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Chuan-Chun Wu
University of Northern Iowa

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Wu, Chuan-Chun, D.I.T.

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U·M·I
300 N. Zeeb Rd.
Ann Arbor, MI 48106

MANUFACTURING CURRICULUM ISSUES OF TWO-YEAR MECHANICAL ENGINEERING TECHNOLOGY PROGRAM IN TAIWAN, R.O.C.

A Dissertation
Submitted In Partial Fulfillment
of the Requirements for the Degree
Doctor of Industrial Technology

Approved:

Dr. John T. Fecik, Advisor

Dr. Ali E. Kashef, Co-Advisor

Dr. Scott C. Helzer

Dr. Dale W. Olson

Dr. Andrew F. Thompson

Chuan-Chun Wu
University of Northern Iowa
May 1994

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Approved:

Dr. John T. Fecik, Advisor

Dean of the Graduate College

Chuan-Chun Wu
University of Northern Iowa
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ABSTRACT

The purpose of this study was to evaluate current practices and possible changes in the mechanical engineering technology manufacturing curriculum in Taiwan's two-year junior technical colleges. The study was based on survey responses from three populations: (a) graduates of mechanical engineering (manufacturing division) programs in two-year junior technical colleges, (b) their manufacturing supervisors, and (c) their company chief executive officers (CEOs). The survey was designed to develop responses for following:

1. Determine the degree of importance of courses in the current Taiwanese two-year curriculum in manufacturing, in the opinion of the three groups surveyed.

2. Determine what the future curriculum components of a two-year manufacturing program should be, in the opinion of the three groups surveyed.

3. Report the employment characteristics of Taiwanese two-year junior technical college graduates.

4. Develop the specific recommendations for Taiwan's two-year technical junior college manufacturing education programs.

The survey's return rate was 46.7% for program graduates, 54.5% for supervisors, and 43.6% for CEOs. The data were statistically analyzed using the Borich

Discrepancy Model to measure the degree of importance respondents assigned to subjects in the current curriculum and possible future curricula. Pearson correlation coefficients indicate a strong consensus on both current practices and desired curriculum changes.

The data show that respondents judged the most important subject areas of the current curriculum to be material science, computer assisted engineering techniques, basic manufacturing control techniques, and English as a second language. The most important areas to include in a future curriculum were judged to be physics, ethical and value sensitivity, human relationships and organizational behavior, and advanced manufacturing and inspection technologies.

Based on the data and review of the literature, five recommendations are made for Taiwan's manufacturing curriculum in the two-year technical junior colleges. They are: (a) greater emphasis on engineering and computer-based subject matter areas, (b) greater emphasis on industrially oriented decision-making models, (c) shorter revision intervals, (d) greater flexibility to meet local conditions and student needs, (e) a permanent advisory organization to design, implement, and evaluate curriculum content.

CHAPTER I

INTRODUCTION

Transforming Taiwan, R.O.C. into a completely modern, industrialized nation by the end of the 20th century has been the ultimate goal of Taiwan's industrial and educational policies. This transformation may be viewed as a series of three stages. In the first stage, Taiwan developed industries based on natural resources--agriculture and food processing. As land became scarce, the economy gradually became dependent on labor-intensive industries. The foundation of Taiwan's recent export boom has been the competitiveness of its labor-intensive industries. However, as the number of competitors in the same area (Asia) increased, the unskilled and semi-skilled labor advantage has been disappearing. As a result, a third stage developed as large amounts of capital, including human capital, flowed into Taiwan from the more developed countries. Currently, Taiwan's highest priority of economic development is the establishment of capital and technology-intensive industries. Taiwan has devoted national efforts to the implementation of a Six-Year National Development Plan, exploration of energy resources, establishment of heavy machinery and precision electronic industries (Republic of China Yearbook, 1993).

Taiwan has been in a rapid state of change because of these economic and technological developments. Although technology has played an important role in shaping past society, never before have there been such significant technological changes in such a short time. This rapid change in technology and society has brought about many complex challenges for technical education in Taiwan.

Statement of Problem

The skills and knowledge that industrial technicians must possess upon graduation are dependent upon the needs of industry. In Taiwan many industrial technicians are educated through mechanical engineering (JTC-ME) programs in two-year junior technical colleges. These programs need to offer the graduates a range of knowledge and skills demanded by industry.

Over the past 20 years, technical education in Taiwan has undergone many changes. Changing technology has required educators to evaluate and improve the curriculum in technical education in Taiwan. Although much work has been done to achieve educational relevance, there yet exists a need to evaluate and improve existing programs. The problem confronting educators in Taiwan in the field of two-year technical colleges is the continued evaluation and improvement of curricula. Without input from industry, curricula in manufacturing will fail to keep pace with technological change.

