The nature and extent of formal in-plant skills and technical training in selected public utility and manufacturing companies in the United States

Peter Olaniyi Awotunde
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THE NATURE AND EXTENT OF FORMAL IN-PLANT SKILLS AND TECHNICAL TRAINING IN SELECTED PUBLIC UTILITY AND MANUFACTURING COMPANIES IN THE UNITED STATES

Iowa State University

Ph.D. 1982

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The nature and extent of formal in-plant skills and technical training in selected public utility and manufacturing companies in the United States

by

Peter Olaniyi Awotunde

A Dissertation Submitted to the Graduate Faculty in Partial Fulfillment of the Requirements for the Degree of DOCTOR OF PHILOSOPHY

Major: Industrial Education

Approved:

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In Charge of Major Work,

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For the Graduate College

Iowa State University
Ames, Iowa

1982
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CHAPTER I. INTRODUCTION

Preamble

Training within industry can be regarded as a means to an end rather than as an end itself. The major function of industrial and business organizations is to produce goods and services which are useful to society. However, the major function cannot be efficiently performed unless the organizations operate at an optimum level of productivity, which, in turn, cannot be achieved without the combined efforts of the organizations' employees.

Factors that affect an organization's productivity level include the state of the technology and the training of the employees. As technology changes from time to time, so also do the operations within business and industry change. Also, the demands on the employees change as they must acquire new ways of performing their jobs due to the changes in job content. In fact, as McGehee and Thayer (1961) indicated, "Each change of method in producing products and each new product introduced usually requires some sort of training" (p. 10). The effect of changes in technology on workers was pointed out by Russell Flanders (1977) when he wrote:

The creation of new occupations and the decline or disappearance of familiar ones are natural results of our technological development. With regard to education, we must recognize that our advancing technology will require most workers to obtain additional training for their careers. In some instances, complete retraining for new occupations may be necessary (p. 7).
Failure to operate at an optimum level of productivity would cause an industrial or business organization to incur expensive losses, especially if untrained employees tried to operate sophisticated, expensive equipment. Rosemary Springhorn (1977) realized this point when she claimed:

Most of American industry has learned that investment in technical and skills training is as important as plant investment. And the reason is clear. It does little good to invest in computers, numerically controlled machines, tools, or other sophisticated devices unless a skilled workforce is available to operate and maintain them (p. 21).

This type of claim is probably supported by research results such as those of a Conference Board Survey (Lustermen, 1977) of 610 firms (each with 500 or more employees) which showed that the firms spent more than $2 billion during 1974-75 on employee education and training. In-house education and training accounted for $1.6 billion, compared with about $220 million for tuition-aid programs and $180 million for other outside courses such as the ones conducted by corporate suppliers, professional and trade groups, and proprietary organizations and consultants. The results showed further that about 3.7 million of 32 million employees of the surveyed firms participated in in-house courses provided by their companies during working hours in 1974-75. Also, another 700,000 employees of the surveyed firms were enrolled in company courses given them during nonworking hours, while tuition aid programs were provided for 1.3 million employees.
The terms "training" and "education" have been so often used interchangeably that a distinction between them becomes appropriate at the outset. Branscomb and Gilmore (1975) differentiated between the two terms:

It is not always possible to make a clear distinction between corporate "training" and, say, Whitehead's sense of "education," although one can imagine a scale of parameters in terms of which that distinction might be drawn. At one end of the scale, which we regard as more typical of training, lies measurability, narrowness of subject matter, relevance to a particular time and place, well defined range of use and efficiency of information transfer. At the other end of the scale, more characteristic of what we mean by education, lies the exposure to contrasting assumptions and points of view, the involvement of personal intellectual initiative, less constrained range of use even to uncertainty about its specific utility, and the general impossibility of measuring on a quantitative scale the degree and quality of acquisition of insight (p. 226-227).

Training, apart from increasing production of goods and/or services can, if properly executed, increase self-confidence among workers. This could be brought about because the training programs employed by the different industries and businesses can standardize the methods of doing the work, reduce the amount of supervision necessary, lower turnover rate caused by unsatisfactory adjustment to a new job, correct mistaken judgment as a result of the hiring interview, and increase the interest in the job because of a more thorough understanding of the task to be performed and its relationship to that of other employees--thereby increasing the morale of the workers. As indicated by Richard B. Johnson (1976), some of the problems that any effective training can
solve include the needs to:

1. Increase productivity
2. Improve the quality of work and morale
3. Develop new skills, knowledge, understanding, and attitudes
4. Use correctly new tools, machines, processes, methods, or modifications thereof
5. Reduce waste, accidents, turnover, lateness, absenteeism, and other overhead costs
6. Implement new or changed policies or regulations
7. Fight obsolescence in skills, technologies, methods, product markets, capital management, etc.
8. Bring incumbents to that level of performance which meets (100% of the time) the standard of performance for the job
9. Develop replacements, prepare people for advancement, improve manpower, deployment, and ensure continuity of leadership
10. Ensure the survival and growth of the enterprise (p. 1-9).

Training has been defined as "an act of providing a means for learning to take place" (Proctor and Thornton, 1961, p. 19). However, there are a number of processes which constitute "training". The processes which, in turn, include think-steps, set-up steps, and action steps have built-in
measures which allow the processes to regulate themselves.
The processes consist of:

1. Determination of training needs
2. Methods of instruction
3. Preparation of a training program
4. Design of training evaluation
5. Measurement of pretraining characteristics
6. Delivery of instruction
7. Measurement of posttraining characteristics
8. Feedback of results.

Statement of the Problem

Training in business and industry, according to Gayeski (1981), is one of the most rapidly expanding fields in the United States of America today. Peterfreund (1975) also noted that corporations were becoming increasingly involved in regard to specific job training, as well as the provision of broader educational/developmental programs for employees.

Important and expanding as training is, there exists limited information concerning its characteristic quality within industry. Little or no research studies, to be more specific, have been reported concerning technical training in business and industry. Many of the studies that have been done have concentrated on particular aspects of technical training and have often been limited in geographical scope.
Consequently, a broad picture of the technical program within specific industries is not clear. The problem was recognized by Ginzberg and Hepburn (1972) when they wrote:

"We know very little about the total training structure in the United States because it is so diffused that nobody has an overview of it (p. 22)."

Tracey (1974), in a view supporting the position above, described his experience in the course of writing a book on training and development systems. He sought specific data with respect to: (1) number of companies that conducted training, (2) number of courses or training programs offered, (3) number of staff assigned to training activities (4) number of personnel trained, and (5) training costs—salaries, materials, aids and equipment, and total costs. He sent letter inquiries to several private and government organizations in an attempt to obtain facts. The attempts were unsuccessful. Tracey quoted typical responses as:

"We regret that we do not have any material of this kind, and frankly we have serious doubts that it has ever been compiled."

"Several researchers have attempted with very little success to gather information of the type you want."

The Bureau of Labor Statistics, under a contract with this office (Manpower Administration, U.S. Department of Labor), is now completing a pilot study in the metal working and public utility industries of the kinds and quality of training records kept by employers and the base from which data can be retrieved from the records (p. 5).

Similar recognition of the situation has been stated by other authors (Utgard and Davis, 1970; McGehee and Thayer,
1961) concerning training in business and industry. Rather than concerning itself with the training programs of all industries, this study was concerned with the skills and technical training conducted by two industries--public utility and manufacturing. In other words, the problem of this study was to investigate the significant characteristic qualities of formal in-plant skills and technical training in selected public utility and manufacturing companies that had 500 or more employees in the United States. The significant characteristic qualities which constituted the nature and extent of such training were defined to include the following: (1) goals of investment in training, (2) factors affecting training decisions, (3) cost of training per hour per employee, (4) total number of trainees and man-hours of training, (5) methods and techniques of training, (6) location of training facilities, (7) linkages with public education, (8) number of instructors, and (9) types of government support utilized by the companies in skills and technical training.

Purpose of the Study

The main purpose of the study was to acquire information about the nature and extent of the skills and technical training conducted within the selected public utility and manufacturing companies in the United States. Such information could be useful to:
1. Industrial education administrators and teachers in making decisions concerning the improvement of their technical programs.

2. Government agencies in having more accurate information regarding the extent of the skills and technical training conducted in the public utility and manufacturing industries.

The value of training to any industrial and/or business organization cannot be overemphasized. As Wolansky (1981) pointed out, industries expand rapidly and require highly specialized semi-skilled and skilled workers, thereby creating a necessity for in-plant training. Wolansky also underscored the importance of in-plant training to developing countries when he wrote:

Industries in rapidly developing countries such as Nigeria face problems of recruiting an adequate supply of skilled workers because the demand exceeds the net supply of available trained persons in most of the major economic sectors.... While the in-plant training contributes a small portion (less than 10 percent) of the trained labor force, such training programs extend the pool of skilled workers and represent a major investment (p. 17-18).

The information acquired from this study could, in the light of the foregoing observations, be useful to the personnel concerned with the planning of training within industry and to developing countries regarding the establishment and/or management of the training function within industry. More specifically, the study sought to find answers to the following questions:
1. What are the factors that influence training decisions in the public utility and manufacturing industries?

2. What are the significant characteristics of the selected industries in regard to the use of the different training methods and techniques?

3. What are the differences in the extent of skills and technical training (e.g., number of trainees per year, cost per hour per trainee, goals of training, delivery systems) provided by the selected public utility and manufacturing industries?

4. What types of government assistance for skills and technical training are used by public utility and manufacturing industries?

5. Is there any linkage between the in-plant skills and technical skills of the public utility and manufacturing industries, and public education in the United States?

6. How are the contents of in-plant skills and technical training selected in the public utility and manufacturing industries?

7. How are the skills and technical training effects determined in the public utility and manufacturing industries?
Assumptions of the Study

The following assumptions were made concerning this study:

1. The samples used in the study are representative of the research population.
2. The samples used in the study are independent of each other.
3. Any uncontrolled variables in the study are uniformly distributed over the entire samples.

Definition of Terms

The following are the definitions of terms used in this study:

1. Industry: A group of productive or profit-making enterprises or organizations that have a similar technological structure of production and that produce or supply technically substitute goods, services, or sources of income.
2. Business: A usually commercial or mercantile activity customarily engaged in as a means of livelihood and typically involving some independence of judgment and power of decision.
3. Technology: The application of scientific knowledge to practical purpose in a particular field.
4. Productivity: The degree of effectiveness of
industrial management in utilizing the facilities for production, especially the effectiveness in utilizing labor and equipment.

5. Training in industry: The formal procedures which a company uses to facilitate employees' learning, on the job or in the classroom, so that their resultant behavior contributes to the attainment of the company's goals and objectives.

6. Training function: All that has to be done in meeting the training responsibilities of an organization.

7. Determination of training needs: An examination of the organization's present and expected operations and the manpower necessary to carry them out, in order to identify the numbers and categories needing training and retraining.

8. Group training methods: Methods of training and instruction given to a group rather than to individuals, e.g., lecture, group discussion, demonstration, case study.

9. Heuristic/Discovery Method: An educational method, the principle of which is to arrange the work so that the pupil discovers laws and principles for himself, rather than learns them directly from the teacher.
10. Multi-skill (progressive) training: A method of training which builds on common basic training a series of additional skills; e.g., an apprentice trained in basic engineering and mechanical craft practices as a "bench fitter" may take further training in "centre lathe turning" and/or "tool making".

11. On-the-job training: Training that occurs on the actual work site where the production or service is carried on. It does not include classroom instruction.

12. Skills and technical training: A type of training provided with the following objectives:
   a. To compensate for deficiencies in the knowledge and/or skills of entry-level workers.
   b. To provide training on special equipment, in processes or techniques.
   c. To remedy employee performance deficiencies caused by inadequate skills or knowledge.
   d. To upgrade the skills and knowledge of current employees required by the introduction of new systems, equipment, tools, procedures, techniques, or products.

13. Job programs or J programs: Programs developed by Training Within Industry (TWI) during World War II.
The programs are made up of:

a. Job instruction training (JIT) which is concerned with the skills required in instructing others.

b. Job methods training (JMT) which is concerned with the improvement of work methods.

c. Job relations training (JRT) which is concerned with building and maintaining good relations with others.

14. Adjunctive programming: An aspect of programmed instruction in which the learner first undergoes a short learning experience by reading a chapter or section of a chapter in a book, watching a film or attending a field excursion. He then reviews the experience selectively for major points before he turns to a series of questions which need not necessarily cover all the points dealt with in the chapter or film.

15. Job rotation: A method of training in which the idea is to expose a trainee to a number of functions in a relatively short time by rotating him through various departments.

16. Role playing: A training technique of creating a life situation, usually one involving conflicts between people, and then having persons in a group
play the parts of specific personalities.

17. Coaching: Coaching is the intelligent assignment of responsibilities and the patient guidance of trainees toward effective performance of the duties involved in discharging those responsibilities.

18. Previous year: Previous year in this study means 1980.

19. Training decisions: Training decisions are problem-solving activities in which companies make up their minds concerning conducting, reducing or increasing in-plant skills and technical training programs.
CHAPTER II. REVIEW OF LITERATURE

The review of literature has been divided into the following four sections:

1. The concepts of human resource development, and training
2. The historical perspective of industrial training
   (a) The decades of the thirties and the forties
   (b) The post World War II era
3. The factors that affect training decisions
4. The training methods and techniques

The Concepts of Human Resource Development, and Training

Human resource development has been described in various ways by different authors. Socknat (1967) conceived of the term as the process by which the quantity and quality of skills and knowledge are increased. This view led Socknat to consider elementary through higher education, vocational training, on-the-job training, various rehabilitation programs and occupational mobility as development programs. Boulding (1967) considered human resource development as a special case of general development. Knowledge was viewed as the driving force for the development of society as well as human resources.

The training literature is replete with reference to the
lack of differentiation between the various activities involved in human resource development by some authors and researchers. However, it is difficult to describe training without the clear understanding that the term is a subset of human resource development. The different conceptual frameworks for describing human resource development include that of Nadler (1970). Nadler considered human resource development as a series of activities—employee training, employee education, and employee development—conducted within a specified time and designed to bring about behavioral changes. Individuals bring a variety of behaviors into any situation. Some of these behaviors do not fit into the new situation and have to be modified while others have to be reinforced and supplemented with new behaviors for the benefit of both the individual and the new situation. The purpose of employee training in Nadler's framework is to either introduce a new behavior or modify the existing ones while the purpose of employee education is to provide suitable experiences that will enable the employee to produce more behaviors than when he or she entered the situation. The purpose of employee development, on the other hand, is to enable the employee to move with the organization through a combination of the new, the reinforced, and the modified behaviors as the organization develops, changes and grows.

Peterfreund (1976) also viewed human resource development
as composed of the three activities: training, education, and development. Training was equated with technical or manual skill developments which relate directly to the job. In other words, since the needs of training are the presumed needs of the workplace, the aim of training must be to get the work done while coping with the immediate job environment. Equating education with the development of the mind, the transmission of knowledge and the ability to reason, Peterfreund indicated that the efforts of most industries to "educate" were less directed to the immediate job surroundings and more to the individual's knowledge base. Development, in this framework, was shown to embrace "training" and "education" as well as the development of character, interpersonal growth and behavior.

Rather than conceptualizing human resource development as a conglomeration of three activities, Napier, Maurer and Bryant (1980) portrayed it as a model with the following logic: (1) that education will overcome inadequacies in role playing skills, and (2) that the role playing skills, in turn, will increase the probability that the recipient of the education will become employed. This model advanced the position that an individual is deficient in some manner which prohibits him or her from being integrated into the economic institution of the society. The personal deficiencies could be generated by: (1) obsolete job skills and
knowledge bases or (2) emerging roles which require special skills that do not exist among potential factors. A proponent of this human resource development framework can comfortably argue that the panacea for finding employment is to improve an individual's role-playing skills. Once the role-playing skills are improved, the opportunities to participate in the economic system will also improve.

Schein (1977) approached his conceptual framework for human resource development through the adoption of certain assumptions concerning human or organizational growth. Schein wrote concerning his assumptions:

Human growth takes place through successive encounters with one's environment. As the person encounters a new situation, he or she is forced to try new responses to deal with that situation. Learning takes place as a function of how these responses work out and the results they achieve. If they are successful in coping with the situation, the person enlarges his repertory of responses. If they are not successful, the person must try alternate responses until the situation has been dealt with (p. 5).

