA A D SD
2.	The co-op program document entitled "Policies and Procedures" is appropriate for the college.	SA A D SD
3.	The handbook for co-op students is adequate for the purpose intended.	SA A D SD
4.	The handbook for employer supervisors is adequate for the purpose intended.	SA A D SD
5.	The three-part Cooperative Education Agreement form is well-designed.	SA A D SD
6.	Other written materials used in the administration of the Utah Tech co-op program are adequate.	SA A D SD
7.	The co-op staff are competent.	SA A D SD
8.	The co-op program at Utah Tech is valuable to employers in the Salt Lake Valley.	SA A D SD
9.	Cooperative education experiences contribute significantly to the total education of participating Utah Tech students.	SA A D SD
10.	The cooperative education program at Utah Tech demonstrates the college's commitment to Salt Lake Community needs.	SA A D SD

Comments (use back side if necessary):

UTAH TECHNICAL COLLEGE AT SALT LAKE
COOPERATIVE EDUCATION SUPERVISORY FOLLOW-UP SURVEY

Dear Supervisor:

Your employee (our student majoring in _____ has just finished a quarter of participation in the Utah Tech cooperative education program. You have already evaluated the student-employee's performance for the quarter; now we ask that you evaluate our program and professional personnel by completing this form. When finished, please mail it in the enclosed postpaid envelope. Many thanks for your help!

Please circle one of the four responses to the right of each statement. SA means "strongly agree," A means "agree," D means "disagree," and SD means "strongly disagree."

1.	The cooperative education course motivated my employee to learn new job skills.	SA A D SD
2.	I feel that the co-op experience helped to prepare my employee for a higher-level position.	SA A D SD
3.	As a result of the co-op course, communications between me and my employee have improved.	SA A D SD
4.	I have gained additional confidence in my employee's professional capabilities as a result of the co-op experience.	SA A D SD
5.	The process of setting up learning objectives as the basis for evaluation and grading of the co-op course is appropriate.	SA A D SD
6.	The credit hours earned by the student-employee for completion of the co-op course were about right for the amount of work required.	SA A D SD
7.	I approve of the college's policy that allows co-op credit to be applied toward degree/certificate requirements.	SA A D SD
8.	The explanation of Utah Tech's co-op program that I received early in the quarter was adequate.	SA A D SD
9.	The number of meetings with the college instructor-coordinator during the quarter was about right.	SA A D SD
10.	The co-op handbook for supervisors is adequate.	SA A D SD
11.	The three-part co-op agreement form is adequate.	SA A D SD
12.	The college instructor-coordinator was competent in working with my employee and me on the achievement of the learning objectives.	SA A D SD
13.	The grading system for the co-op course (25 percent student self-evaluation, 50 percent supervisor evaluation, and 25 percent instructor-coordinator's evaluation) is fair.	SA A D SD

14. The co-op course was at least as valuable to my employee, overall, as any other course he/she has taken at Utah Tech. SA A D SD

15. I would encourage other employees in my group to enroll in cooperative education courses at Utah Tech. SA A D SD

Comments:

UTAH TECHNICAL COLLEGE AT SALT LAKE
CO-OP PROGRAM EVALUATION BY FORMER STUDENT

Dear Student:

Our records show that you have been enrolled in one or more cooperative education courses at Utah Tech within the past 5 years. We are in the process of evaluating our co-op program policies, procedures, personnel, written materials, etc.--every aspect of program operation--and you can be of great help to us by completing this evaluation form. When finished, please mail it in the enclosed postpaid envelope. Many thanks for your help!

Please fill in the blank with the name of your academic program (e.g., Accounting) when you were a student at Utah Tech; then circle one of the four responses to the right of each statement. SA means "strongly agree," A means "agree," D means "disagree," and SD means "strongly disagree."

1.	The cooperative education program motivated me to learn new skills related to my profession.	SA A D SD
2.	I gained additional confidence in my professional capabilities as a result of the co-op experience.	SA A D SD
3.	I feel that the co-op course helped to prepare me for a higher-level position.	SA A D SD
4.	As a result of the co-op experience, communications between me and my supervisor were improved.	SA A D SD
5.	The process of setting up learning objectives as the basis for evaluation and grading of the co-op course is appropriate.	SA A D SD
6.	The credit hours I received for the co-op course were about right for the amount of work required.	SA A D SD
7.	I approve of the policies on how co-op credit hours were applied toward the certificate/degree in my academic program at Utah Tech.	SA A D SD
8.	The number of meetings with my co-op instructor-coordinator throughout the quarter was about right.	SA A D SD
9.	The co-op handbook for students is adequate.	SA A D SD
10.	The three-part co-op agreement form is adequate.	SA A D SD
11.	My instructor-coordinator was competent in helping me to achieve my learning objectives.	SA A D SD
12.	My supervisor on the job provided help in achieving my learning objectives.	SA A D SD
13.	The grading procedure (25 percent student self-evaluation, 50 percent supervisor evaluation, and 25 percent instructor-coordinator evaluation) is fair.	SA A D SD
14.	The central co-op office personnel were helpful throughout the process.	SA A D SD