Purpose of the Study

The purpose of this study was to evaluate current practices and possible changes in the mechanical engineering technology manufacturing curriculums in Taiwan's two-year JTC-ME (manufacturing division) programs. To gather input from industry, three populations were surveyed to gather information about the current curricula and possible changes. The following questions were pursued:

1. What current subject areas of two-year (JTC-ME) program curriculum were important for graduates in their employment?

2. What possible subject areas should be emphasized in future two-year (JTC-ME) program curricula?

3. What are the employment characteristics of two-year JTC-ME program graduates, as identified by their manufacturing supervisors and company CEOs?

4. With these questions answered, then recommendations for Taiwan's JTC-ME (manufacturing division) education can be developed to make technical education more responsive to the needs of industry.

Need for the Study

The need for this study was supported from a historical perspective. "There is little formal research being done in manufacturing curriculum development in Taiwan R.O.C. Upgrading and refinement of programs will be necessary if the potential for the future in manufacturing programs is to be fully realized" (Chen, 1992). It is essential there be regular analysis of the content base and updating of curricula to take into consideration the important avenues of change (Liu, 1984).

Technological change is important to curriculum developers as they strive to maintain viable and relevant educational programs in manufacturing. It is necessary to determine the importance of present subject areas of the curricula as perceived by graduates of JTC-ME and their employment supervisors. In addition, there is a requirement to determine the emphasis which should be placed on future subject areas of curricula (Lucas, 1981). An evaluation of curricula in terms of how well graduates are prepared for employment was critical for Taiwan's technical education (Chen, 1992, p. 147).

There is a lack of research which uses information obtained directly from industry in Taiwan. If industrial survey techniques are developed for use on a continuing basis, educators who develop mechanical engineering in manufacturing curricula will have a better foundation for program evaluation and improvement. In order to educate skilled technicians, teaching curricula must be kept up to date. With the increased emphasis on quality in Taiwan's technical education, the need to evaluate and improve curricula has become imperative (Lee, 1990).

This study will be beneficial in evaluating present programs and formulating future directions in Taiwan's manufacturing education. Thus, the information obtained from this study should be important to:

1. People responsible for the development of manufacturing curricula.

2. People responsible for the organization and administration of manufacturing programs.

3. People responsible for vocational guidance and counseling.

4. People responsible for teaching students in JTC-ME (manufacturing division) programs.

5. People in business and industry who employ graduates of JTC-ME (manufacturing division) programs.

6. Future graduates of JTC-ME (manufacturing division) programs.

Limitations

Manufacturing education includes a large range of educational programs. Since it is impossible to deal with all of them, this study observes the following limits:

1. The study was limited to Taiwan's mechanical engineering programs in the manufacturing division.

2. Initial respondents were limited to graduates of programs in mechanical engineering technology (manufacturing division) in two-year junior technical college administered by Taiwan's Ministry of Education.

3. Graduates between 1992-1993 were excluded from the population because males must serve in the military for two years following graduation.

4. Only supervisors and executives with an employee who completed the initial questionnaire were included.

5. Only those graduates employed in related technical occupations were included.

6. Employment characteristics were limited to the following categories, length of employment, job stability, starting salary range, present salary range, work satisfaction, supervisory work, technical proficiency, need for technical skills, attitude toward college preparation, preparation for initial employment, preparations for advancement, management or supervisory skills, number of promotions, and job performance.

Procedure and Methodology

For this survey, questionnaires were developed to gather the necessary information. A pilot test was conducted to develop the readability, reliability and validity of the questionnaires. One form was mailed to graduates, another was mailed to the supervisors and the companies' CEOs.

A questionnaire was sent to a random sample of students who graduated between 1987-1991 from JTC-ME (manufacturing division) programs in Taiwan. If no response was received from an individual within two weeks, a follow-up letter and questionnaire were sent. Approximately two weeks after the follow-up questionnaire, a second follow-up letter was mailed to non-respondents. After all returned questionnaires were collected, addresses of employers and names of supervisors and CEOs were obtained from the questionnaires. The other questionnaire was then mailed to supervisors and CEOs of the graduates who responded. The design of this questionnaire was similar to the one sent to graduates so that comparisons could be made. The data were compiled and analyzed with inferential statistics to determine the degree of importance respondents assigned to each subject area and to compare responses of graduates, supervisors and CEOs.