On the basis of these assumptions, the author indicated that two things—new challenges and information on how responses to the challenges have worked out—were needed for human and organizational growth to occur. By applying the developmental assumptions to industrial organizations, Schein concluded that effective performance over a period of time required planning for recruiting, managing, developing, measuring, disposing of, and replacing human resources as warranted by the task to be done. The model offered by Schein regarding
human resource development consisted of the following:

1. Components which insure an adequate process of staffing the organization;

2. Components which plan for and monitor growth and development;

3. Components which facilitate the actual process of the growth and development of the people who are brought into the organization;

4. Components which deal with decreasing effectiveness, leveling off, obsolescence of skills, turnover, retirement, and other phenomena which reflect the need for either a new growth direction or a process of disengagement of the person from his or her job.

5. Components which insure that as some people move out of jobs, others are available to fill those jobs, and as new jobs arise, people with the appropriate skills are available to fill them (p. 6-8).

Another model offered by Miller (1969) considered the training function. It criticized the traditional model of training, frequently referred to in the training literature (Denova, 1971, p. 608; Parker, 1976, p. 19-20; Proctor and Thornton, 1961, p. 21), which considers training as composed of five discrete phases connected sequentially with each phase standing independently. The traditional model, which proponents have often referred to as having professional
value, comprises the following phases: (1) conducting training needs analysis, (2) developing training objectives, (3) designing training curriculum, including training methods and evaluation approach, (4) implementing the training program, and (5) measuring the training results. Miller pointed out that this particular way of thinking about training could lead to the following:

1. Needs assessment data which are prematurely organized and stated as training needs,
2. Objectives which are stated in very general and unmeasurable terms and not closely related to the real training needs,
3. Programs designed and implemented which are only slightly related to the real training needs or "real life" circumstances faced by trainees (p. 1).

Miller concluded his observations on the traditional training model by stating, "...in general, this conception of training leads to increasingly more general and less precise training efforts" (p. 1). Miller's way of conceptualizing training is to view it as an interdependent and interrelated process in which the five phases of the traditional model form subprocesses which are highly interrelated and interdependent on all other processes as well as on the total process.
Historical Perspective of Industrial Training in the United States

Job training is as old as man's first primitive family groupings. The early man was concerned with survival which required that he specialized in hunting, food-gathering, and self-defense. The idea of specialization, which later became the essence of industrial engineering and productive efficiency, was developed by Plato (Ritchey, 1964). Babbage (1835, Chapter XIX) wrote on division of labor—a principle which Adam Smith (1776/1976) also dwelt much upon. These early writings provide the basic concept and philosophy for the industrial revolution and the evolving of the industrial nations of the world. One of the main themes of the writings is the concept of training and development of human resources for efficient and effective use of other resources to achieve production and organization's objectives (Labby, 1965).

As Drawbaugh (1975) pointed out, training for work in early America was accomplished primarily through apprenticeships which were the common method of training in Medieval Europe. The apprenticeship system required that a person be bound by indenture to serve a master craftsman for a number of years with the view to learning the master's trade. However, the Industrial Revolution of the eighteenth century, which brought with it the factory system, necessitated a new form of training—the factory schools. The factory schools
were established by American manufacturers for various reasons. Clark and Sloan (1958) claimed that the manufacturers were forced to establish their own schools for two reasons: (1) the striking expansion of the economy with the insistent demand for skilled labor and (2) the fact that no public or private institution at the secondary level offered industrial training. Another author (Nadler, 1970) wrote concerning the reasons for the establishment of the schools:

The complicated farm machinery which had been developed required trained mechanics.... Increasing complexity of industrial production also encouraged the development of factory schools designed to produce a workforce trained for a particular employer,... Factory schools were mainly concerned with preparing new workers to enter the workforce (p. 22).

There was a rise in the growth of factory schools during World War I because of the emergency created by the war, which in turn, created the need for the quick training of workers for skills in certain specialized operations. The prosperity that followed the war also augured well for the establishment of more factory schools. The automobile, for example, still an oddity before World War I became an article of mass production after 1918. Its widespread use created an increased demand for oil, steel, rubber, and electrical equipment. It caused the building and rebuilding of roads and created new secondary occupations for which workers had to be trained or retrained.
The decades of the thirties and the forties

The depression years of the 1930s witnessed a reversal of the trend of training workers. Because of the layoff of many skilled workers at the time, employers had so large a pool of workers from which to draw skilled manpower, if there was a need for it, that it was not necessary for them to intensify their training efforts. Stewart (1980) wrote concerning the Great Depression and its effect on training of workers:

With large-scale unemployment through the thirties, human capital accumulation by adult workers must have been negative as more skills were lost through disuse than acquired by education, training or job experience. Training for work experience declined (p. 19).

However, this situation was reversed with the onset of World War II in 1939. The war caused the labor force to increase by about 10 million workers and soldiers between 1940 and 1945 (Jaffe and Stewart, 1951; Wool, 1947). Stewart (1980) also pointed out that the drafting of many young men into the Armed Forces during the war caused the available reserves of labor for wartime expansion of production and employment to consist of persons with little occupational experience or training—principally women and youth and the unemployed, many with irregular job experience or exposure to work discipline. Woytinsky and Associates (1953) indicated that the emergency created by the war for skilled labor brought such a pressure to bear on the government that a total of nearly
$327 million was made available by the Congress between 1940 and 1945 for the training of defense and war production workers.

Industrial training took a new direction during World War II with the establishment, by the National Defense Advisory Council, of Training Within Industry (TWI). This emergency service was created to assist defense industries meet their manpower needs by training within industry each worker to make the fullest use of his best skill up to the maximum of his individual ability (McCord, 1976, p. 32-34). This objective was met by Training Within Industry through the following set of principles which guided its operations:

1. Convincing management that training was an everyday affair.
2. Serving as a clearinghouse of information on ways industry could meet production problems through training.
3. Helping industry to instruct its supervisors.

The three job programs—job instruction training, job methods training, and job relations training—developed by Training Within Industry for its operations influenced the professionalization of the field of training in that the programs served as training models for industries which conducted training programs.
The post World War II era

Interest in training for skilled labor, rather than abate with the cessation of hostilities, continued its high level trend during the period following World War II. The period from the 1950s to the present can be described as a period of rapid social, economic, and technological changes. In fact, Tracey (1974) described part of the period (the 1960s) as:

...a period during which instant worldwide communications became commonplace. It was ten years of exciting growth in computer sciences. It was a period of significant social change.... It was a period of economic upheaval, of increased domestic and internal competition for markets, of increased unemployment, of frequent union and management confrontations, and of rapid obsolescence of skills (p. vii). The impact of the technological changes has ranged from the use of more versatile materials such as synthetic products to the developments in electronics which have made automation and the use of computers possible in industries. These changes have affected the work force in a number of ways. The elevator, for example, initially created many jobs by making the high-rise buildings practical. However, the development and the subsequent use of automatic elevator systems have reduced the number of elevator operators. As Deutsch (1979) pointed out, the essence of this technological change is that it is unpredictable; it created many jobs and eliminated many others.

The new jobs created through the technological change
have also necessitated the training or retraining of part of the country's work force. In fact, dealing with the effects of the rapid social, economic, and technological changes on the country and its work force has been a joint effort of the government and the private sector as evidenced in the following Acts of the United States Congress (1958, 1962, 1964, and 1973):

1. The Government Employees Training Act of 1958—which was designed to lead to, among other things, the building and retention of a permanent cadre of skilled and efficient government employees, well abreast of scientific, professional, technical, and management development both in and out of government.

2. The Area Redevelopment Act of 1961—which was designed to overcome the problem of persistent unemployment and underemployment in some areas of the country by, among other measures, giving Federal assistance to communities, industries, enterprises, and individuals in areas needing redevelopment.

3. The Manpower Development and Training Act of 1962—under which the government was required to promote and encourage the development of broad and diversified training programs, including on-the-job training, in order to combat the effects of technological changes and automation which were considered as
responsible for rendering the skills of many people obsolete.

4. The Economic Opportunity Act of 1964—which sought to open the opportunity for education and training to everyone as a means of combating poverty in the midst of plenty by making use of, among other methods, on-the-job training.

5. The Comprehensive Employment and Training Act of 1973—under which training costs were underwritten for the Act's clients who were undergoing on-the-job training in the private sector.

Norris (1980) pointed out that when on-the-job training started in 1964 under the Manpower Development and Training Act, the government offered to support 10,000 positions in private industries and that the program's enrollment rose to 115,000 in 1968. Norris pointed out further that a series of on-the-job training-related programs under the Comprehensive Employment and Training Act were initiated by the Department of Labor in the late 1970s. In this program, the participation of the private sector was solicited for the training of disadvantaged workers. The steps taken by the Department of Labor in the program were described by Norris:

The provision that all on-the-job trainee must be hired by the employer prior to the onset of training. This change was instituted to discourage the termination of the employee after the period of subsidized employment has expired (p. 10).
Factors Affecting Training Decisions

Training, if not seriously considered as the best alternative for the solution of an operating problem before an organization embarks on it, can create problems for the organization. Training ties up an organization's manpower, time, money, facilities, equipment and materials. In fact, in considering the organization and management of training, Richard B. Johnson (1976) pointed out that training could disrupt the production processes of an industrial organization because of the human and economic resources involved. Johnson was of the opinion that training will be justified when, among other variables:

1. There is no way to solve the operating problem involved,

2. Other interventions have been considered and found less effective (p. 2-10).

Some more specific factors that influence the decision of industrial organizations to conduct training programs of their own have been the focus of attention by many authors and researchers in recent years. Hoos (1969) conducted a research study designed with a view to acquiring factual information about the kind of training and retraining programs available to the work force, their sponsorship, the reasons for their establishment, the way they were conducted, their extent and limitations, their procedures and problems, and
their prospects for continuation. He identified the private industry as one of the chief agents for job-skill development and, therefore, used four companies of the San Francisco Bay area as his sample. Each program was approached as an entity, and all its dimensions were explored. This was done through participant observation, consultation with officials and teachers responsible for the programs, interviews with trainees, perusal of all pertinent records, and personal telephone and mail follow-up on drop-outs and graduates of the program. Some of the findings of the study which Hoos generalized concerning other parts of the United States are:

1. That the fear of competitors kept training confined to small, ironclad units in some companies,

2. That many firms regarded a formal training program of their employees as giving a clue to their future production plans, and

3. That industry would invest in retraining programs only when it could not draw upon some labor pool to fill its needs.

That the shortage of manpower influences a firm's decision to conduct training is evidenced in a research study conducted in 1968 on the policies, attitudes and practices of employers in the Cleveland area. The study (Department of Labor, 1971), which was conducted under a contract with the Manpower Administration, had a sample of 131 employers.
Interviews were conducted, using a structured questionnaire, at various management levels ranging from the presidents of the establishments to their personnel directors.

Interviewees were asked to rank the factors that had the greatest influence on altering or causing training decisions in their establishments. The analysis of the rankings showed that manpower shortages were mentioned most often. In fact, the factor (manpower shortages) was mentioned by 44% of the respondents, was ranked first by 34% of them, and was the only factor mentioned by 20% of the interviewees. The research results pointed out further that manpower shortages was listed twice as often as company growth. The results of the rankings, coupled with the comments of some of the interviewees led the researchers to make the following conclusion in regard to the study:

Most of the factors mentioned indicate that some type of a major crisis - for example, changes in technology, products, or programs - is the primary motivation for the employer to make a training decision. These factors also help to explain why the employer has a turn-on and turn-off system of training. The employer turns on his training system when skill shortages grow until he has no choice but to train his own people, and the employer turns off his training system when the skill shortages ease to a tolerable level (p. 11).

That the rapid technological change since the end of World War II has influenced, and still influences, the decision of employers to conduct or increase training cannot be overemphasized. Nadler (1970) indicated that changes in technology create a requisite need for behavioral changes in
individuals. Wecksler (1963) cited the case of an aircraft company to support the notion that technological changes affect the decision of employers to conduct or increase training. According to Wecksler, the Lockheed-Georgia company's training department continually offers courses to employees in the various job classifications to keep them abreast of new developments.

While some employers conduct or expand training if it solves their immediate operating problems, others do so with due consideration for both their establishment and the individual employees. This was clearly borne out by Rodes (1969) in his statements concerning the objectives for establishing the School of Automotive Trades by General Motors in Flint, Michigan, immediately after World War I. The twofold objective was as follows:

1. To provide opportunities for the employees of the plants to obtain training related directly or indirectly to the automobile industry, to help them prepare themselves for advancement, to qualify for other jobs in which they are interested, or to further their ambitions from an educational standpoint.

2. To develop and conduct programs and courses of training related to various phases of the automobile industry that will be helpful to management in the
plants and contribute to meeting the needs of the organizations.

A more recent opinion in support of the influence of the consideration for employees and the organization on training decisions was expressed by Branscomb and Gilmore (1975). The authors stated that the corporate motivations to educate and to conduct training include the following six elements:

1. To introduce new employees or newly appointed managers to the organization, style, and objectives of that corporate community, and all managers to organizational changes.

2. To incorporate and diffuse rapid technological changes, particularly those resulting from scientific engineering innovations that are in their first embodiment of a proprietary character.

3. To sustain professional vitality which includes both motivation and basic professional skills to ensure personal professional growth and, importantly, career path flexibility.

4. To avoid the cost of travel and released time for training at outside institutions.

5. To exploit the increased motivation of on-the-job training which allows newly acquired skills to be immediately practiced, and
6. To fulfill legal and social responsibilities to expand employment and advancement opportunities for minorities and the disadvantaged (p. 223).

The British Government published a set of new training proposals in 1972 (Department of Employment, 1972). Dr. Barrie Pettman of the University of Hull seized the opportunity of this publication by the Government to state his opinion concerning the variables involved in a firm's decision to initiate or improve training (Pettman, 1972, p. 190). Pettman classified the variables into two main categories—those predominantly external to the firm and those mainly internal to the firm. The variables with predominantly external influences are:

1. Levy and grant paid to the firm by the relevant training board(s).
2. Demand for labor. From the firm's point of view, if there is an expansion of demand for its products and this leads to an expansion of the derived demand for labor, then the firm may initiate or increase training.
4. Unions. The actual influence exerted depends on the type of union and the level of the union's involvement.

The variables considered as having predominantly internal
influences are:

1. Size of firm. For example, internal and external economics of scale in training may be present in a large firm.

2. Keeping up with the Joneses. This, to a limited extent, may be the status factors associated with particular occupations and their training or with training per se as a benefit to the firm.

3. Previous training undertaken by the firm and the extent to which such trained workers are still employed by the firm.


5. Labor turnover.

6. Substitute ability of various skills.

Training Methods and Techniques

Training may not be efficient unless appropriate methods and techniques are employed in the delivery of the program and its contents. As McGehee and Thayer (1961) pointed out, there is a plethora of methods and techniques used in industrial training today. Among these methods and techniques are those which represent broad approaches to meeting training needs. One of the broad approaches and probably one of the most popular means of training in industry is the on-the-training.
On-the-job training

McGehee and Thayer (1961) defined on-the-job training as "a method by which the learner in acquiring skills, knowledge, and attitudes, uses the machinery and materials which he will use once his formal training is completed" (p. 186). On-the-job training, apart from enabling the learner to associate with his future superiors and peers has some other benefits to both the learner and the sponsoring agency. Amrine, Ritchey and Hulley (1975), in considering the benefits of on-the-job training, had the following to say:

This method of training is entirely satisfactory under many conditions.... Its flexibility allows a program to be started and stopped at will and to be adjusted to the individual concerned. The employee has first-hand experience with the job and learns by doing. With adequate supervision and guidance, his correct performance can be immediately applauded, and his wrong performance corrected (p. 357).

McGehee and Thayer (1961), rather than limiting their views concerning on-the-job training to its advantages also considered some of the problems that on-the-job training is likely to cause. The authors noted that economy and maximization are not inherent in on-the-job training because the performance of trainees using production equipment and materials may be such that serious economic loss will be incurred.

There is little or no empirical research study regarding the effectiveness or otherwise of on-the-job training method. Merenda (1958) reported a study of the relative effectiveness
of formal school training vs. on-the-job training of naval apprentices. He found that formal school training was superior to on-the-job training. However, the criteria used showed some of the deficiencies of the study. Written examinations were used for advancement in naval ratings without presenting any evidence to indicate that these examinations had any relationship to job proficiency.