15. The co-op course was at least as valuable, overall, as any other course I have taken at Utah Tech. SA A D SD

16. If I had the opportunity, and the credit would apply toward a degree/certificate, I would enroll in cooperative education again. SA A D SD

Comments:

UTAH TECHNICAL COLLEGE AT SALT LAKE
COOPERATIVE EDUCATION STUDENT FOLLOW-UP EVALUATION

Dear Student:

Having just finished a quarter of participation in the co-op program, you can be of great help to us by completing this evaluation form. Many thanks for your help!

Please fill in the blank with the name of your academic program (e.g., Accounting) when you were a student at Utah Tech; then circle one of the four responses to the right of each statement. SA means "strongly agree," A means "agree," D means "disagree," and SD means "strongly disagree."

1.	The cooperative education program motivated me to learn new skills related to job.	SA A D SD
2.	I have gained additional confidence in my professional capabilities as a result of the co-op experience.	SA A D SD
3.	I feel that the co-op course has helped to prepare me for a higher-level position.	SA A D SD
4.	As a result of the co-op experience, communications between me and my supervisor have improved.	SA A D SD
5.	The process of setting up learning objectives as the basis for evaluation and grading of the co-op course is appropriate.	SA A D SD
6.	The credit hours I received for the co-op course were about right for the amount of work required.	SA A D SD
7.	I approve of the policies on how co-op credit hours can be applied toward the certificate/degree in my academic program at Utah Tech.	SA A D SD
8.	The number of meetings with my co-op instructor-coordinator throughout the quarter was about right.	SA A D SD
9.	The co-op handbook for students is adequate.	SA A D SD
10.	The three-part co-op agreement form is adequate.	SA A D SD
11.	My instructor-coordinator was competent in helping me to achieve my learning objectives.	SA A D SD
12.	My supervisor on the job provided help in achieving my learning objectives.	SA A D SD
13.	The grading procedure (25 percent student self-evaluation, 50 percent supervisor evaluation, and 25 percent instructor-coordinator evaluation) is fair.	SA A D SD
14.	The central co-op office personnel were helpful throughout the process.	SA A D SD
15.	The co-op course was at least as valuable, overall, as any other course I have taken at Utah Tech.	SA A D SD

16. If I had the opportunity, and the credit would apply toward a degree/certificate, I would enroll in cooperative education again. SA A D SD

Comments:

HOLYOKE COMMUNITY COLLEGE
COOPERATIVE EDUCATION SURVEY

PLEASE CIRCLE THE NUMBER WHICH CORRESPONDS TO YOUR RESPONSE.

1. Sex

   1. male
   2. female

2. Age

   1. under 18
   2. 18 to 20 years
   3. 21 to 25 years
   4. 26 to 30 years
   5. 31 to 40 years
   6. over 40 years

3. Was your Cooperative Education placement related to your curriculum at HCC?

   1. directly related
   2. somewhat related
   3. unrelated

4. Did you qualify for work study at HCC?

   1. yes
   2. no
   3. never investigated work study

5. Overall, how would you evaluate your Cooperative Education experience?

   1. excellent
   2. good
   3. fair
   4. poor

6. Circle the statement that best describes your reason for enrolling in Cooperative Education.

   1. financial reasons, needed a job
   2. wanted work experience in my field
   3. no other electives open
   4. gave me a better course schedule
   5. wanted to test my career decision
   6. seemed like an easy way to earn 3 credits
   7. had no choice about enrolling--Cooperative Education is required in my curriculum
   8. other_____

7. Who located this Cooperative Education placement?

   1. Cooperative Education staff or faculty coordinator
   2. already working for this company when I enrolled in Cooperative Education
   3. found the job on my own without help from the Cooperative Education Program

8. When you complete your education do you plan to seek employment in the same career field as your Cooperative Education placement

   1. yes, same career field
   2. in a related career field
   3. in a different career field
   4. undecided

9. Circle the appropriate answer.

   1. I am in Co-op I, and plan to enroll in Co-op II.
   2. I am in Co-op I, and do not plan to enroll in Co-op II.
   3. I am already in Co-op II.