Definition of Terms

The following terms are defined here for the purposes of this study:

1. Manufacturing: A series of interrelated activities and operations involving the design, material selection, planning, production, quality assurance, management, and marketing of discrete consumer and durable goods (Zobczak, 1984).

2. Curriculum: "The sum of learning activities and experiences that a student has under the auspices or direction of the school" (Finch & Crunkilton, 1993, p. 7).

3. Industrial technician: A semi-professional or paraprofessional who needs more formal education than a craftsman but less than a professional engineer (World Book Encyclopedia, 1980).

4. Technical education: Education for an occupation which is mathematics/science oriented and requires skills of a technical nature (Oaks, 1989).

5. Two-year technical junior college in mechanical engineering program: A technical education program which prepares a person for industrial occupations of a specialized nature in manufacturing. This program admits graduates of senior high school or vocational high school for a two year program of study in Taiwan. After completing their studies, graduates may apply to the Taiwan Institute

of Technology for advanced studies, or they may take an exam for admission to a university as sophomores or juniors (Republic of China Yearbook, 1990-91).

6. Computer Integrated Manufacturing: Computer integrated manufacturing (CIM) in a manufacturing enterprise occurs when: (a) all the processing functions and related managerial functions are expressed in the form of data, (b) these data are in a form that may be generated, transformed, used, moved, and stored by computer technology, and (c) these data move freely between functions in the system through the life of the product, with the objective that the enterprise as a whole will have the information needed to operate at maximum effectiveness (Manufacturing Studies Board of the National Research Council, 1986).

CHAPTER II

LITERATURE REVIEW

The literature review has been organized into three major sections. The first provides an overview of technical education and junior technical colleges in Taiwan. The second section reviews changes in manufacturing in recent decades. The third section reviews the related curriculum studies in both the U.S.A. and Taiwan.

Section I

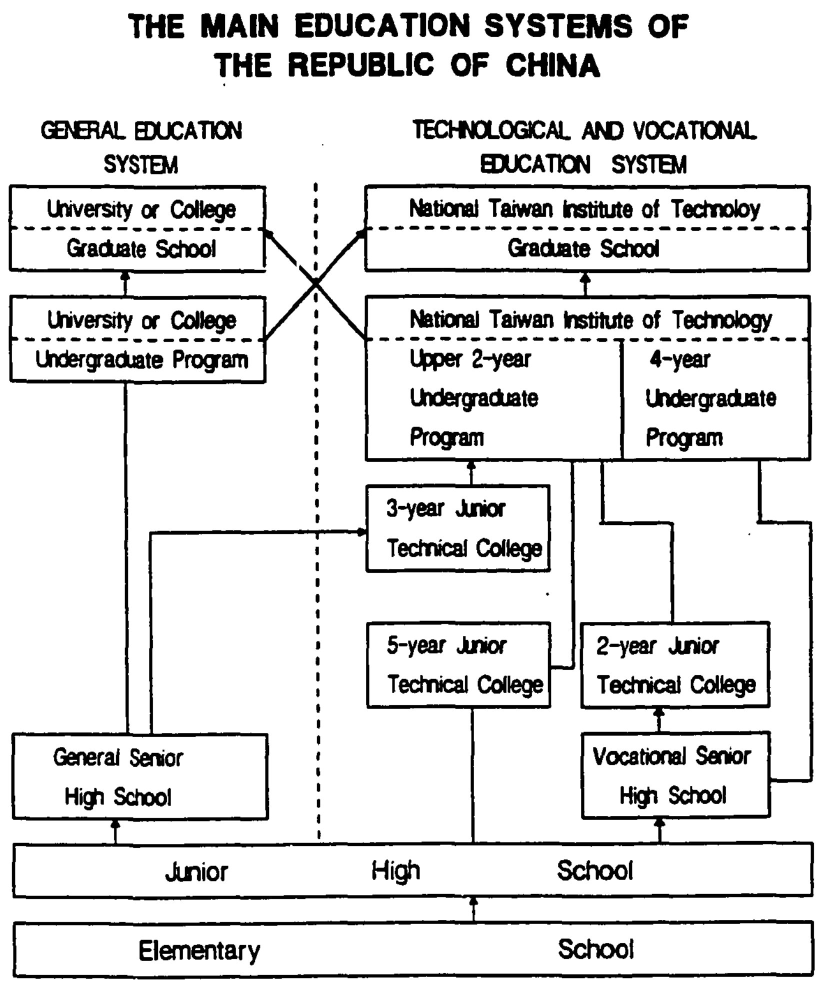
Technical Education and Junior Technical Colleges in Taiwan