**Vestibule training**

Another method that represents a broad approach to training needs is the vestibule training method. Vestibule training is usually set up on the sponsoring company's property, removed from the actual work place. The equipment and materials used on the production floor are duplicated as closely as possible in the vestibule method of training (Amrine et al., 1975, p. 359; McGehee and Thayer, 1961, p. 188). The conclusion can easily be drawn from the description of vestibule training that the primary purpose of the method is training, not production.

McGehee and Thayer (1961) used the vestibule method to train workers for such textile jobs as fixers, weavers, and setters. Under conditions which were not completely controlled, the authors made a comparison of the effectiveness of the method (vestibule) vs. on-the-job training method in regard to the training of workers. They found that vestibule training method reduced training time and resulted in improved
job performance on the part of the trainees.

**Formal off-the-job training**

Still another method in the group of the broad approaches to meeting training needs is formal off-the-job training. What the trainee does on the job under this method, and what he does in a classroom or laboratory, are not clearly related. In fact, what he learns in a classroom or laboratory is supplemental rather than central to learning to perform the job tasks. That formal off-the-job method will not substitute for or replace actual job experience is portrayed in an investigation (Mann and Hoffman, 1960) conducted in a power plant. Like most of the studies reported on employee training methods, this investigation was based on mere reactions of employees to formal classroom training. The employees believed that formal classroom training was not as adequate as actual job experience.

Because formal off-the-job training is not closely related to learning to perform job tasks, research reports such as that of Fleisham, Harris and Burtt (1955) have questioned the value of the formal off-the-job training of supervisors. The weakness of the training (off-the-job) has also been pointed out by McGehee and Thayer (1961):

> A major weakness of most programs of this kind is the failure to incorporate materials which will contribute to transfer of training. Only infrequently are provisions made for the application of principles learned to the job. Rarely is there any follow-up to assist in transfer or insure its occurrence (p. 191).
On the basis of this weakness, McGehee and Thayer made three suggestions as to how to decide whether or not to use this method of training. The suggestions are that:

1. Certain skills, knowledge and attitudes probably can be developed more effectively by this method than by others.

2. Trainers should find out if opportunity for transfer is provided.

3. An analysis of organizational climate will indicate whether the conditions are such that skills, knowledge and attitudes developed in a classroom will receive reinforcement on the job.

Apart from the methods that represent broad approaches to meeting training needs, there are those that are narrower in scope and have been designed to meet special training needs. These are mainly instructional techniques and include:

lecture, conference or discussion, coaching, job instruction, case study, simulation, role-playing, television and films, programmed instruction, and training models. Specific instructional techniques used in training have been one of the foci of attention by experts of industrial training and instructional resources for many decades.

Planty, McCord and Efferson (1948) contended that the lecture could be more useful in the training of executives than in the training of lower level employees. Executives,
According to the authors, are more used to oral presentations than lower level employees. While this view was not backed up by any research study to show its authenticity, an endorsement of it was demonstrated by McGehee and Thayer (1961) when they indicated that unless careful grouping of trainees by ability and/or achievement level takes place, it may be difficult to achieve a level of instruction which moves everyone along at the appropriate rate because the lecture method does not have as an integral characteristic the recognition of individual differences.

Research studies have been directed to studies of the comparative achievement of students in televised classes, large (but not televised) classes, and smaller classes often designated as conventional instruction. Some of the recent findings indicated that students in televised classes tended to achieve about as well as those in conventional small classes, although they tended to prefer conventional to televised instruction (Carpenter and Greenhill, cited in Siegel, Adams and Macomber, 1960). Siegel et al. (1960) carried out a study, the purpose of which was to determine the effect, if any, of instructional procedure upon subject matter retention one year or more after completion of a course. Retention scores of students who had received conventional instruction in nine courses were compared with the scores of students who had been instructed in the same
courses by large group procedures—closed circuit television, large group (but not televised) instruction, and instruction by graduate students rather than fulltime faculty members. The research results showed that retention of subject matter a year or more after completion of a course was not adversely affected by increased class size or by the particular instructional procedure used.

Since training implies that an individual is being subjected to change or behavior modification, it becomes appropriate to consider the specific instructional techniques and their effects in bringing about behavior modifications. Maier (1949) indicated that there are two possible types of conditions under which a change in an individual or the modification of an individual's behavior occurs—namely, changes under motivation, and changes under frustrating conditions. Maier (1952) examined these two basic conditions for behavior modification and their implications for training. Change or behavior modification under motivating conditions was illustrated as follows:

...a person has a set of habits and attitudes which he has previously acquired and these tend to persist because they are stronger than alternatives. If one wishes to induce a change under such a condition, one must build up alternative habit and attitudes and make them stronger and more attractive than the former response (p. 43).

The author (Maier, 1952) noted, concerning this first condition for behavior modification, that people will change when
more attractive alternatives are presented and that any method or technique that brings alternative procedures or behaviors to attention or makes them attractive assumes that one kind of behavior will be substituted for another when the substitute is known, understood, or desired.

The second condition for behavior modification (i.e., changes under frustrating conditions) was also illustrated by Maier in the following way:

...the person who has a phobia for snakes may fear a picture of a snake, knowing full well that the fear is inconvenient and that a picture of a snake can do no injury. Attempts to train the person out of this fear by methods to convince him that pictures of snakes do no harm have been entirely ineffective.... Behavior of this kind persists because a person is trapped by his old responses, not because he does not know or desire alternatives (p. 44).

Maier indicated that the techniques for changing behavior under the two conditions differ. In the first case (change under motivating conditions), the conventional training techniques (lecture, discussion, etc.) are adequate because they can be used to train the individual to develop new or substitute behaviors. Case-training procedures must be developed under the second condition (change under frustrating condition) to reduce the compelling strength of the old response before efforts to develop a substitute can become effective.

Results of research studies have also shown the use of each of the instructional techniques in the training of
workers. Utgaard and Davis (1970) carried out a study to determine the relative frequency with which 18 common instructional techniques were utilized in selected industries—manufacturing, transportation, and finance—in the metropolitan Twin Cities (Minneapolis-St. Paul). Nearly 74% of the 151 firms surveyed responded to the mailed one-page questionnaire which included check-list type questions on industrial classification, net income, number of employees, age of president, age of firm and the type of employees who received the most training. It was found out, from this study, that:

1. Job instruction training, conference or discussion, and apprentice training were reported to be the most frequently used training techniques by the manufacturing firms, while the nonmanufacturing firms most frequently used job instruction training and conference or discussion techniques.

2. Junior board, vestibule training, laboratory training and television were the training techniques least frequently used by the manufacturing and the nonmanufacturing firms.

3. For both types of firms, net revenue was a factor in the frequency of use of films, while the number of employees was a factor in the frequency of use of case study, films, simulation, role playing,
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television, and vestibule training.

4. For both types of firms, age of firm was a factor in the frequency of use of role-playing techniques.

5. For manufacturing firms, net revenue was a factor in the frequency of use of coaching, lecture and role-playing while number of employees affected the use of lecture and special study. Also, the frequency of use of conference or discussion, apprentice training, case study, internships and assistantships, simulation, programmed group exercises, and television was influenced by age of firm.

6. For nonmanufacturing firms, net revenue was a factor in the frequency of use of simulation, programmed instruction, internships and assistantships, and programmed group exercises. Also, age of firm was a factor in the frequency of use of coaching.

Carroll, Paine and Ivancevich (1972) also carried out a survey of 117 training directors, who worked for the companies with the largest number of employees as indicated on Fortune's list of the top 500 corporations. The objective of the survey was to compare the limited research available on the effectiveness of the various training methods with the judgments of the training directors on the same issue. The directors were asked to compare nine instructional techniques under each of six training objectives. The instructional
techniques are programmed instruction, case study, lecture method (with questions), conference or discussion, role playing, sensitivity training (t-group), TV-lecture (lecture given to large audience over television), movie films, and business (using computer or hand calculator). The training objectives used in the study are knowledge acquisition, change in attitudes, participant acceptance, retention of what is learned, development of interpersonal skills and development of problem-solving skills. The results of Carroll et al. (1972) survey showed that for most of the training objectives the training directors believed that about half of the training techniques were effective and the other half were not very effective for the training objective stated. Furthermore, the training techniques considered effective for one objective were usually considered ineffective for another objective. Also, the training directors differed most from previous research results in their ratings of effectiveness for the lecture method for the various training objectives. The previous research results showed that the lecture technique was more effective under the training objective—knowledge acquisition and participant acceptance—than the training directors believed it had.

A more recent and similar (to Carroll et al., 1972) study by Neider (1981) was designed to fulfill three objectives:
1. To find out what training techniques were most effective for satisfying commonly stated training objectives (e.g., knowledge acquisition, knowledge retention, etc.);

2. To determine whether or not human resource development practitioners had changed their opinions regarding the effectiveness of various techniques over the previous decade; and

3. To pinpoint training subjects which human resource development practitioners believed were important for managers.

A questionnaire in regard to the study mailed to 500 selected members of the American Society for Training and Development had 44% response rate. The following were the findings when the sample was asked to indicate the relative effectiveness of 11 training techniques in the achievement of six training objectives:

1. Regarding knowledge acquisition, respondents listed (in order of preference) programmed instruction, lecture, conference or discussion and the case method as the four most effective techniques.

2. Concerning changing attitudes, the four techniques (listed in order of preference) considered as most effective were: role playing, sensitivity training, conference or discussion, and case studies.
3. With respect to the objective "problem-solving skills", the respondents ranked the case study as the most effective technique, followed by business games, conference or discussion, and role playing (in order of preference).

4. Concerning interpersonal skills, the techniques (in order of preference) considered most effective were role playing, sensitivity training, conference or discussion, and business games.

5. Regarding the objective "participant acceptance", the techniques considered most effective were conference or discussion, case study, lecture, and business games (listed in order of preference).

6. Role playing, programmed instruction, conference or discussion, and case study were ranked (in order of preference) as the four most effective techniques.

Neider (1981) concluded on the basis of the findings that training experts had negligible attitudinal changes regarding the effectiveness of the different training techniques.

Summary

The review of literature presented in this chapter has been beneficial in the understanding of the concept of human resource development. All organizations are faced with the necessity to use certain kinds of resources to meet their
goals and purposes. These resources include physical resources, financial resources, and human resources. Within the area of human resources are (1) human resource utilization which includes recruitment, selection, placement, appraisal and compensation, and (2) human resource development, which, according to the authors referenced in this chapter, includes the various kinds of learning experiences (training, education and development) which contribute to individual and organizational effectiveness.

Of particular importance in the concept of human resource development is the notion that employee training focuses on the job while employee education and development focus on the individual and the organization, respectively. It could be concluded, by applying the concept to industrial organizations, that some or all of the skills acquired by an employee in one organizational setting will have to be modified through training to meet the requirements of the employee's new organization. Furthermore, through education, activities which are designed to improve the overall competence of the employee in a specific direction beyond the job being presently held will be organized so as to prepare the employee for upward mobility within the organization. The employee's process of moving with the organization as it changes and grows is termed employee development.

Training implies that an individual is being subjected
to changes of behavior modifications. This suggests that the instructional techniques used to bring about the changes may have to be of different types. While some techniques were considered adequate for bringing about behavior modifications under motivating conditions, others were considered to be appropriate for changing behavior under frustrating conditions.
CHAPTER III. METHODOLOGY

The procedures adopted for this study, as presented in this chapter, have been divided into the following sections:

1. The research population and selection of the samples
   a. Selection procedure

2. The research hypotheses

3. The development of the main research instrument

4. The collection of data

5. The analyses of data
   a. Procedure for testing for the normality of distributions
   b. The multiple regression analysis procedure
   c. Other procedures of the SPSS system utilized

The Research Population and the Selection of Samples

The population for this research was made up of public utility and manufacturing companies in the United States. Within this population, two samples (one from public utility, the other from manufacturing) which met the following requirements were selected for the study:

1. Company had 500 or more employees,

2. Company conducted formal in-plant skills and technical training,

3. Company indicated a willingness to participate in the study.
Selection procedure

The first task in the process of selecting the samples was to compile a list of some of the public utility and manufacturing companies in the United States that met the first requirement--500 or more employees--using information concerning the classification of companies and number of employees obtained from some publications (Standard and Poor's Register of Corporations, Directors and Executives, 1981; Petre, 1980; Levine, 1981). A preliminary survey instrument was designed and mailed on November 28, 1981, to the chief executives of 164 companies in the initial list which comprised 94 manufacturing and 70 public utility companies. The preliminary survey instrument, apart from asking whether or not the companies had in-plant skills and technical training, also requested the chief executives to indicate whether or not their companies would be willing to participate in the research study. A letter which explained the purpose of the study and indicated a time limit--two weeks--for returning the completed instrument accompanied the preliminary survey instrument.

At the end of three weeks, 58% of the 164 companies had returned the completed instrument. However, only 50% of the companies which responded (20 manufacturing and 28 public utility) indicated the willingness to participate in the study. It was observed, through some of the comments made on
some of the returned instruments, that:

1. Some companies did not want to participate in any study that would consume considerable time of their personnel.

2. Some companies would not participate in any study in which the names of their personnel and/or companies would be mentioned in its report.

The preliminary survey instrument was modified, based on the comments, and copies were mailed on December 31, 1981, to either the personnel directors or the industrial relations directors of another set of 169 companies consisting of 93 manufacturing and 76 public utility companies. This second mailing yielded a 64% (of 169 companies) return rate out of which 54 companies (22 manufacturing and 32 public utility) indicated a willingness to participate in the study. As a result of follow-up letters on January 22, 1982, to nonresponding chief executives, personnel, and industrial relations directors from the first and second mailings, 22 more companies (17 manufacturing and 5 public utility) returned the completed instruments. Out of these late respondents, eight companies (6 manufacturing and 2 public utility) indicated the willingness to take part in the study. In summary, out of the 333 companies surveyed through the preliminary survey instruments, 62% (i.e., 205 companies) responded. The total number of companies which indicated the willingness to participate in the
study, and which constituted the selected samples for this study, was 109 (made up of 47 manufacturing and 62 public utility companies). The preliminary survey instruments and the letters which accompanied them appear in Appendix A.

Attempts to get some of the largest industrial corporations (manufacturing) listed in Levine (1981) to participate in the study were unsuccessful. Only 3 of the 30 corporations surveyed through the preliminary survey instruments agreed to take part in the study. The other corporations declined to participate either because of the complexities of their programs or the nonavailability of time.

The Research Hypotheses

The following hypotheses, which helped to focus the research study, were formulated prior to the development of the main research instrument:

1. There are no significant mean differences among the public utility and manufacturing companies concerning their ratings for the goals of skills and technical training.

   Ho: \( \mu_{pu} = \mu_m \)

   Ha: \( \mu_{pu} \neq \mu_m \) where: \( pu = \) public utility companies \( m = \) manufacturing companies
2. There are no significant mean differences among the public utility and manufacturing companies in regard to the amount of money spent in skills and technical training during the previous year.

   \[ H_0: \mu_{pu} = \mu_m \]

   \[ H_a: \mu_{pu} \neq \mu_m \]

3. There are no significant mean differences among the public utility and manufacturing companies in terms of their ratings for the variables influencing skills and technical training decisions.

   \[ H_0: \mu_{pu} = \mu_m \]

   \[ H_a: \mu_{pu} \neq \mu_m \]

4. There are no significant mean differences among the three sizes of companies concerning their ratings for the goals for skills and technical training.

   \[ H_0: \mu_1 = \mu_2 = \mu_3 \]

   \[ H_a: \text{At least two of the } \mu \text{s are different} \]

5. There are no significant mean differences among the three sizes of companies in regard to the estimated amount of money spent in skills and technical training during the previous year.

   \[ H_0: \mu_1 = \mu_2 = \mu_3 \]

   \[ H_a: \text{At least two of the } \mu \text{s differ} \]

6. There are no significant mean differences among the three sizes of companies in terms of their ratings of the factors influencing skills and technical training decisions.

   \[ H_0: \mu_1 = \mu_2 = \mu_3 \]

   \[ H_a: \text{At least two of the } \mu \text{s differ} \]
7. The level of usage of 15 training methods and techniques in skills and technical training is not related to:

a. The estimated amount of money spent in skills and technical training during the previous year
b. The estimated number of trainees per year
c. The classification of the company
d. The size of a company

Ho: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$

Ha: All the regression coefficients are not simultaneously equal to zero

The Development of the Main Research Instrument

Because of the wide geographical distribution of the samples, as well as the consideration of the time that would be involved in conducting personal interviews in the selected companies, it was decided that the research data would be collected by using a questionnaire. In the construction of the questionnaire, the ideas obtained from several authors (Carroll et al., 1972; Clark and Sloan, 1958; Department of Labor, 1971; Harvey, 1980; Wenig and Wolansky, 1972) were utilized. Care was taken to include all the details related to each of the hypotheses in the questionnaire. The final questionnaire, which was constructed and reviewed several times, contained 25 questions. The questionnaire appears in Appendix B.
The Collection of Data

The questionnaire was mailed on February 4, 1982, to the contact persons (as identified by executives on the returned preliminary survey instrument) of each of the selected sample companies. The questionnaire was accompanied by a letter which requested the contact persons to complete and return the questionnaire within two weeks. A self-addressed, stamped envelope was also provided for use by the contact persons in returning the completed questionnaire.