10. If you plan to enroll next semester, which of the following Cooperative Education II courses will you take?

    1. BUS271
    2. DPR272
    3. SSM281
    4. FRM212
    5. SSC202
    6. RMG212
    7. NTM281
    8. NST281
    9. RFM281

11. If you are not enrolling in Cooperative Education next semester, circle the reason below.

    1. already completed two semesters of Cooperative Education
    2. could not fit Cooperative Education in my schedule
    3. will complete graduation requirements this semester
    4. do not plan to enroll at HCC in the next semester
    5. plan to skip a semester then enroll in Cooperative Education II
    6. did not like Cooperative Education
    7. see no further benefits in another semester of Cooperative Education
    8. other: _____

12. Do you plan to work for this company after you complete your studies at HCC

    1. yes
    2. would consider it
    3. no

13. If you answered "no" to question 12, circle the statement that best describes why you are not interested in working for your Cooperative Education employer after you finish your studies at HCC.

    1. plan to transfer
    2. no opportunity for advancement
    3. expect to move out of area
    4. poor pay structure
    5. personality conflicts
    6. decided to change my career field
    7. other _____

(Revised 4/84)

APPENDIX E

ASSOCIATION RESOURCE LIST

In conducting this study, project staff contacted or became aware of a number of associations and organizations involved in research, promotion, or information dissemination related to co—op education and/or high-technology education and training. The following list is included here to illustrate the kinds of resources available for additional information. The list is not all inclusive; however, it provides a number of valuable information sources for designing, operating, and evaluating successful co-op programs in high-technology areas.

Information Centers and Systems

Congressional Information Service, Inc.
4520 East-West Highway
Washington, DC 20014

National Association for Industry-Education Cooperation
235 Hendricks Boulevard
Buffalo, NY 14226
(716) 834-7047

National Network for Curriculum Coordination in Vocational and Technical Education
Sangamon State University
Springfield, IL 62708

National Technical Information Service
U. S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

Office of Technology Assessment
Congress of the United States
Washington, DC 20510

Technology Education Research Center
8 Eliot Street
Cambridge, MA 02138

Vocational Technical Education Consortium of States (V-TECS)
Commission on Occupational Education Institutions
Southern Association of Colleges and Schools
795 Peachtree Street, NE
Atlanta, GA 30365

World Future Society
4916 St. Elmo Avenue
Bethesda, MD 20814

Professional Organizations

American Association of Community and Junior Colleges
1 Dupont Circle
Washington, DC 20036

American Electronics Association
Technology Training and Careers
P.O. Box 11036
Palo Alto, CA 94306

American Federation of Labor and Congress of Industrial Organizations (AFL-CIO)
815 16th Street, NW
Washington, DC 10006

American Nuclear Society
555 N. Kensington Avenue
LaGrange Park, IL 60525

American Society for Engineering Education
11 Dupont Circle
Suite 200
Washington, DC 20036

American Society for Training and Development
600 Maryland Avenue, SW
Suite 305
Washington, DC 20024

Chamber of Commerce of the United States
1615 H Street, NW
Washington, DC 20062

Cooperative Education Association
221 N. LaSalle Street
Chicago, IL 60601

Cooperative Work Experience Education Association
Box 94987
301 Centennial Mall South
Lincoln, NE 68509

International Labor Organization (ILO)
Washington Branch Office
1750 New York Avenue, NW
Washington, DC 20006

JETS, Inc.
United Engineering Center
345 E. 47th Street
New York, NY 10017

Laser Institute of America
4100 Executive Park Drive
Cincinnati, OH 45241

League for Innovation in the Community College
23276 S. Pointe Drive
Suite 103
Laguna Hills, CA 92653

National Action Council for Minorities in Engineering
3 W. 35th Street
New York, NY 10001

National Alliance of Business (NAB)
1015 15th Street, NW
Washington, DC 20005

National Association of Minority Engineering Program Administrators
University of Illinois-Urbana
Paul Parker
Room 107
Urbana, IL 61801

National Commission for Cooperative Education
P.O. Box 775
Boston, MA 02117

National Postsecondary Alliance
1960 Kenny Road
Columbus, OH 43210

National Science Foundation
1800 G Street, NW
Washington, DC 20550

National Technical Association
South Building
1425 H Street, NE
Suite 701
Washington, DC 20005

National Technical Services Association
1800 M Street, NW
Suite 103ON
Washington, DC 10036

Society of Automotive Engineers
400 Commonwealth Drive
Warrendale, PA 15096

Society of Manufacturing Engineers

Specialties: Robotics International of SME
One SME Drive
P.O. Box 930
Dearborn, MI 48218