Relevant education and training to prepare engineering technicians is a critical concern for Taiwan's industrial development. Technical education in Taiwan is to produce specialists who possess the broad base of knowledge, skills, and attitudes necessary to be productive in modern technical occupations that are characterized by rapid change and highly sophisticated content (Chang, 1980). The objectives were defined by MOE as: "to culture professional technicians in the areas of (a) Design, (b) manufacturing, (c) operation, (d) control, (e) testing, and (f) maintenance" (Ministry of Education, 1984, p. 753). Taiwan's technology education is a planned sequence of classroom and laboratory experiences, usually at the secondary and post-secondary level, which prepares an individual for a cluster of job opportunities in the area of technology at a level between skilled and professional employees. In Taiwan, technical education within the vocational education system (see Figure 1) is intended to provide students with productive knowledge and skills for their future living.

The system of technical and industrial education in Taiwan includes three levels: the vocational-industrial high school, the junior technical college, and the senior technical college. Those in academic secondary education are required to continue some general technical and vocational studies which are compulsory for all students at the lower secondary level. After the completion of nine years of compulsory schooling, the middle school graduate may decide to take either a joint entrance examination for academic higher study or a joint entrance examination for technical or vocational higher secondary study. Success in the examination will lead to admission to higher secondary education. In addition, a graduate of a middle school may also pass a joint entrance examination to enter the five-year program in a junior college.

Technical and vocational education are offered in several types of institutions at the post high school: comprehensive schools, technical schools, and trade schools (Republic of China Year Book, 1990-91). Graduates of higher secondary vocational and technical schools may take a

Figure 1. The current school system in Taiwan. From: Educational statistics of R.O.C., MOE, p. 3., 1993.



special examination. Success in this examination will lead to admission to higher education in a field of specialization at the National Taiwan Institute of Technology. This institute was established in 1974 with two main purposes: to train technologists on the one hand, and to create an integrated technical and vocational education system on the other.

The system of junior technical college (JTC) education in Taiwan offers three programs: 2-year, 3-year, and 5-year. There are five-year junior colleges for junior high graduates, three-year junior colleges for senior high graduates, and two-year junior colleges for vocational higher secondary school graduates. Graduates of the post-secondary junior colleges may be admitted to further programs in the universities through special selection procedures. Taiwan had a total of 74 junior colleges in 1992. Of this total, industrial schools accounted for about 28%, commerce schools 14.8%, Management of Industry & Business Administration 28.3%, and others (including marine, agricultural, medicines, nursing, and fine arts) 29.2% (Ministry of Education, 1993).

The technical education structure of Taiwan illustrates the direct relationship between educational opportunity and integration of general, technical, and vocational education on the one hand, and flexibility of structure on the other. Within the system, those completing either an academic education or general education have more opportunities open to them than those completing specialized programs. Conversely, those completing specialized programs have more immediate employment opportunities than those completing general education programs and not pursuing further studies. However, the structure is not in place for continuing education which would eventually allow persons to rejoin the educational system at a later date for the purpose of professional change or promotion. In addition, in most cases the joint entrance examination would decide the admission of students to study on the upper levels.

Due to the rapid expansion of higher education during the 70s and 80s, the output from junior colleges could not be easily absorbed by the labor market. To solve this problem, further growth in higher education was carefully planned in the Manpower Development Plan of 1976-81 (Chang, 1980). Chang also suggested that the annual increase of college student enrollments should not exceed 3% and expansion of science and engineering majors should be given top priority. According to this plan, junior colleges should not increase their current level of enrollments except for a slight annual increase in engineering majors. The policy has been followed successfully, with the exception of a 5% increase in the 1980s. The establishment of the National Taiwan Institute of Technology as a step toward the establishment of an integrated technical and vocational education system has been widely recognized in light of the fact that its graduates are welcomed by industry. Several other similar institutes are proposed for the future to provide opportunities for those graduates from vocational schools to receive further schooling at the junior college level and at the technology institute (Lee, 1990).

At any level of education, rapid expansion may lead to problems with quality. The rapid expansion of junior colleges in Taiwan has led to questions about quality. One question relates to the time needed to adequately train technicians. This is not only confusing to the students but also to the teachers under Taiwan's technical education system. In the United States, most technical junior college curricula require two academic years (Finch & Crunkilton, 1993). Three-year and 5-year junior colleges not only waste educational resources but also provide a confusing aspect to the technical educational system in Taiwan (Chen, 1992). The motives for founding the 2-year program were to train intermediate technicians to meet the needs of national economic development and to satisfy young people's eagerness to learn modern technology (Chen, 1992). The graduates of this program were welcomed by industry because their academic levels were satisfactory (Chen, 1992).