At the end of three weeks, only 56 out of the 109 contact persons had returned the completed questionnaire, giving an initial response rate of 51%. Two other contact persons called to indicate that their skills and technical training programs were set up in such a way that it would not allow their further participation in the study. A letter was mailed (see Appendix A) to those contact persons who had not returned the completed questionnaire by February 25, 1982. The letter requested them to complete and return the instrument before March 14, 1982, in the stamped, self-addressed envelope provided. Another copy of the questionnaire also accompanied the letter in case the first copy was forwarded in-plant to a different contact person. As a result of this exercise, 32 more questionnaires were returned, giving a final response rate of 84% (made up of 51 public utilities and 41 manufacturing companies).
The Analysis of Data

It was discovered that about 5% of the returned main research instruments did not contain useful information, thereby making them unusable. The data from the usable instruments were coded on the Iowa State University Computation Center Student Coding Form from which the data were punched on cards. The data on cards were transferred to disc storage for two reasons: (1) to protect the data from being lost due to possible loss of cards, and (2) to facilitate the use of Wylbur to process the data on the Statistical Package for the Social Sciences (SPSS) subprograms and the Statistical Analysis System (SAS) procedures.

The tests of the null hypotheses formulated for this study were preceded by the tests to ascertain whether each of the following sets of data came from normal population or not. The sets of data were:

1. Data for the estimated amount of money spent in skills and technical training during the previous year
2. Data for the estimated number of skills and technical trainee per year
3. Data for the estimated man-hours of skills and technical training per year
4. Data for the estimated cost per hour for each skills and technical trainee
5. Data for the total number of staff in skills and technical training.

**Procedure for testing for the normality of distributions**

The observed data points for each of the five sets of data were ordered from smallest to largest (i.e., in the form $X(1), X(2), X(3), \ldots, X(n)$, where there were $n$ data points and $X(1) \leq X(2) \leq X(3) \leq \ldots \leq X(n)$. The rankits (i.e., the expected ordered statistics from a standard normal distribution in the form of $m_1, m_2, m_3, \ldots, m_n$ where $m_1 \leq m_2 \leq m_3 \leq \ldots \leq m_n$) for each data point in each of the five sets of data were also obtained. The rationale adopted here was that if any of the sets of data came from a normal distribution, then the points in the rankit plot (i.e., a plot of $X_i$ vs $m_i$) should be close to being on a straight line. This meant that the sample correlation coefficient between the ordered data and the rankits should be close to one. This correlation coefficient (i.e., the Shapiro-Wilk statistic ($W$)) was calculated in the following way:

$$W = \left( \frac{\sum_{i=1}^{n} (X(i) - \bar{X})(m_i - \bar{m})}{\sqrt{\sum_{i=1}^{n} (X(i) - \bar{X})^2 \sum_{i=1}^{n} (m_i - \bar{m})^2}} \right)^2$$

Shapiro-Wilk statistics that were very close to one (say $\geq .9$) were accepted as being indicative of the sets of data coming from a normal distribution. The Statistical Analysis System
(SAS) procedures utilized in these tests included the SORT and the PRINT procedures (see Appendix C).

The following are the statistical procedures engaged in the test of each of the null hypotheses for the study:

1. For hypotheses 1, 2 and 3, the null hypotheses (Ho) were tested against the alternative hypotheses (Ha) using a student t-test. Because the two samples were independent, the following t-test statistic was employed:

\[
t = \frac{\bar{X}_p - \bar{X}_m}{\sqrt{(N_p - 1)S^2_p + (N_m - 1)S^2_m \frac{1}{N_p} + \frac{1}{N_m}}} \sqrt{N_p + N_m - 2}
\]

where \( \bar{X}_p \) and \( \bar{X}_m \) are the means of the public utility and manufacturing companies' scores, respectively

\[S^2_p\] is the sample variance for the public utility companies

\[S^2_m\] is the sample variance for the manufacturing companies

\[N_p\] is the size of the sample from the public utility companies

\[N_m\] is the size of the sample from the manufacturing companies

The null hypotheses (Ho) were rejected for \( t \geq t_{\alpha/2} \) with \( N_p + N_m - 2 \) degrees of freedom. The selected level of significance (\( \alpha \)) was .05.
2. For hypotheses 4, 5 and 6, the null hypotheses (Ho) were tested against the alternative hypotheses (Ha) using an F test. The test statistic applied was:

\[ F = \frac{\text{mean square between sizes}}{\text{mean square within sizes}} \]

The null hypotheses were rejected for \( F \geq F_{1-\alpha} \), with \((K - 1)\) and \((n - k)\) degrees of freedom, where \( K \) is the number of sizes, and \( n \) is the total number of cases. However, it should be noted that the estimated amount of money spent on skills and technical training during the previous year (as reported by the different companies) constituted a set of data which was not normally distributed. Because of this situation, a logarithmic (log) transformation of this variable had to be carried out before performing the analysis of variance F test for hypothesis 5. Log transformation, to be more specific, was taken in order to "normalize" the non-normally distributed variable.

Concerning hypothesis 4, the eight goals of skills and technical training were factor analyzed using the SPSS FACTOR procedure with varimax rotation and principal iteration options. This was done with the purpose of constructing new composite variables (factors) for use in performing the F test for the hypothesis. However, the varimax rotated factor matrix did not contain composite variables, so each of the eight goals was used as the dependent variable for the F test.
Concerning hypothesis 5, the 13 variables influencing training decisions were also factor analyzed using the Statistical Package for the Social Sciences (SPSS) FACTOR procedure with varimax rotation and principal iteration options. Each of the five composite variables (factors) which emerged from the factor analysis was used as the dependent variable when carrying out the F-test for the hypothesis.

3. For hypothesis 7, the null hypothesis (Ho) was tested against the alternative hypothesis (Ha) using a multiple regression analysis overall F-test with the following model:

\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + E \]

where \( Y \) is the level of usage of the training methods and techniques.

- \( X_1 \) is the estimated amount of money spent in skills and technical training during previous year.
- \( X_2 \) is the estimated number of skills and technical trainees per year.
- \( X_3 \) is the classification of company coded as:
  \[ X_3 = \begin{cases} 1 & \text{if manufacturing company} \\ 0 & \text{if public utility company} \end{cases} \]
- \( X_4 \) is the size of company coded as:
  \[ X_4 = \begin{cases} 2 & \text{if 500 to 4999 employees} \\ 3 & \text{if 5000 to 9999 employees} \\ 4 & \text{if 10,000 employees or more} \end{cases} \]
$X_5$ is the interaction between $X_3$ and $X_4$.

Because the number of skills and technical trainees per year, as well as the estimated amount of money spent in skills and technical training during the previous year (as reported by the samples), were not normally distributed, data transformations (log) had to be carried out before performing the overall F-test of the multiple regression analysis.

**The multiple regression analysis procedure**

The 15 training methods and techniques were factor analyzed using the SPSS FACTOR procedure with varimax rotation and principal iteration options. However, one of the training methods (sandwich method) was dropped from the analysis because it contained 30 missing cases. Multiple regression was run on each of the five factors which emerged from the remaining 14 training methods and techniques.

**Other procedures of the SPSS system utilized**

Apart from the FACTOR and the REGRESSION procedures used in the multiple regression analysis, other SPSS procedures utilized in the analysis of this research data were:

1. The T-TEST procedure for testing hypotheses 1, 2 and 3
2. The ONEWAY procedure for testing hypotheses 4, 5 and 6
3. The FREQUENCY procedure used in summarizing some
of the categorical data in percentages and some of continuous data for which the mean, median, standard deviation and the range were required.
CHAPTER IV. FINDINGS

The findings of this study, presented in this chapter, have been structured into the following sections:

1. Findings related to the normality of the distributions of some of the data
2. Findings that were general
3. Findings related to the research hypotheses

Findings Related to the Normality of the Distributions of Some of the Data

The Shapiro-Wilk statistic ($w$) computed for each of the variables—estimated amount of money spent in skills and technical training during the previous year and the estimated number of skills and technical trainees per year—did not indicate that the data for the variables came from a normal population. However, the logarithmic transformations of the sets of data improved the normality of the distributions. The results of the normality tests are presented in Tables 1 and 2.

Because of the violation of the normality assumption, logarithmic transformations of the two variables were used for testing some of the hypotheses for this study. Three other variables—estimated man-hours of skills and technical training per year, estimated cost per hour per trainee, and the total number of staff in skills and technical training—
Table 1. Normality test table for the variable: Estimate of money spent in skills/technical training during previous year, by company classification

<table>
<thead>
<tr>
<th></th>
<th>Moments (untransformed data)</th>
<th>Moments (log transformed data)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Classification</td>
<td>Classification</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>N</td>
<td>42</td>
<td>27</td>
</tr>
<tr>
<td>Mean</td>
<td>1166302</td>
<td>812822</td>
</tr>
<tr>
<td>St. dev.</td>
<td>1953628</td>
<td>2343984</td>
</tr>
<tr>
<td>Skewness</td>
<td>1.95042</td>
<td>4.5271</td>
</tr>
<tr>
<td>Variance</td>
<td>3.817E+10</td>
<td>5.494E+12</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>2.62302</td>
<td>21.8162</td>
</tr>
<tr>
<td>W: Normal</td>
<td>0.624854</td>
<td>0.378638</td>
</tr>
</tbody>
</table>

Table 2. Normality test table for the variable: Estimated number of skills/technical trainees per year, by company classification

<table>
<thead>
<tr>
<th></th>
<th>Moments (untransformed data)</th>
<th>Moments (log transformed data)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Classification</td>
<td>Classification</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>N</td>
<td>45</td>
<td>32</td>
</tr>
<tr>
<td>Mean</td>
<td>1243.53</td>
<td>780.75</td>
</tr>
<tr>
<td>St. dev.</td>
<td>3038.27</td>
<td>2663.39</td>
</tr>
<tr>
<td>Skewness</td>
<td>4.33355</td>
<td>5.22902</td>
</tr>
<tr>
<td>Variance</td>
<td>9231110</td>
<td>7093662</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>20.6634</td>
<td>28.5082</td>
</tr>
<tr>
<td>W: Normal</td>
<td>0.420081</td>
<td>0.314037</td>
</tr>
</tbody>
</table>
also violated the assumption that their data came from normal populations. Results of the normality tests are presented in Tables 3 to 5.

The logarithmic transformations of the three variables (presented in Tables 3 to 5) were also used to artificially normalize the nonnormally distributed variables.

Table 3. Normality test table for the variable: Estimated man-hours of skills and technical training per year, by company classification

<table>
<thead>
<tr>
<th>Moments</th>
<th>Classification</th>
<th>Moments</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>(untransformed data)</td>
<td></td>
<td>(log transformed data)</td>
<td></td>
</tr>
<tr>
<td>Public utility</td>
<td>39</td>
<td>Public utility</td>
<td>39</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>24</td>
<td>Manufacturing</td>
<td>24</td>
</tr>
<tr>
<td>Mean</td>
<td>76886.4</td>
<td>4.28397</td>
<td>3.62086</td>
</tr>
<tr>
<td>St. dev.</td>
<td>134101</td>
<td>146063</td>
<td>0.792892</td>
</tr>
<tr>
<td>Skewness</td>
<td>2.72691</td>
<td>3.82557</td>
<td>0.124627</td>
</tr>
<tr>
<td>Variance</td>
<td>1.798E+10</td>
<td>2.133E+10</td>
<td>0.628678</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>7.97960</td>
<td>15.4137</td>
<td>-1.01546</td>
</tr>
<tr>
<td>W: Normal</td>
<td>0.617348</td>
<td>0.417764</td>
<td>0.955368</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.961555</td>
</tr>
</tbody>
</table>
Table 4. Normality test table for the variable: Estimated cost per hour for each skills/technical trainee, by company classification

<table>
<thead>
<tr>
<th></th>
<th>Moments (untransformed data)</th>
<th>Moments (log transformed data)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Public utility</td>
<td>Manufacturing</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>N</td>
<td>34</td>
<td>25</td>
</tr>
<tr>
<td>Mean</td>
<td>33.5588</td>
<td>23.88</td>
</tr>
<tr>
<td>St. dev.</td>
<td>100.966</td>
<td>48.6615</td>
</tr>
<tr>
<td>Skewness</td>
<td>5.67561</td>
<td>4.1153</td>
</tr>
<tr>
<td>Variance</td>
<td>10194.1</td>
<td>2367.94</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>32.7216</td>
<td>17.7403</td>
</tr>
<tr>
<td>W: Normal</td>
<td>0.266906</td>
<td>0.376628</td>
</tr>
</tbody>
</table>

Table 5. Normality test table for the variable: Total number of staff in skills/technical training, by company classification

<table>
<thead>
<tr>
<th></th>
<th>Moments (untransformed data)</th>
<th>Moments (log transformed data)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Public utility</td>
<td>Manufacturing</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>N</td>
<td>46</td>
<td>28</td>
</tr>
<tr>
<td>Mean</td>
<td>37.8182</td>
<td>7.64286</td>
</tr>
<tr>
<td>St. dev.</td>
<td>108.917</td>
<td>8.25615</td>
</tr>
<tr>
<td>Skewness</td>
<td>4.22377</td>
<td>2.03871</td>
</tr>
<tr>
<td>Variance</td>
<td>11862.9</td>
<td>68.164</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>17.9916</td>
<td>4.45629</td>
</tr>
<tr>
<td>W: Normal</td>
<td>0.361521</td>
<td>0.760364</td>
</tr>
</tbody>
</table>
Findings That Were General

Out of the 86 companies that provided useful information through the main research instrument, 74.4% or 64 companies had between 500 and 4,999 employees, 8 companies or 9.3% had between 5,000 and 9,999 employees, and 14 companies or 17.3% had 10,000 or more employees. Table 6 summarizes the findings concerning items 2 to 6 of the main research instrument (see Appendix B).

Table 6. Summary of findings concerning items 2 to 6 on the main research instrument

<table>
<thead>
<tr>
<th>Item</th>
<th>Range</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Estimate of money spent in skills/technical training during the previous year</td>
<td>$2000-$12 million</td>
<td>$146,678</td>
</tr>
<tr>
<td>3. Estimated number of skills/technical trainees per year</td>
<td>2-17,693</td>
<td>200</td>
</tr>
<tr>
<td>4. Estimated man-hours of skills/technical training per year</td>
<td>80-65,000</td>
<td>10,000</td>
</tr>
<tr>
<td>5. Estimated cost per hour for each skills/technical trainee</td>
<td>$1-$600</td>
<td>$12</td>
</tr>
<tr>
<td>6. Total number of staff in skills/technical training</td>
<td>1-580</td>
<td>6</td>
</tr>
</tbody>
</table>

The means of the six items in the Table (Table 6) were not presented because they were not considered to be a good
descriptive index of the items due to the nonnormal distributions of the data. The median is more useful as an indicator of the distribution for each item.

Rather than being concerned with skills and technical training instruction only, instructors in 77.9% of the 86 companies were responsible for such extra duties as production, supervision and management, safety inspection, engineering duties, and quality control. This was an indication that, in most of the companies, management and supervision personnel as well as engineers had skills and technical training instruction as part of their duties or vice versa (i.e., instructors had management, supervision or engineering duties as part of their duties). In fact, 53.7% of these companies where instructors were responsible for other duties were public utility companies while 46.3% were manufacturing companies.