SME Manufacturing Engineering Education Foundation
P.O. Box 930
One SME Drive
Dearborn, MI 48128

Association of Finishing Processes of SME
One SME Drive
P.O. Box 930
Dearborn, MI 48128

Technology Transfer Society
7033 Sunset Boulevard
Suite 302
Los Angeles, CA 90028

Research and Development Organizations

Battelle Memorial Institute
505 King Avenue
Columbus, OH 43201

National Aeronautics and Space Administration
Technology Transfer Division
Office of Space and Terrestrial Applications
Washington, DC 20546

University-Based Research and Development Organizations

Cooperative Education Research Center
Northeastern University
Boston, MA 02115

Department of Engineering and Public Policy
Carnegie-Mellon University
5000 Forbes Avenue
Pittsburgh, PA 15213

Edison Welding Institute
The Ohio State University
1100 Kinnear Road
Columbus, OH 43212
(614) 486-9400

National Association of Industrial Technology
c/o Bowling Green State University
School of Technology
Bowling Green, OH 43403

National Center for Research in Vocational Education
The Ohio State University
1960 Kenny Road
Columbus, OH 43210

APPENDIX F

OVERVIEW OF CO-OP PROGRAM BETWEEN V.C. SUMNER NUCLEAR POWER FACILITY, SOUTH CAROLINA ELECTRIC AND GAS, AND ORANGEBURG-TECHNICAL COLLEGE

STUDENT COOPERATIVE EDUCATION RPOGRAM

Between

SOUTH CAROLINA ELECTRIC & GAS COMPANY

And

ORANGEBURG-CALHOUN TECHNICAL COLLEGE

Cooperative Education is a vauable resource for the educational and industrial community as well as the student involved. Recognizing tnis fact, Orangeburg-Calhoun Technical College and South Carolina Electric & Gas Company have initiated an on-going educational program which is designed to identify qualified students, enrolled in the Electronic Instrumentation Technology curriculum at Orangeburg-Calhoun Technical College who have the potential and desire to work in the nuclear power industry.

Purpose: The purpose of this education program is to identify students who are enrolled in the EIT curriculum at Orangeburg-Calhoun Technical College and have the potential and desire to work in the nuclear power industry. This program affords the student the opportunity to become involved in the operation of a nuclear power facility. The primary purpose of this program is to enhance the students' academic opportunity. The student will be involved at SCE&G for one academic quarter.

Requirements: The applicant must be a registered student in the EIT department at Orangeburg-Calhoun Technical College and must have satisfactorily completed all course through the third quarter as shown in the Orangeburg-Calhoun Technical College catalog before applying. The student must satisfactorily complete all courses through the fourth quarter before being admitted to the cooperative education program.

To apply, the student should complete an admissions form and an employment application for SCE&G, and return it to the EIT department head. The completion of this application is for informational purposes for admission to the program. Completion of the application should not imply that an employment opportunity exists with SCE&G.

The successful applicant for this program will generally have a 3.0 (out of 4.0) GPR on technical subjects in the EIT curriculum. However, other factors will also be considered, including the student's desire to work in the nuclear industry. The successful applicant will receive a letter of recommendation from the EIT department head. The selected aplicant will be notified of his acceptance by SCE&G.

Procedure: After the student has completed the initial application for the cooperative education program, he will be interviewed by employees of SCE&G. He must then pass a physical examination, a psychological examination, and a security check

to certify that the applicant can meet requirements approved by the Nuclear Regulatory commission. Costs for all tests and reasonable costs for transportation to and from the interview will be paid by SCE&G. The selected student will receive a wage rate comparable to industry standards while participating in this cooperative education program. He will be covered by Workman's Compensation while participating and considered a temporary employee. The location for this activity will be at the V. C. Sumner Plant, Jenkinsville, South Carolina. The student is responsible for his transportation to and from the facility during his participation. Students selected may extend their course of study in the EIT curriculum by one quarter as a result of their participation in this Co-op arrangement. There is no guarantee, either expressed or implied, that a selected student will be offered employment by SCE&G at the conclusion of his participation in this program or when he receives his associate degree from Orangeburg-Calhoun Technical College. By the same token, there is no obligation on the part of the student to accept employment if an opportunity does, in fact, exist, and he is offered employment with SCE&G. The selected student would begin participation in the program no earlier than the scheduled fifth quarter of his academic schedule.

Students should apprise themselves of the fact that requirements for entry into this course are stringent, and there is no obligation for acceptance, however, an opportunity to participate in this program would enhance their educational and academic experiences.

For further information, contact your department head.