Furthermore, that the skills and technical training instruction did not constitute a full-time job for some of the staff in many of the public utility and manufacturing companies was evident in the results of the analysis of the responses to the question, "Are other instructional specialists employed from outside this company on a part-time basis?" Results of the analysis showed that 54 companies or 62.8% of the companies employed part-time instructors. The sources of these part-time personnel, presented in Table 7, also revealed
<table>
<thead>
<tr>
<th>Source of employment</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other similar institutions</td>
<td>5</td>
<td>5.8</td>
</tr>
<tr>
<td>Public institutions</td>
<td>35</td>
<td>40.7</td>
</tr>
<tr>
<td>Other sources(^a)</td>
<td>33</td>
<td>38.4</td>
</tr>
</tbody>
</table>

\(^a\)Other sources of employment were: training consultancies, and equipment manufacturers and vendors.

Table 7. Percentage of companies employing part-time instructors from different sources

that both the public utility and the manufacturing companies depended, to some extent, on the public schools to staff their skills and technical training departments. In fact, that source (i.e., public institutions) was the most common source of employment of part-time instructors by the responding companies.

The location of skills and technical training facilities used by the companies was another indicator of the interaction between the public schools and industry. Analysis of the responses regarding whether or not all the skills and technical training facilities were located inside the different companies revealed that of the 84 companies responding to this question, 45 companies or 52.3% did not have all the facilities located within their plants. Also, an analysis of the outside facilities used by these 45 companies showed that the facilities owned by the public schools were the most
commonly used outside facilities. More specifically, the outside facilities were owned:

1. By the responding companies in 19.8% of the cases.
2. By the public institutions in 34.9% of the cases.
3. By other similar companies in 15.1% of the cases.
4. By the government in 4.7% of the cases.
5. By equipment manufacturers and vendors in 5.8% of the cases.

In selecting the contents for skills and technical training, the companies used a combination of methods. However, the needs assessment method was used more frequently by the companies than any other method (see Table 8). Since the methods used to select contents are, more often than not, dictated by the objectives of the activity, Table 8 indicates that the skills and technical training conducted by the companies were, as expected, directed more toward the company's needs than toward the individual's needs.

Table 8. Percentage of companies using specific method to select course content

<table>
<thead>
<tr>
<th>Method</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task analysis</td>
<td>52</td>
<td>60.5</td>
</tr>
<tr>
<td>Advisory committee</td>
<td>33</td>
<td>38.4</td>
</tr>
<tr>
<td>Needs assessment</td>
<td>60</td>
<td>69.8</td>
</tr>
<tr>
<td>Creative insight</td>
<td>25</td>
<td>29.1</td>
</tr>
<tr>
<td>Previous experience</td>
<td>49</td>
<td>57.0</td>
</tr>
</tbody>
</table>
The situation regarding the determination of skills and technical training results in the various companies was similar to the situation concerning the selection of course contents in that a combination of methods was used. Analysis of the responses to this item showed that 63 companies or 73.3% of the respondents used formal tests which, in some cases, included both pre- and post-tests as well as skills tests. Observing trainees as they worked on their variously assigned jobs was a method of evaluating the results of training utilized by 65 companies (75.6%), while 66 companies or 76.7% of the respondents used the reports of supervisors and foremen concerning trainees or the products of the skills and technical training programs who were assigned to work with the supervisors and foremen. The quality of the products and services produced by 25 companies, or 29.1% of the respondents, was also a method used by those companies to evaluate the effectiveness of their skills and technical training programs.

The question, "Does your company utilize any form of government assistance in skills/technical training?" was asked to determine whether or not many companies used some of the manpower development programs such as the government sponsored programs provided under the Manpower Development and Training Act, Comprehensive Employment and Training Act, and the Economic Opportunity Act. However, the situation
concerning the use of these programs was lower than the percentage reported by the Department of Labor in 1971. Only 11 companies or 12.8% of the 85 companies which responded to this question indicated that they utilized government support in their skills and technical training programs. The forms of government support utilized by these companies included veterans' benefits for apprentices and on-the-job trainees, as well as state support for apprentice training in public institutions. Other comments which indicated the forms of government support utilized by some companies were: "We have a contract under the Comprehensive Employment and Training ACT (CETA) to train and to hire CETA eligible individuals" and "We have a Department of Labor approved apprenticeship training program." In fact, a manufacturing company indicated that it had a grant from the Irish government for skills and technical training related to its plants in Ireland.

Limited use of government support indicated that most of the companies surveyed in this study did not want government's participation in the skills and technical training programs of private enterprises. This indication was further confirmed by the responses of the companies concerning whether or not they would like more participation by the government in their skills and technical training programs. Only 6 companies or 7% of the respondents indicated that they would
like such participation. The following were the forms of supports which these 6 companies would like the government to operate:

1. Providing tax credit incentives to upgrade skills of the unemployed and the underemployed
2. Providing expanded vocational/technical programs in public schools
3. Providing quality technical education
4. Providing a system whereby trainees in industries could have related classroom instruction in the community colleges rather than having to be admitted into a full-time, two-year program by the colleges.

Responses to the question, "What, in your opinion, are the similarities and the differences between your company's skills/technical training and student experiences being presently provided through vocational education?" revealed the perception of vocational education by industry. More specifically, concerning similarities, there seemed to be a consensus among the companies that they and vocational education were doing a good job of teaching the fundamentals (i.e., the basic theory) of various trades. However, concerning differences, the companies were of the opinion that their skills and technical training programs were more geared toward the specific needs of their companies than vocational education was geared to provide to their employees. Other dif-
ferences, as stated by the companies included: (1) more on-the-job training experiences in skills and technical training of industries; (2) most vocational education programs use outdated delivery systems with ancient grading practices and minimal hands-on experiences; (3) objectives in vocational education are vague and unmeasurable; and (4) vocational education is 10 to 12 years behind the present technological applications. The comments, while one might not totally agree with them, suggested the need for more interaction between vocational education and industry, especially when 81 companies or 94.2% of the respondents were of the opinion that there would be greater emphasis and demand for skills and technical training in their companies during the next 10 years.

The nature of the interaction which industry and vocational education should embark upon seemed to be evident in the responses of the companies in regard to how they and vocational education could further cooperate to train students and future employees. The following were typical responses:

1. Company personnel could be employed to teach (part-time) vocational education students.

2. Vocational education should concentrate on the basic theory of trades while industry should assume responsibility for providing the skills needed on the job.
3. Vocational education and industry should share goals to catch up with technology.

4. Vocational education and industry should update each other concerning changes in technology.

5. Vocational instructors should be required to work in industry for a period of time before teaching.

6. Vocational education should increase the cooperative work experience of students.

Findings Related to the Research Hypotheses

The following were the findings related to the seven hypotheses formulated for this research study.

**Hypothesis 1**

It was hypothesized that there would be no significant mean differences between the two samples (public utility and manufacturing companies) in terms of their ratings for each of the eight goals (see Appendix B) of skills and technical training. The results of the t-tests (presented in Tables 9 and 10) showed that the two sets of companies differed from each other in regard to two of the eight goals—namely, increasing stability of employment and increasing safety in the work environment. The results indicated further that:

1. Manufacturing companies were more concerned about the stability of their skills and technical personnel employment than public utility companies were.

2. Public utility companies were more concerned about safety in their work environments than manufacturing
Table 9. Analysis of the ratings for Goal 2 (increasing stability of employment) by company classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>T-value</th>
<th>DF</th>
<th>2-tail prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>35</td>
<td>4.20</td>
<td>0.58</td>
<td>2.05</td>
<td>81</td>
<td>.04</td>
</tr>
<tr>
<td>Public utility</td>
<td>48</td>
<td>3.77</td>
<td>1.13</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Ratings were based on a Likert scale (1-5).*

*α = .05.*

Table 10. Analysis of the ratings for Goal 3 (increasing safety in the work environment) by company classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>T-value</th>
<th>DF</th>
<th>2-tail prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>35</td>
<td>4.40</td>
<td>0.85</td>
<td>-3.02</td>
<td>82</td>
<td>.003</td>
</tr>
<tr>
<td>Public utility</td>
<td>49</td>
<td>4.82</td>
<td>0.39</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Ratings were based on a Likert scale (1-5).*

*α = .05.*
companies were.

Although no significant mean differences were found between the two sets of companies concerning the remaining six of the eight goals, it is worth noting that each of the six goals was important to the two samples in regard to skills and technical training. The total mean value for each of the goals as well as the rank of each of the goals are presented in Table 11.

**Hypothesis 2**

Hypothesis 2 stated that there would be no significant mean differences between the public utility and the manufacturing companies in terms of the estimated amount of money spent in skills and technical training during the previous year. The results of the t-test for this hypothesis (presented in Table 12) was significant at the .05 level.

However, as the means of the estimates for the two samples (see Table 12) showed, the public utility companies spent more money in skills and technical training than the manufacturing companies did during the previous year.

**Hypothesis 3**

It was hypothesized that there were no significant mean differences between the public utility and the manufacturing companies in terms of their ratings for each of the 13 variables (see Appendix B) influencing training decisions. The
Table 11. Analysis of the ratings for six of the eight goals of skills/technical training by company classification

<table>
<thead>
<tr>
<th>Goal</th>
<th>Classification</th>
<th>Mean value</th>
<th>Mean value (total)</th>
<th>Rank</th>
<th>DF</th>
<th>T-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing the productivity level of employees</td>
<td>Manufacturing</td>
<td>4.77</td>
<td>4.80</td>
<td>1</td>
<td>83</td>
<td>-0.51</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>4.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increasing the ability to cope with new technology</td>
<td>Manufacturing</td>
<td>4.18</td>
<td>4.29</td>
<td>2</td>
<td>82</td>
<td>-1.59</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>4.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providing a means for motivating employees</td>
<td>Manufacturing</td>
<td>3.97</td>
<td>3.95</td>
<td>3</td>
<td>82</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>3.92</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increasing the ability to get along with co-workers</td>
<td>Manufacturing</td>
<td>3.74</td>
<td>3.82</td>
<td>4</td>
<td>81</td>
<td>-0.77</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>3.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providing a means for meeting spot needs or emergency developments</td>
<td>Manufacturing</td>
<td>3.63</td>
<td>3.73</td>
<td>5</td>
<td>82</td>
<td>-1.30</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>3.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providing a means for raising the educational level of employees</td>
<td>Manufacturing</td>
<td>3.49</td>
<td>3.54</td>
<td>6</td>
<td>81</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>3.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 12. Analysis of the estimated amount of money spent in skills/technical training during the previous year by company classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>T-value</th>
<th>DF</th>
<th>2-tail prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>27</td>
<td>4.91</td>
<td>1.00</td>
<td>2.33</td>
<td>67</td>
<td>0.03</td>
</tr>
<tr>
<td>Public utility</td>
<td>42</td>
<td>5.40</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results were based on a logarithmic transformation of the estimated amount of money spent in skills/technical training during the previous year.

\[ \alpha = 0.05. \]

T-tests for this hypothesis showed significant mean differences concerning four of the 13 variables at the .05 level (results are presented in Tables 13 to 16).

Table 13. Analysis of the ratings for Variable 1 (demand for labor) by company classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>T-value</th>
<th>DF</th>
<th>2-tail prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>34</td>
<td>3.92</td>
<td>1.19</td>
<td>3.63</td>
<td>79</td>
<td>0.01</td>
</tr>
<tr>
<td>Public utility</td>
<td>47</td>
<td>3.11</td>
<td>1.46</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ \alpha = 0.05. \]
Table 14. Analysis of the ratings for Variable 4 (labor turnover) by company classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>T-value</th>
<th>DF</th>
<th>2-tail prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>34</td>
<td>3.65</td>
<td>1.04</td>
<td>3.63</td>
<td>79</td>
<td>0.001</td>
</tr>
<tr>
<td>Public utility</td>
<td>47</td>
<td>2.70</td>
<td>1.23</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a_\alpha = .05.

Table 15. Analysis of the ratings for Variable 9 (reaction of customers to products and services) by company classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>T-value</th>
<th>DF</th>
<th>2-tail prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>35</td>
<td>3.57</td>
<td>1.17</td>
<td>3.19</td>
<td>79</td>
<td>0.002</td>
</tr>
<tr>
<td>Public utility</td>
<td>46</td>
<td>2.70</td>
<td>1.26</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a_\alpha = .05.
Table 16. Analysis of the ratings for Variable 13 (tax credit incentive) by company classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>T-value</th>
<th>DF</th>
<th>2-tail prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>34</td>
<td>1.94</td>
<td>0.92</td>
<td>2.24</td>
<td>58</td>
<td>0.03</td>
</tr>
<tr>
<td>Public utility</td>
<td>44</td>
<td>1.52</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

^Separate variance estimate was used because the variance for the two classifications were not equal (probability of F < .05).

^Degree of freedom (DF) was approximated from 57.79 to 58.

Much emphasis could not be placed on the significance of the t-statistic for factor 13 (tax credit incentives) because of the abnormality of the data (i.e., unequal variances) which made the statistic an approximation of the t-value. However, it was inferred from the rest of the results (i.e., Tables 13 to 15) that the manufacturing companies were more influenced than the public utility companies by the three variables—labor turnover, reaction of customers to products and services, and demand for labor—in regard to the decisions to conduct, expand, or reduce skills and technical training in their companies.

It is also worth noting (see Table 17) that, although significant mean differences were not found between the
Table 17. Analysis of the ratings for nine of the 13 variables influencing skills/technical training decisions by company classification

<table>
<thead>
<tr>
<th>Variable</th>
<th>Classification</th>
<th>Mean value</th>
<th>Mean value (total)</th>
<th>Rank</th>
<th>DF</th>
<th>T-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skills shortages</td>
<td>Manufacturing</td>
<td>4.12</td>
<td>4.04</td>
<td>1</td>
<td>76</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>3.96</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emerging technology</td>
<td>Manufacturing</td>
<td>3.76</td>
<td>3.85</td>
<td>2</td>
<td>77</td>
<td>-0.74</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>3.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company growth</td>
<td>Manufacturing</td>
<td>4.00</td>
<td>3.83</td>
<td>3</td>
<td>78</td>
<td>1.62</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>3.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of funds for training</td>
<td>Manufacturing</td>
<td>3.21</td>
<td>3.18</td>
<td>4</td>
<td>79</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>3.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substitutability of skills</td>
<td>Manufacturing</td>
<td>3.26</td>
<td>3.11</td>
<td>5</td>
<td>77</td>
<td>1.28</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>2.96</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management style</td>
<td>Manufacturing</td>
<td>3.11</td>
<td>3.07</td>
<td>6</td>
<td>79</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>3.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dissatisfaction with public schools' products</td>
<td>Manufacturing</td>
<td>2.88</td>
<td>2.78</td>
<td>7</td>
<td>79</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>2.68</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dissatisfaction of employees</td>
<td>Manufacturing</td>
<td>2.70</td>
<td>2.57</td>
<td>8</td>
<td>77</td>
<td>1.26</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>2.43</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bargaining with craft unions</td>
<td>Manufacturing</td>
<td>2.23</td>
<td>2.44</td>
<td>9</td>
<td>77</td>
<td>-1.57</td>
</tr>
<tr>
<td></td>
<td>Public utility</td>
<td>2.65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
public utility and manufacturing companies regarding the remaining nine of the 13 variables affecting skills and technical training decisions, the following three variables were important to both sets of companies:

1. Skills shortages,
2. Emerging technology,

Hypothesis 4

Hypothesis 4 stated that there were no significant mean differences among the three sizes of companies concerning their ratings for each of the goals of skills and technical training. The results of the analysis for the ratings (presented in Table 18) showed that there were differences among the company sizes regarding Goal 4—increasing the ability to cope with new technology. When the multiple range test (Scheffé) was performed, companies of size 1 were different from companies of size 3 in terms of the mean ratings for Goal 4 of skills and technical training at the .05 level.

The total mean value for each of the remaining seven goals, presented in Table 19, indicated that regardless of size of company, the goals were important in skills and technical training conducted in the public utility and manufacturing companies. It is also worth noting (see Table 19) that some of the goals were more important than others. More specifically, the two very important goals in skills
Table 18. Analysis of variance of the ratings for Goal 4 (increasing the ability to cope with new technology) by company size

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>DF</th>
<th>SS</th>
<th>MS</th>
<th>F^b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>3.78</td>
<td>1.89</td>
<td>5.09</td>
</tr>
<tr>
<td>Within groups</td>
<td>80</td>
<td>29.69</td>
<td>0.37</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>82</td>
<td>33.47</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

^aThe number of companies (in this analysis) constituting each size, as well as the mean and the standard deviation of the ratings were as follows:

<table>
<thead>
<tr>
<th>Size</th>
<th>DF</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>62</td>
<td>4.18</td>
<td>0.64</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>4.71</td>
<td>0.49</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>4.64</td>
<td>0.50</td>
</tr>
</tbody>
</table>

^bProbability of F = .008.

and technical training of the three sizes of companies were:

1. Increasing the productivity level of employees,
2. Increasing safety in the work environment.

Hypothesis 5

It was hypothesized that there would be no significant mean differences among the three company sizes in terms of the estimated amount of money spent in skills and technical training during the previous year. The results of the test of this hypothesis are presented in Table 20. When the multiple range test (Scheffé) was performed, companies of
Table 19. Analysis of the ratings for seven of the eight goals of skills/technical training by company size

<table>
<thead>
<tr>
<th>Goal</th>
<th>Size</th>
<th>Mean value</th>
<th>Mean value (total)</th>
<th>Rank</th>
<th>DF</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing the productivity level of employees</td>
<td>1</td>
<td>4.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>5.00</td>
<td>4.80</td>
<td>1</td>
<td>2.81</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increasing safety in the work environment</td>
<td>1</td>
<td>4.65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4.86</td>
<td>4.64</td>
<td>2</td>
<td>2.80</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increasing the stability of employment</td>
<td>1</td>
<td>3.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4.17</td>
<td>3.94</td>
<td>3</td>
<td>2.79</td>
<td>1.43</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4.29</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providing a means for motivating employees</td>
<td>1</td>
<td>3.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4.43</td>
<td>3.93</td>
<td>4</td>
<td>2.80</td>
<td>2.18</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increasing the ability to get along with co-workers</td>
<td>1</td>
<td>3.71</td>
<td></td>
<td>5</td>
<td>2.79</td>
<td>2.46</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4.43</td>
<td>3.82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providing a means for meeting spot needs or emergency developments</td>
<td>1</td>
<td>3.69</td>
<td></td>
<td>6</td>
<td>2.80</td>
<td>1.02</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3.71</td>
<td>3.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providing a means for raising the educational level of employees</td>
<td>1</td>
<td>3.47</td>
<td></td>
<td>7</td>
<td>2.79</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3.57</td>
<td>3.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on a Likert scale (1-5).
Table 20. Analysis of variance of the estimated amount of money spent in skills/technical training during the previous year^a

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>DF</th>
<th>SS</th>
<th>MS</th>
<th>F^b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>20.70</td>
<td>10.35</td>
<td>17.90**</td>
</tr>
<tr>
<td>Within groups</td>
<td>66</td>
<td>38.15</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>68</td>
<td>58.85</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

^aThis analysis was based on a logarithmic transformation of the estimated amount spent in skills/technical training during the previous year as indicated by the companies. The number of companies comprising each size and the mean and the standard deviation of the estimated amount (log) of money spent in skills/technical training during the previous year were as follows:

<table>
<thead>
<tr>
<th>Size</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>49</td>
<td>4.86</td>
<td>0.81</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>5.79</td>
<td>0.60</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>6.18</td>
<td>0.62</td>
</tr>
</tbody>
</table>

^bProbability of F < .001.

size 1 were found to be different from companies of sizes 2 and 3 at the .05 level. In fact, companies of sizes 2 and 3, as one would expect, spent more money in formal, in-plant skills and technical training than did the companies of size 1 during the previous year.
Hypothesis 6

Hypothesis 6 stated: "There are no significant mean differences among the three sizes of companies in terms of their ratings for the variables influencing skills and technical training decisions." The results of the factor analysis which preceded the test of the hypothesis are presented in Table 21.

Table 21. Varimax rotated factor matrix of the 13 variables influencing skills/technical training decisions

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>0.85787</td>
<td>-0.00257</td>
<td>-0.03912</td>
<td>0.09331</td>
<td>0.19762</td>
</tr>
<tr>
<td>F2</td>
<td>0.07734</td>
<td>-0.16521</td>
<td>0.05903</td>
<td>0.28249</td>
<td>-0.47248</td>
</tr>
<tr>
<td>F3</td>
<td>0.40490</td>
<td>0.09484</td>
<td>0.17940</td>
<td>-0.29226</td>
<td>-0.06250</td>
</tr>
<tr>
<td>F4</td>
<td>0.59682</td>
<td>0.17861</td>
<td>-0.12070</td>
<td>0.04190</td>
<td>0.27961</td>
</tr>
<tr>
<td>F5</td>
<td>0.01367</td>
<td>-0.02127</td>
<td>0.60027</td>
<td>0.16479</td>
<td>-0.07130</td>
</tr>
<tr>
<td>F6</td>
<td>0.12842</td>
<td>0.10767</td>
<td>0.67172</td>
<td>0.00163</td>
<td>0.21300</td>
</tr>
<tr>
<td>F7</td>
<td>-0.20647</td>
<td>0.15721</td>
<td>0.39496</td>
<td>-0.14806</td>
<td>-0.30322</td>
</tr>
<tr>
<td>F8</td>
<td>0.14403</td>
<td>0.34491</td>
<td>0.05909</td>
<td>0.37883</td>
<td>-0.00345</td>
</tr>
<tr>
<td>F9</td>
<td>0.16306</td>
<td>0.95460</td>
<td>0.11068</td>
<td>-0.07301</td>
<td>-0.00475</td>
</tr>
<tr>
<td>F10</td>
<td>-0.06040</td>
<td>-0.05099</td>
<td>0.10152</td>
<td>0.71548</td>
<td>-0.05745</td>
</tr>
<tr>
<td>F11</td>
<td>0.18146</td>
<td>-0.09491</td>
<td>0.09020</td>
<td>0.05022</td>
<td>0.51029</td>
</tr>
<tr>
<td>F12</td>
<td>0.40437</td>
<td>-0.14726</td>
<td>0.22945</td>
<td>0.05037</td>
<td>0.18292</td>
</tr>
<tr>
<td>F13</td>
<td>0.38729</td>
<td>0.12258</td>
<td>0.00749</td>
<td>-0.02492</td>
<td>-0.08367</td>
</tr>
</tbody>
</table>
Examination of the factor matrix (Table 21) revealed that the 13 variables influencing skills and technical training decisions could be grouped into five composite factors as follows:

Factor A:

F1. Demand for labor
F3. Substitutability of skills
F4. Labor turnover
F12. Dissatisfaction with the products of public schools
F13. Tax credit incentives

Factor B:

F9. Reaction of customers to products and services

Factor C:

F5. Management style
F6. Company growth
F7. Emerging technology

Factor D:

F11. Skill shortages

Factor E:

F8. Dissatisfaction of employees
F10. Availability of funds

The results of the statistical tests for Hypothesis 6 using each of the composite factors (i.e., Factors A, B, C, D, and E) as the dependent variable and the three company sizes as the independent variables did not show any differ-
ences among the company sizes regarding their ratings for each of the five composite factors (i.e., Factors A, B, C, D, and E). However, when each of the 13 variables was used as the dependent variable in the statistical tests for Hypothesis 6, differences were found among the three sizes of companies concerning their ratings for two of the 13 variables affecting skills and technical training decisions. The two variables were (1) labor turnover, and (2) dissatisfaction with the products of public schools. Results of the analyses for the two variables are presented in Tables 22 and 23. When the multiple range test (Scheffe) was performed at the .05 level, companies of size 3 were found to be more influenced by labor turnover than the companies of size 2. Also, companies of size 1 were not so influenced as companies of size 3 concerning another variable—dissatisfaction with products of public schools.

It was further concluded by comparing the total mean values for each of the ratings (Table 24) that the following three of the 13 variables were important to the three company sizes in regard to training decisions:

1. Skills shortages
2. Emerging technology

Also, tax credit incentives did not seem to have much influence on the training decisions of the three sizes. The
Table 22. Analysis of variance of the ratings for Variable F4 (labor turnover) by three company sizes

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>DF</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>10.66</td>
<td>5.33</td>
<td>3.65</td>
</tr>
<tr>
<td>Within groups</td>
<td>77</td>
<td>112.54</td>
<td>1.46</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>79</td>
<td>123.20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The number of companies of which each size was constituted, as well as the mean and standard deviation of the ratings, were:

<table>
<thead>
<tr>
<th>Size</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>3.05</td>
<td>1.21</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>2.17</td>
<td>1.33</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>3.71</td>
<td>1.14</td>
</tr>
</tbody>
</table>

Probability of F = .03.

Table 23. Analysis of variance for the ratings of Variable F12 (dissatisfaction with the products of public schools) by company size

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>DF</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>10.25</td>
<td>5.13</td>
<td>3.86</td>
</tr>
<tr>
<td>Within groups</td>
<td>77</td>
<td>102.23</td>
<td>1.33</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>79</td>
<td>112.49</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The number of companies constituting each size, as well as mean and the standard deviation of the ratings, were as follows:

<table>
<thead>
<tr>
<th>Size</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>2.57</td>
<td>1.18</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>3.00</td>
<td>0.89</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>3.50</td>
<td>1.09</td>
</tr>
</tbody>
</table>

Probability of F = .03.
Table 24. Analysis of the ratings for 11 of the 13 variables influencing skills/technical training decisions by company size

<table>
<thead>
<tr>
<th>Variable</th>
<th>Size</th>
<th>Mean value&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mean value (total)</th>
<th>Rank</th>
<th>DF</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skills shortages</td>
<td>1</td>
<td>4.01</td>
<td>4.01</td>
<td>1</td>
<td>2.78</td>
<td>1.58</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4.21</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emerging technology</td>
<td>1</td>
<td>3.79</td>
<td>3.85</td>
<td>2</td>
<td>2.75</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4.33</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company growth</td>
<td>1</td>
<td>3.77</td>
<td>3.81</td>
<td>3</td>
<td>2.77</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demand for labor</td>
<td>1</td>
<td>3.44</td>
<td>3.43</td>
<td>4</td>
<td>2.77</td>
<td>1.20</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of funds for training</td>
<td>1</td>
<td>3.15</td>
<td>3.18</td>
<td>5</td>
<td>2.77</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substitutability of skills</td>
<td>1</td>
<td>3.03</td>
<td>3.06</td>
<td>6</td>
<td>2.75</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3.23</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management style</td>
<td>1</td>
<td>3.05</td>
<td>3.06</td>
<td>7</td>
<td>2.77</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3.17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Based on a Likert scale (1-5).
Table 24. (Continued)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Size</th>
<th>Mean value</th>
<th>Mean value (total)</th>
<th>Rank</th>
<th>DF</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaction of customers to products and services</td>
<td>1</td>
<td>3.07</td>
<td>3.05</td>
<td>8</td>
<td>2.77</td>
<td>1.87</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2.17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3.36</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dissatisfaction of employees</td>
<td>1</td>
<td>2.47</td>
<td>2.54</td>
<td>9</td>
<td>2.75</td>
<td>1.03</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bargaining with craft unions</td>
<td>1</td>
<td>2.53</td>
<td>2.47</td>
<td>10</td>
<td>2.75</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2.14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tax credit incentives</td>
<td>1</td>
<td>1.67</td>
<td>1.71</td>
<td>11</td>
<td>2.75</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
total mean value for the ratings (based on a Likert scale (1-5)) by the three company sizes was 1.7051.

**Hypothesis 7**

It was hypothesized that the level of usage of each of the composite factors of the 15 training methods and techniques in skills and technical training would not be related to (1) the estimated amount of money spent in skills and technical training during the previous year, (2) the estimated number of trainees per year, (3) the classification of the company, and (4) the size of the company. The results of the factor analysis of the 15 training methods and techniques (presented in Table 25) showed that the methods and techniques could be grouped into five composite factors.

The five composite factors were:

**Factor 1:**

4. Formal off-the-job training
8. Training devices and simulators
12. Lecture
13. Case study
14. Adjunctive programming
15. Role playing

**Factor 2:**

2. On-the-job training (OJT)
9. Job instruction training (JIT)
10. Conference or discussion
Table 25. Varimax rotated factor matrix of the 15 training methods and techniques

<table>
<thead>
<tr>
<th>Methods/techniques</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
<th>Factor 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.01930</td>
<td>-0.16259</td>
<td>0.78422</td>
<td>-0.07669</td>
<td>-0.22674</td>
</tr>
<tr>
<td>2</td>
<td>-0.16955</td>
<td>0.63135</td>
<td>-0.05583</td>
<td>-0.02293</td>
<td>0.06709</td>
</tr>
<tr>
<td>3</td>
<td>0.19309</td>
<td>-0.19990</td>
<td>0.79618</td>
<td>0.11932</td>
<td>0.07668</td>
</tr>
<tr>
<td>4</td>
<td>0.61131</td>
<td>-0.03002</td>
<td>0.07458</td>
<td>0.28998</td>
<td>0.08951</td>
</tr>
<tr>
<td>5</td>
<td>-0.01910</td>
<td>0.16383</td>
<td>0.09251</td>
<td>0.59857</td>
<td>0.12796</td>
</tr>
<tr>
<td>6</td>
<td>0.28196</td>
<td>0.05546</td>
<td>-0.10196</td>
<td>0.85089</td>
<td>0.06171</td>
</tr>
<tr>
<td>7</td>
<td>0.01261</td>
<td>-0.02199</td>
<td>-0.10167</td>
<td>0.16608</td>
<td>0.93040</td>
</tr>
<tr>
<td>8</td>
<td>0.53267</td>
<td>-0.11185</td>
<td>0.09399</td>
<td>0.44901</td>
<td>-0.02606</td>
</tr>
<tr>
<td>9</td>
<td>0.00713</td>
<td>0.55434</td>
<td>-0.21988</td>
<td>0.11695</td>
<td>-0.11722</td>
</tr>
<tr>
<td>10</td>
<td>0.46786</td>
<td>0.60699</td>
<td>0.03115</td>
<td>0.10723</td>
<td>0.25718</td>
</tr>
<tr>
<td>11</td>
<td>0.08233</td>
<td>0.60862</td>
<td>-0.06052</td>
<td>0.05855</td>
<td>-0.02666</td>
</tr>
<tr>
<td>12</td>
<td>0.54889</td>
<td>0.17089</td>
<td>0.41852</td>
<td>0.18135</td>
<td>0.26697</td>
</tr>
<tr>
<td>13</td>
<td>0.83647</td>
<td>0.11076</td>
<td>0.08090</td>
<td>0.06569</td>
<td>0.11688</td>
</tr>
<tr>
<td>14</td>
<td>0.71257</td>
<td>0.02741</td>
<td>-0.01127</td>
<td>0.05227</td>
<td>-0.07617</td>
</tr>
<tr>
<td>15</td>
<td>0.83284</td>
<td>-0.06346</td>
<td>0.09371</td>
<td>-0.05680</td>
<td>-0.09506</td>
</tr>
</tbody>
</table>
11. Coaching

Factor 3:
1. Vestibule training
12. Lecture

Factor 4:
5. Apprentice training
6. Integrated training (on- and off-the-job)

Factor 5:
7. Job rotation

The results of the multiple regression analysis (F-test) for Hypothesis 7, using each of the five distinct factors as the dependent variables, showed an overall F-significance (P < .01) in regard to Factor 1 (results presented in Table 26).

Table 26. Analysis of variance table for Factor 1 regressed on five independent variables

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>SS</th>
<th>MS</th>
<th>F^b</th>
<th>R^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>5</td>
<td>469.08</td>
<td>93.82</td>
<td>9.41**</td>
<td>0.51</td>
</tr>
<tr>
<td>Residual</td>
<td>45</td>
<td>448.84</td>
<td>9.97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

^aThe analysis was based on the logarithmic transformations of the estimated amount of money spent in skills and technical training during the previous year and the estimated number of skills/technical trainees per year.
^bProbability < .01.
The results of further analysis—i.e., the partial regression coefficients for each of the independent variables—revealed some additional information concerning the contributions of each of the independent variables to the prediction of the level of usage of Factor 1. The partial regression coefficient table (Table 27) shows:

1. That $X_2 = \text{estimated number of skills and technical trainees per year}$ significantly aided in predicting the level of usage of Factor 1 in skills and technical training.

2. That the addition of $X_3 = \text{classification (public utility or manufacturing)}$ significantly contributed to the prediction of $Y$ (level of usage of Factor 1 in skills and technical training) beyond what was made possible by $X_2$.

3. That the addition of $X_5 = \text{interaction between size and classification}$ significantly contributed to the prediction of Factor 1 in skills and technical training after accounting for the contributions of $X_2$ and $X_3$.