APPENDIX G

A POLICY STATEMENT: LANE COMMUNITY COLLEGE

Office of Instructional Operations
LANE COMMUNITY COLLEGE

OIAP: 4-4.0
October, 1976

SFE/CWE CREDIT CEILING

PURPOSE: To make available the policy establishing a ceiling for SFE/CWE credits that can be applied towards a degree or certificate.

1. Reference: Memorandum from Larry Murray and Bob Way dated November 28, 1972 and approved by the Academic Council on January 8, 1973.

2. Responsibilities: Associate Deans, Directors, and Department Heads

3. Procedure:

   a. The following policy for SFE/CWE credit ceiling for the Associate of General Studies and Associate of Arts Degrees, Associate of Science Degree and One-Year Certificate Programs has been approved by the Academic Council.

      (1) Associate of Arts Degree and Associate of General Studies Degree

      A maximum of 18 CWE credits may be appiled to the Associate of Arts and General Studies Degrees. Additional CWE credits may be taken when the student cannot benefit from the training, but the credit will not count toward a degree.

      (2) Associate of Science Degree

      The ceiling for SFE/CWE credits will be determined by each instructional department.

      (3) One-Year Certificate Program

      The Ceiling for SFE/CWE credits will be determined by each instructional department.

Dean of Instructional Operations

OPR: Office Instructional Operations
Effective: Immediately
Distribution: Holders of OIAP Manuals

APPENDIX H

DIARY OF A CO-OP STUDENT: HOLYOKE COMMUNITY COLLEGE

Last summer, when an environmental science student told Job Developer Pete Tuttle that her schedule didn't permit attendance at the co-op seminars, Peter came up with a solution: that she write a diary recording her progress at the co-op job. Following are exceprts from "Student's" diary:

First Week:

The first week was primarily an introductory period. I was familiarized with the general laboratory operations and with the gas chromatograph, everything I encountered was a new learning experience . . .

Second Week:

This week still involved a great deal on introduction to such aspects as the GC computer and the GC itself. I am very fortunate in having been trained by a very patient and informative individual . . .

Third Week:

By this time, I was beginning to encounter analyses that were carried out in my first two weeks. Thus, I was a little more sure of what I was doing.

Fourth Week:

This job offers a great deal of variety. At this point, I am still being exposed to totally new analyses, each with its own peculiarities . . .

Fifth Week:

Many tasks involve a significant amount of time being spent on identifications and calculations. . . . Once again, I encountered analyses I was exposed to earlier . . .

Sixth Week:

There are still many new tests that I have yet to encounter. Every week seems to hold something new, and this week is no exception . . .

Seventh Week:

This was devoted almost entirely to purge-and-trap [a cleanout procedure]. This is an involved and lengthy analysis . . . [Student describes in technical detail such an "involved and lengthy analysis" and explains--again in technical terms--how the purchase of new, more modern equipment could trim down time and effort spent on the problem.]

Eighth Week:

[By now, student is sounding very professional and secure. She writes a detailed and technical report of the work in which she has been involved. The following are her lead-off phrases.] Once again, we are still bogged down in

the analysis of volatiles. You must be able to budget your time. It is crucial to keep up on what samples are in, what analyses must be performed, and their respective holding times . . .

Summary:

This Co-op experience was indeed extremely valuable. I enjoy the job very much, and at this point, I can say for myself that I couldn't have chosen a better major/field.

I have gained so much from this job! It's a great thing to be able to apply what one has learned and studied in the academic environment. The idea that "learning is one thing, but doing is another" cannot be stressed enough.

The lab is run quite efficiently, and it is a pleasant environment in which to work. As with any job, there are those stressful moments. I feel it is moments like those that test your ability and strengthen character. It is imperative that you be able to accept criticism as well as be responsive to those around you.

I cannot say enough about the individual under whom I trained. I was very fortunate in having been able to work with such a person. Not only have I gained experience in my field, but I have also gained direction as to my future.

I would recommend this type of experience for anyone . . .

APPENDIX I

TABLE OF CONTENTS FOR A COMPANY CO-OP MANUAL: CINCINNATI MILACRON, INCORPORATED

An important strategy to ensure successful co-op in high-technology occupational areas is for the training sponsor to provide a timely and relevant orientation to the co-op student. One element of that strategy is to give each student a co-op company manual. Such manuals, prepared by the training sponsors, can answer questions commonly asked about the student's employment and can point out and clarify special procedures for co-op employees. The manual does not replace the company's employee handbook but supplements it. A sample table of contents from one company's co-op manual is found here. The contents reflect the type of information that the co-op student needs to assist him or her in making a smooth transition from the classroom to the training station.

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