4. That the addition of $X_4 = \text{size of company}$ and $X_1 = \text{estimated amount of money spent in skills and technical training during the previous year}$ did not contribute significantly to the prediction of $Y$ (level of usage of Factor 1) beyond what was made possible by $X_2$, $X_3$, and $X_5$. 
Table 27. Partial regression coefficient table for Factor 1 regressed on five independent variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>Beta</th>
<th>Standard error of B</th>
<th>DF</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_2 = \text{(Estimated number of skills/technical trainees per year)}$</td>
<td>2.12</td>
<td>0.43</td>
<td>0.90</td>
<td>1.49</td>
<td>5.58*</td>
</tr>
<tr>
<td>$X_3 = \text{Classification}$</td>
<td>-10.56</td>
<td>-1.24</td>
<td>3.27</td>
<td>2.48</td>
<td>10.47**</td>
</tr>
<tr>
<td>$X_5 = \text{Interaction between classification and size}$</td>
<td>3.00</td>
<td>1.03</td>
<td>1.23</td>
<td>3.47</td>
<td>5.92*</td>
</tr>
<tr>
<td>$X_4 = \text{Size}$</td>
<td>-1.53</td>
<td>-0.28</td>
<td>1.13</td>
<td>4.46</td>
<td>1.84</td>
</tr>
<tr>
<td>$X_1 = \text{(Estimate of money spent in skills/technical training during pervious year)}$</td>
<td>-0.31</td>
<td>-0.28</td>
<td>0.87</td>
<td>5.45</td>
<td>0.13</td>
</tr>
</tbody>
</table>

*,**Significant at the .05 and .01 levels, respectively.
CHAPTER V. CONCLUSIONS, SUMMARY AND RECOMMENDATIONS

The problem of this study was to determine the nature and the extent of formal in-plant skills and technical training in selected public utility and manufacturing companies in the United States. The significant characteristic qualities which constituted the nature and the extent of such training were defined to include the following:

1. The goals of investment in training
2. The variables that influenced decisions to conduct, expand or decrease skills and technical training
3. The cost of training per hour per employee
4. The number of skills and technical trainees per year
5. The man-hours of training per year
6. The methods and techniques utilized in skills and technical training
7. The location of facilities for training purposes
8. The linkages of skills and technical training in the selected companies with public education.
9. The number of instructors
10. The type of government support utilized by the companies in skills and technical training
The purposes of the study were to obtain such information as could be useful to:

1. Industrial education administrators and teachers in making informed decisions concerning the improvement or the development of their technical training programs

2. Government agencies in having more accurate information in regard to the extent of the skills and technical training conducted in-plant by the public utility and manufacturing industries

Two samples—one from public utility companies, the other from manufacturing companies—were selected for this study. The criteria for selecting a company included:

1. Company had 500 or more employees

2. Company conducted formal in-plant skills and technical training

3. Company indicated a willingness to participate in the study

The main research instrument (questionnaire) was mailed to the contact persons for each of the companies in the two samples (47 manufacturing and 62 public utility companies). The two samples were selected from a set of 333 companies to whom original requests for participation in the study were sent. There was a final return (of instrument) rate of 84% made up of 51 public utility and 41 manufacturing companies.
However, 5% of the returned main research instrument were declared nonusable because they provided little or no information. Some of the data provided by the companies (e.g., estimated amount of money spent in skills/technical training in 1980, estimated number of trainees per year, and estimated man-hours of training) created situations whereby data transformations had to be undertaken because of the violations of the assumption of normality necessary for multivariate analysis.

Conclusions

The following were the conclusions, related to the hypotheses formulated for this research study.

**Hypothesis 1**

Hypothesis 1 in the null format stipulated that there would be no significant mean differences between the public utility and the manufacturing companies concerning their ratings for each of the goals of skills and technical training. Based on the findings related to this hypothesis (Tables 9 to 11), the null hypothesis was rejected and the following conclusions were drawn:

1. The two samples differed from each other in regard to one goal of skills and technical training—increasing the stability of employment. The sample composed of manufacturing companies considered the
goal to be more important in skills and technical training than did the sample composed of public utility companies.

2. The two samples differed concerning another goal of skills and technical training—increasing safety in the work environment. The goal was more important to the public utility companies than it was to the manufacturing companies.

3. Although each of the remaining six goals was important to the public utility and the manufacturing companies in regard to skills and technical training, the following goals were rated higher, on the average, than other goals:
   
a. Increasing the productivity level of employees (total mean value = 4.7957)
b. Increasing the ability to cope with new technology (total mean value = 4.2883)
c. Providing a means for motivating employees (total mean value = 3.9449).

Hypothesis 2

Hypothesis 2 in the null format stated that there would be no significant mean differences between the public utility and the manufacturing companies in terms of the estimated amount of money spent in skills and technical training during the previous year. Based on the findings
related to this hypothesis (Table 12), the null hypothesis was rejected and it was concluded that the two samples differed from each other. The public utility companies spent more money (on the average) in skills and technical training than the manufacturing companies during the previous year (1980).

**Hypothesis 3**

Hypothesis 3 stated that there would be no significant mean differences between the public utility and the manufacturing companies in regard to their ratings of each of the variables influencing training decisions. Based on the findings related to this hypothesis (Tables 12 to 17), the null hypothesis was rejected and it was concluded that:

1. The two samples differed from each other regarding one variable—demand for labor. The variable influenced training decisions more in the manufacturing companies than it did in the public utility industries.

2. The samples differed from each other regarding another variable—labor turnover. The variable influenced training decisions more in the manufacturing companies than it did in the public utility companies.

3. The two samples differed from each other concerning still another variable—reaction of customers to
company's products and services. Again, the variable had more influence on the training decisions of the manufacturing companies than those of the public utility industries.

4. The two samples differed from each other concerning yet another variable—tax credit incentives. Although the variable influenced training decisions in the manufacturing companies more than it did in the public utility companies, it was not considered to be an important variable by both sets of companies in regard to making training decisions.

5. The three variables which were important to both the public utility and the manufacturing companies (although there were no differences between the ratings by both sets of companies regarding level of importance) in skills and technical training were:
   a. Skills shortages (total mean value for the ratings = 4.038)
   b. Emerging technology (total mean value for the ratings = 3.8490)
   c. Company growth (total mean value for the ratings = 3.8298).

**Hypothesis 4**

Hypothesis 4 posited that there would be no significant mean differences among the three sizes of companies with
respect to their ratings of each of the goals for skills and technical training. The null hypothesis was rejected on the basis of findings related to the hypothesis (Tables 18 and 19). It was concluded that companies of size 1 differed from those of size 3 in their ratings for one variable—increasing the ability to cope with new technology. Companies of size 3 (i.e., companies with over 10,000 employees) considered the goal to be more important in skills and technical training than companies of size 1 (i.e., companies with 500 to 4,999 employees) considered it to be. The findings led to the further conclusion that companies of size 3 were more technologically oriented than companies of size 1 in regard to their skills and technical training programs. It was further concluded that each of the remaining seven goals was important to the three company sizes although the following two goals were more important than others:

1. Increasing the productivity level of employees 
   (total mean value = 4.7976)

2. Increasing safety in the work environment (total mean value = 4.6386).

Hypothesis 5

Hypothesis 5 stipulated that there would be no significant mean differences among the three sizes of companies in regard to the estimated amount of money spent in skills and technical training during the previous year. Based on the
findings related to this hypothesis (Table 20), the null hypothesis was rejected. It was concluded that companies of sizes 2 and 3 (i.e., companies having more than 5,000 employees) spent more money on skills and technical training during the previous year than companies of size 1 (i.e., companies having 500 to 4,999 employees).

**Hypothesis 6**

Hypothesis 6 stated that there would be no significant mean differences among the three sizes of companies in terms of their ratings of the variables influencing training decisions. Based on the findings related to this hypothesis (Tables 22 to 24), the null hypothesis was rejected and it was concluded that companies of size 1 differed from companies of size 3 regarding the following variables:

1. Labor turnover
2. Dissatisfaction with public schools products.

The decisions of companies of size 3 (i.e., companies having more than 10,000 employees) to conduct, expand or reduce skills and technical training were more influenced by the two variables than the decisions of companies of size 1 (i.e., companies having 500 to 4,999 employees).

**Hypothesis 7**

Hypothesis 7 stated that the level of usage of each of the 15 training methods and techniques would
not be related to (1) the estimated amount of money spent in skills and technical training during the previous year, (2) the estimated number of trainees per year, (3) the classification of company, and (4) the size of company. Based on the findings related to this hypothesis (Tables 26 and 27), the following conclusion was made: That the null hypothesis should be rejected in regard to a set of training methods and techniques (Factor 1)—formal off-the-job training, training devices and simulators, lecture, case study, adjunctive programming, and role playing. It was further concluded by examining the partial regression coefficients' F-values that the best model for finding the relationship between Factor 1 and the independent variables was

\[ Y = \beta_0 + \beta_2 X_2 + \beta_3 X_3 + \beta_5 X_5 + E \]

where:

- \( X_2 \) is the estimated number of skills/technical trainees per year,
- \( X_3 \) is the classification of the company (i.e., public utility or manufacturing), and
- \( X_5 \) is the interaction between classification and size of the company.
Summary

In summary, these were the major findings of this study:

1. In 77.9% of the 86 responding companies, skills and technical training instructors were responsible for such extra duties as production, supervision and management, training design and course development, safety inspection, engineering duties, and quality control.

2. In 62.8% of the 86 responding companies, part-time instructors were employed for skills and technical training. The sources of employment of the part-time instructors were:
   a. Other similar companies in 5.8% of the cases
   b. Public institutions in 40.7% of the cases
   c. Other sources such as training consultancies, and equipment manufacturers and vendors in 38.4% of the cases.

3. Some of the skills and technical training facilities used by 52.3% of the 84 responding companies were not located inside the companies' plants. More specifically, the outside facilities used by the companies (42.3% of 84 companies) were owned by:
   a. The responding companies in 19.8% of the cases
   b. The public institutions in 34.8% of the cases
   c. Other similar companies in 4.7% of the cases
d. Equipment manufacturers and vendors in 5.8% of the cases.

4. In selecting the content for skills and technical training, the 86 responding companies used a combination of methods. The needs assessment method was used by 69.8% of the companies, task analysis method by 60.5% of the companies, and previous experience by 57% of the companies. Advisory committee and creative insight were used to select content by 38.4% and 29.1% of the companies, respectively.

5. The most common method for evaluating training outcomes among the public utility and manufacturing companies was the reports received from foremen and supervisors concerning trainees or graduates of the skills and technical training programs assigned to work with the supervisors and foremen. This method was used by 76.7% of the 86 respondents. Observation of trainees as they worked on their assigned jobs was a method used by 75.6% of the companies, while 29.1% of the companies used the quality of their products or services to determine how effective their skills and technical training programs were.

6. Only 12.8% of the 86 responding companies utilized any form of government support in their skills and technical training programs.
7. Only 6% of the 86 responding companies would like such government participation in their skills and technical training programs as:
a. Providing tax credit incentives
b. Providing expanded vocational/technical programs in public schools
c. Providing quality education
d. Providing related classroom instruction in the community colleges to trainees in industries.

8. The comments of the respondents did not indicate that the public utility and manufacturing companies had a favorable perception of vocational education. Vocational education was perceived as being outdated in approach, lagging behind the present technological applications, and having vague objectives that would be difficult to measure.

9. Despite such comments as included in Finding 8, the public utility and manufacturing companies suggested ways by which they could work with vocational education to train students and future employees. The suggestions included:
a. Employing company personnel to teach (part-time) vocational education students
b. Vocational education concentrating only on the basic theory of trades and industry concentrat-
ing on teaching the skills needed on-the-job.

c. Updating each other concerning changes in technology
d. Sharing goals to catch up with technology
e. Increasing the cooperative work experience of students.

10. A total of 94.2% of the 86 responding companies indicated that there would be greater emphasis and demand for skills and technical training in their companies during the next 10 years.

11. The public utility and manufacturing companies differed from each other concerning the following two of the eight goals of skills and technical training:

a. Increasing stability of employment
b. Increasing safety in the work environment.

The former (a) was more important to the manufacturing companies than to the public utility companies. The latter (b) was more important to the public utility companies than to the manufacturing companies.

The remaining six of the eight goals of skills and technical training seemed (individually) to be important to the skills and technical training programs of both sets of companies. The following
goals appeared to be more important than others:
   a. Increasing the productivity level of employees
   b. Increasing the ability to cope with new technology
   c. Providing a means for motivating employees.

12. When the ratings for the eight goals of skills and technical training were analyzed relative to company sizes, differences were found between the mean ratings for the following goal: Increasing the ability to cope with new technology.

13. The public utility companies and the manufacturing companies differed from each other concerning three of the 13 variables affecting skills and technical training decisions:
   a. Demand for labor
   b. Labor turnover
   c. Reaction of customers to products and services.

Also, out of the remaining 10 of the 13 variables, the three variables that were individually important to the three sizes of companies were:
   a. Skills shortages
   b. Emerging technology
   c. Company growth.

14. The three sizes of companies differed one from the other in terms of their ratings for each of the 13
variables affecting skills and technical training decisions. The variables were:

a. Labor turnover

b. Dissatisfaction with the products of public schools.

Also, out of the remaining 11 of the 13 variables, the following variables were found to be more important than other variables to the three sizes of companies in making training decisions:

a. Skills shortages

b. Emerging technology

c. Company growth.

15. The public utility companies spent more money, on the average, than did the manufacturing companies in skills and technical training during the previous year.

16. As was expected, companies of sizes 2 and 3 (i.e., companies having 5,000 or more employees) spent more money, on the average, in skills and technical training during the previous year.

17. The levels of usage of formal off-the-job training, training devices and simulators, lecture, case study, adjunctive programming, and role playing in skills and technical training were related to:

a. The estimated amount of money spent in skills
and technical training during the previous year
b. The estimated number of skills and technical trainees per year
c. The classification of the company
d. The size of a company
e. The interaction between classification and size.

Recommendations

In view of the foregoing findings and conclusions related to this study, the following recommendations were offered:

1. There is need for more interaction between vocational education and industries in terms of having a clearer understanding of the limitations, scope and objectives of each other's programs. The findings of this study lent credence to the view that industry expects more from vocational education regarding the teaching of skills to future employees. Proper understanding of the scope and the objectives of each of the different programs is necessary to resolve the matter.

2. Vocational education could initiate further research into the needs of industries and modify its programs in the light of those needs.

3. Some of the companies could devise better means of
keeping records in regard to costs, trainees, and related data to their skills and technical training. Analysis of the benefits or nonbenefits of programs cannot be properly carried out unless relevant data are available.

4. More research studies could be carried out by institutions, individuals or private companies regarding ways to improve some aspects of formal in-plant skills and technical training. Some of the companies need improved methods of training evaluation and dealing with production and operational pressures, as well as better ways to deal with safety problems in the work environment.

5. The replicability of this study should consider the limitations imposed by the sample size, especially concerning factor analysis of some of the variables.
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ACKNOWLEDGMENTS

I would like to thank all the people who have contributed to the successful completion of this study. Particular thanks to the members of my program of studies committee—Dr. William D. Wolansky (Chairman), Dr. Don MacKay, Dr. Trevor Howe, Dr. Don Schuster, and Dr. Robert Gelina. I am greatly appreciative of their individual contributions and advice in the course of this research study.

I am also indebted to the following staff and student of Iowa State University who contributed in no small way during the period of data analysis for this study:

1. Dr. Richard Warren (Director of RISE)
2. Dr. Rex Thomas (Professional Studies in Education)
3. Dr. William Miller (Industrial Education)
4. Mr. Michael Rogers (Graduate student in Statistics).

Finally, my special thanks to those Chief Executives, Personnel Directors, and Industrial Relations Directors, as well as the Training Officers, of many companies who were surveyed in this study, for devoting part of their very busy schedules to make this study a success.

The Iowa State University Committee on the Use of Human Subjects in Research reviewed this project and concluded that the rights and welfare of the human subjects were adequately protected, that risks were outweighed by the potential
benefits and expected value of the knowledge sought, that confidentiality of data was assured and that informed consent was obtained by appropriate procedures.
APPENDIX A. THE PRELIMINARY SURVEY INSTRUMENTS AND LETTERS THAT ACCOMPANIED THEM
Dear Sir:

I am a graduate student in the Department of Industrial Education at Iowa State University. Our Department of Industrial Education prepares teachers for schools and industry. Currently I am engaged in a dissertation research project on "In-Plant Technical Training in Selected Public Utility and Manufacturing Industries in the United States."

The primary purpose of the study is to acquire information about the nature and extent of technical training sponsored by industry which could be useful to industrial education administrators, government agencies, teachers and those training directors concerned with the planning of industrial training in industry.

I will be grateful if you complete the attached preliminary survey instrument and return it to me within two weeks. A stamped self-addressed envelope is provided for your convenience.

Sincerely yours,

Peter O. Awotunde

William D. Wolansky
Professor and Head
Dept. of Industrial Education

November 16, 1981
PRELIMINARY SURVEY INSTRUMENT

1. Do you provide in-plant technical (skill) training for your employees?
   _____ Yes       _____ No

2. Are you willing to participate in a research project to determine the nature and extent of in-plant technical training in selected public utility and manufacturing companies in the United States?
   _____ Yes       _____ No

3. Who is the contact person for your in-plant technical (skill) training?

4. Are you interested in receiving a copy of the research results?
   _____ Yes       _____ No
Dear Sir:

I am a graduate student at Iowa State University in the Department of Industrial Education, which prepares teachers for schools and industry. I seek your company's assistance in a research project titled "Formal In-Plant Skills and Technical Training in Selected Public Utility and Manufacturing Industries in the United States."

Apart from forming a part of the requirements for my graduation, the study seeks to acquire such information that would be useful to:

(i) Industrial education administrators and teachers in making decisions concerning the improvement of their technical programs.

(ii) Government agencies in having more accurate information regarding the extent of skills and technical training conducted in the public utility and manufacturing industries.

I will be grateful for your company's willingness to participate in this study and for completing the attached questionnaire. Another questionnaire which will not take more than ten minutes to respond to will be sent to your company's contact person (if your company indicates a willingness to participate) within a few weeks of receiving the completed preliminary questionnaire from you.

I assure you that no individual's or company's name will be mentioned in the research report. The study has only to do with the nature and extent of the skills and technical training being offered; there will be no attempt to evaluate the results of such training. Kindly complete the attached preliminary questionnaire and return it to me within two weeks. A stamped self-addressed envelope is provided for your convenience.

Sincerely yours,

[Signature]

Approved:

[Signature]
William D. Wolansky
Professor and Head
Dept. of Industrial Education
PRELIMINARY QUESTIONNAIRE

Please complete the questionnaire and return it to me in the stamped self-addressed envelope provided. The number on the top of this page has only to do with the identification of the company as they return the completed questionnaire for the purpose of categorization.

1. Do you provide formal in-plant skills and technical training for your employees?
   _____ Yes   _____ No

2. Is your company willing to assist in the research project to determine the nature and extent of formal in-plant skills and technical training in selected public utility and manufacturing companies in the United States by sharing information concerning such training in your establishment?
   _____ Yes   _____ No

3. If your answer to Item 2 is "Yes," what is the name and address of the contact person for your in-plant skills and technical training?

   

4. Are you interested in receiving a copy of the research results?
   _____ Yes   _____ No
January 22, 1982

Dear Sir:

A questionnaire concerning "The nature and extent of in-plant skills and technical training in selected public utility and manufacturing industries in the United States" was mailed to you in November 1981. At the time of this writing, the completed questionnaire has not been returned to me. In case you did not receive the questionnaire, I am enclosing another copy for your response.

I will be grateful if you will complete and return the questionnaire to me as early as possible as the study cannot be successfully concluded without your response. Thank you for your cooperation.

Yours sincerely,

Peter O. Awotunde

Approved:

William D. Wolansky
Professor and Head
Dept. of Industrial Education
Dear Sir:

A questionnaire concerning "The nature and extent of in-plant skills and technical training in selected public utility and manufacturing industries in the United States" was mailed to you in December 1981. At the time of this writing, the completed questionnaire has not been returned to me. In case you did not receive the questionnaire, I am enclosing another copy for your response.

I will be grateful if you will complete and return the questionnaire to me as early as possible as the study cannot be successfully concluded without your response. Thank you for your cooperation.

Yours sincerely,

[Signature]

Peter O. Awotunde

Approved:

[Signature]

William D. Wolansky
Professor and Head
Dept. of Industrial Education
Dear

Enclosed is the second questionnaire regarding "Formal In-Plant Skills and Technical Training in Selected Public Utility and Manufacturing Companies in the United States", a study in which you indicated a willingness to participate.

I will be grateful if you will complete the questionnaire and return it to me within two weeks in the stamped, self-addressed envelope provided.

Thank you for your cooperation and assistance in connection with this study.

Yours sincerely,

Peter O. Awotunde

Approved:

William D. Wolansky
Professor and Head
Dept. of Industrial Education
February 22, 1982

Dear

A questionnaire was mailed to you on February 4, 1982, concerning "In-Plant Skills/Technical Training" - a study in which the cooperation of and assistance from your company was assured. At the time of this writing, the completed questionnaire has not been returned to me.

This study, apart from being one of the most important requirements for my graduation, should be useful to industrial education administrators, teachers, and government agencies.

I will be grateful if you will complete and return the questionnaire to me before March 14, 1982. In case you did not receive the said questionnaire, another copy of it is enclosed for your response. A stamped, self-addressed envelope is also enclosed for your convenience.

I sincerely appreciate your taking a few minutes out of your very busy schedule to complete the questionnaire and to make this study a success.

Sincerely yours,

Peter D. Awotunde
(Phone: (515-292-1394)

Enclosures

P.S. If you have any questions concerning the questionnaire, please give me a call.
APPENDIX B. THE MAIN RESEARCH INSTRUMENT
This is part of a research study concerning skills/technical training in selected public utility and manufacturing companies in the U.S. Please complete the entire instrument by checking (✓), or writing in the most appropriate responses.

For items 1-6, indicate the appropriate response for your company:

1. Number of employees:
   ___ 0-499  ___ 500-4,999  ___5,000-9,999  ___10,000-over

2. Estimated revenue spent in skills/technical training during previous year $___________

3. Estimated number of skills/technical trainees per year ______

4. Estimated man-hours of skills/technical training per year ______

5. Estimated cost per hour for each trainee $________

6. Total number of staff in skills/technical training ______

7. How important are the following goals regarding your company's skills/technical training? Rate each goal on a five-point scale by checking (✓) the appropriate column.

   Increasing productivity of employees
   Increasing stability of employment
   Increasing safety in the work environment
   Increasing the ability to cope with new technology
   Increasing the ability to get along with co-workers
   Providing a means for motivating employees
   Providing a means for meeting spot needs or emergency developments
   Providing a means for raising the educational level of employees

8. Are your skills/technical training instructors responsible for duties other than instruction? ___ Yes ___ No
9. If your answer to #8 is Yes, what are the types of duties in which the instructors are engaged?
   (i) Production
   (ii) Supervision, e.g., supervisors, foremen, etc.
   (iii) Management
   (iv) Others (explain) __________________________
   (v) __________________________

10. Are other instructional specialists employed from outside this company on a part-time basis?
    ___ Yes ___ No

11. If your answer to #10 is Yes, what are the sources of employment?
    (i) Other similar companies
    (ii) Public institutions
    (iii) Others (specify) __________________________
    (iv) __________________________

12. Are all of your skills/technical training facilities (tools, classrooms, laboratories, machinery, etc.) located inside your plant?
    ___ Yes ___ No

13. If some of the facilities are located outside the plant, which of the following best describe(s) them?
    (i) Outside facilities are owned by company
    (ii) Outside facilities are owned by public institutions
    (iii) Outside facilities are owned by other companies
    (iv) Outside facilities are owned by the government
    (v) Others (explain) __________________________
    (vi) __________________________

14. Which of the following methods does your company use in selecting content for skills/technical training?
    (i) Task analysis
    (ii) Advisory committee
    (iii) Needs assessment
    (iv) Creative insight
    (v) Previous experience
    (vi) Others (specify) __________________________

15. How are your skills/technical training results determined?
    (i) Formal tests
    (ii) Observation of employees on the job
    (iii) Reports of foremen and supervisors
    (iv) Quality of products or services
    (v) Others (specify) __________________________
    (vi) __________________________
16. How does each of the following factors influence the decision of your company to conduct, expand or reduce skills/technical training? Rate each item on a five-point scale by checking (✓) the appropriate column.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Very Weakly</th>
<th>Weakly</th>
<th>Average</th>
<th>Strongly</th>
<th>Very Strongly</th>
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<tbody>
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<td>Demand for labor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bargaining with craft unions</td>
<td></td>
<td></td>
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<tr>
<td>Substitutability of skills</td>
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<tr>
<td>Labor turnover</td>
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<tr>
<td>Management style</td>
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<tr>
<td>Company growth</td>
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<tr>
<td>Emerging technology</td>
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<tr>
<td>Dissatisfaction of employees</td>
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<tr>
<td>Reaction of customers to products or services</td>
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<tr>
<td>Availability of funds for training</td>
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<tr>
<td>Skill shortages</td>
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<tr>
<td>Dissatisfaction with public schools' products</td>
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<tr>
<td>Tax credit incentives</td>
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</tbody>
</table>

17. Does your company utilize any form of government support in skills/technical training?
   ____ Yes  ____ No

18. If your answer to #17 is Yes, please list forms of support.

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

19. Would you like to see more participation by the government in skills/technical training programs of private enterprises?
   ____ Yes  ____ No

20. If your answer to #19 is Yes, what forms should the participation take? Please explain.

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
21. How often does your company use each of the following methods and techniques in skills/technical training? Rate each item on a five-point scale by checking (✓) your response in the appropriate column.

<table>
<thead>
<tr>
<th>Methods:</th>
<th>Always</th>
<th>Usually</th>
<th>Average</th>
<th>Seldom</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vestibule training</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>On-the-job training (OJT)</td>
<td>✓</td>
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<tr>
<td>Sandwich training</td>
<td>✓</td>
<td></td>
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<tr>
<td>Formal off-the-job training</td>
<td>✓</td>
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<tr>
<td>Apprentice training</td>
<td>✓</td>
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<tr>
<td>Integrated training (on- and off-the-job)</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>Job rotation</td>
<td>✓</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Techniques:</th>
<th>Always</th>
<th>Usually</th>
<th>Average</th>
<th>Seldom</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training devices and simulators</td>
<td>✓</td>
<td></td>
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<tr>
<td>Job instruction training (JIT)</td>
<td>✓</td>
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<tr>
<td>Conference or discussion</td>
<td>✓</td>
<td></td>
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<tr>
<td>Coaching</td>
<td>✓</td>
<td></td>
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<tr>
<td>Lecture</td>
<td>✓</td>
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<tr>
<td>Case study</td>
<td>✓</td>
<td></td>
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<tr>
<td>Adjunctive programming</td>
<td>✓</td>
<td></td>
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<tr>
<td>Role playing</td>
<td>✓</td>
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</tbody>
</table>

22. What, in your opinion, are the similarities and differences between your company's skills/technical training and students' experiences being presently provided through vocational education? Please explain.

**Similarities:**

- 
- 
- 

**Differences:**

- 
- 
-
23. (a) What research, in your opinion, is needed by your company concerning skills/technical training and, (b) how can vocational education assist?
   (a) 
   (b) 

24. In your opinion how can your company and vocational education work together to train students and future employees?

25. Is there going to be a greater emphasis and demand for skills/technical training in your company during the next 10 years?
   _____ Yes       _____ No
APPENDIX C. THE STATISTICAL PROCEDURES

The Statistical Package for Social Sciences (SPSS) Procedures Utilized in Data Analysis

//A331 JOB I3817, AWOTUNDE
/*KEY PA
//STEP1 EXEC SPSS
//SYSIN DD*

1. RUN NAME RESEARCH DATA ANALYSIS
2. VARIABLE LIST ID1, CD1, CLASSIF, GRP, ESREV, NTRAINNEES,
   MANHRS, COSTPERHR, INSTRUCTORS, G1 TO G8,
   Q8, Q91 TO Q94, Q10, A11 TO Q113, Q12,
   Q131 TO Q135, Q141 TO Q146, Q151 TO Q155/
   Q16
3. INPUT MEDIUM CARD
   N OF CASES 86
4. INPUT FORMAT FIXED(F3.0, 3F1.0, F10.5, F6.0, F10.5,
   F3.0, F5.0, 8F1.0, F1.0, F1.0, 4F1.0,
   F1.0, 3F1.0, F1.0, 5F1.0, 6F1.0, 5F1.0/
   F3.0, F1.0, 13F1.0, 2F1.0, 15F1.0, F1.0)
5. RECODE ESREV TO INSTRUCTORS (BLANK = 666666666)/
   CLASSIF, GRP, G1 TO Q155, F1 TO Q25
   (BLANK = 9)
6. MISSING VALUES CLASSIF, GRP, G1 TO Q155, F1 TO Q25 (9)/
   ESREV TO INSTRUCTORS (666666666)
7. READ INPUT DATA Data
   FREQUENCY GENERAL = ALL
   STATISTICS 1, 3, 5, 9
   CROSSTABS TABLES = CLASSIF BY Q8/CLASSIF BY Q10/
   CLASSIF BY Q25
   T-TEST GROUPS = CLASSIF(1,0)/VARIABLES=G1 TO G8
   T-TEST GROUPS = CLASSIF(1,0)/VARIABLES=F1 TO F13
   *COMPUTE VARX = LG10(ESREV)
   ASSIGN MISSING VARX(99)
   T-TEST GROUPS = CLASSIF(0,1)/VARIABLES = VARX
   FACTOR VARIABLES = G1 TO G8
   STATISTICS 1, 2, 4, 5, 6
   ONEWAY G1 TO G8 BY GRP(2,4)/
   RANGES = SCHEFFE (.05)/
   STATISTICS 1
FACTOR VARIABLES = F1 to F13/
STATISTICS 1, 2, 4, 5, 6
*COMPUTE FACA = F1+F3+F4+F12+F13
*COMPUTE FAC= F5+F6+F7
*COMPUTE FACP = F8+F10
ASSIGN MISSING FACA TO FACP(99)
ONEWAY FACA, FAC, FACP BY GRP(2,4)/
RANGES = SCHEFFE (.05)/
STATISTICS 1
ONEWAY F1 to F13 by GRP(2,4)/
RANGES = SCHEFFE (.05)/
*COMPUTE VARX = LG10(ESREV)
ASSIGN MISSING VARX(99)
ONEWAY VARX by GRP(2,4)/
RANGES = SCHEFFE (.05)/
STATISTICS 1
FACTOR VARIABLES = MT1 to MT15/
STATISTICS 1, 2, 4, 5, 6
*COMPUTE FACD = MT4+MT8+MT12+MT13+MT14+MT15
*COMPUTE FACE = MT2+MT9+MT10+MT11
*COMPUTE FACG = MT5+MT6
*COMPUTE X5 = CLASSIF*GRP
*COMPUTE VARY = LG10(ESREV)
*COMPUTE VARX = LG10(NTRAINNEES)
ASSIGN MISSING FACD TO VARX(99)
REGRESSION VARIABLES = FACD, FACE, FACG, X5, VARY, VARX, CLASSIF, GRP/
REGRESSION = FACD WITH X5 TO GRP(1)/
REGRESSION = FACE WITH X5 TO GRP(1)/
REGRESSION = FACG WITH X5 TO GRP(1)/
OPTION 20
//
The Statistical Analysis System (SAS)
Procedures Utilized in Data Analysis

1. //A331 JOB 13817,AWOTUNDE
2. /*KEY PA
3. //STEP1 EXEC SAS
4. //SYSIN DD*
5. DATA RDA;
6. INPUT CLASSIF 5 ESREV 7-16 #2;
7. CARDS;
   . Data
   .
9. PROC SORT; BY CLASSIF;
10. PROC PRINT;
11. PROC UNIVARIATE PLOT NORMAL
12. BY CLASSIF;
13. VAR ESREV;
14. DATA NEW;
15. SET RDA;
16. LESREV = LG10(ESREV);
17. PROC SORT; BY CLASSIF;
18. PROC PRINT;
19. PROC UNIVARIATE PLOT NORMAL;
20. BY CLASSIF;
21. VAR LESREV;

Note: For estimated man-hours of training per year, estimated number of trainees, estimated cost per hour per trainee, and number of instructors, substitute the appropriate variable names and column numbers in 6 (e.g., INPUT CLASSIF 5 MANHRS 23-32 #2;). Also, substitute appropriate variable names in 13, 16, and 21.