The 3-year program of the junior technical college was founded in 1948. Although only a few departments of technology had been established, the academic levels of this program were much higher than the other two programs (the 2-year and 5-year programs) (Ministry Of Education, 1984). The Fifth National Education Convention suggested to the Ministry of Education (MOE) that 3-year programs should be elevated to a 4-year engineering college or changed to become a 2-year JTC. However, due to the limited numbers of 3-year program graduates, the MOE had to consider terminating recruitment of new students for these programs after 1995.

The purposes for establishing the 5-year program in the JTC systems were: (a) to alleviate the competitive pressure for entering senior high schools and colleges for the future graduates of the 9-year public program and (b) to instruct industrial technologies to meet the needs of students for their future occupations. However, because of improper curricula and instruction, inadequate budget, and the lower academic level of the students, the outcome of the 5-year program greatly disappointed employers, educators, and students' parents (Chang, 1980).

Two types of 2-year junior technical colleges exist in Taiwan: one is funded by the government, and the other is operated by private interests. Most junior colleges are operated by private interests. Private 2-year junior technical colleges may be classified as either nonprofit or proprietary schools. The nonprofit schools derive their income from tuition, gifts and grants, endowments, and other sources not based on taxes. Many of these schools are operated by industry; in other words, industry trains some of its own personnel. The proprietary schools, however, most frequently derive operating funds as well as capital funds from tuition alone.

Section II

The Changing of Manufacturing Technology

The manufacturing world has gone through continuous periods of relative stability separated by periods of great change (Skinner, 1985). Wickham Skinner (1985) claimed that he has never seen such a period of change in manufacturing as occurred in the 1980s.

> The action in manufacturing has been extraordinary in the last five years. In my own experience I have never seen such frenetic, energetic, or determined efforts. I have been writing about U.S. manufacturing since the early 1960's, but the cause of the cyclone has nothing to do with anybody's book or articles. Professors don't start revolutions. Ideas may be important, but the roots of major industrial change lie in economics and technology. (p. 67)

The current changes in manufacturing can be organized into four groups: structural changes, economic changes, social changes, and technological changes. The most prominent structural changes include: an expanded global market for manufactured goods, changes in international productivity levels, and the development of an international strategic manufacturing policy by most of the industrial nations in the world. The economic and financial changes such as inflation, interest rates, and currency exchange rates have had a major impact on manufacturing during the last two decades (Hayes, Wheelwright, & Clark, 1988). Such factors shortened return on investment stages and caused many manufacturing firms to delay the replacement of out-dated capital equipment. Major social changes, including increased public sensitivity to environmental issues and to product quality and safety, caught many industry manufacturers unaware. Perhaps, the most critical change during the last decade has been the influence technology has had on manufacturing. Electronics, new materials in plastics and composites, new production techniques designed around flexible manufacturing cells, and the ability to move information rapidly via technology have all changed the way products are manufactured (Cohen & Zysman, 1987). Gerelle and Stark (1988) also note two of these forces as having the greatest impact on manufacturing, an increasing trend toward producing products for the global marketplace and the shift toward the use of computer-based information technology.

The rapid progress made in the computer industry has created a need for individuals who are familiar with the capabilities and limitations of computers. At the same time, this progress has changed the nature of the work force. For example, the use of the computer to assist in the analysis of designs and the production of visual instructions for the rapid accumulation of data used by inspectors has resulted in the elimination of hundreds of thousands of jobs (Favre, 1988). Significant gains in productivity resulting from automated product, improved machinery, and availability of synthetic materials and metal alloys, and other technological breakthroughs have permitted large increases in output without additional workers (Landner, 1985). This realignment of traditional manufacturing processes to automation requires production workers who have an understanding of the entire system as opposed to an understanding of just one component within the system (Skinner, 1985).

These changes have virtually eliminated many tasks requiring more physical strength. Few manufacturing tasks actually require full-time manual control by a worker anymore. As a result, the number of people employed in "direct labor" has been declining steadily since 1975 (Koska & Romano, 1988). Direct labor is now such a small percentage of the total cost of production that it is considered a relatively small target for further cost savings compared to other possibilities. Today, direct labor averages less than 15 per cent of the cost of most manufactured goods; in five years that number is likely to seem as extravagant as 3% defect rates did recently (Chase & Garvin, 1989). However, as the number of manual workers dropped, the need for the workers with technical training (especially in automation) grew. The body of knowledge necessary for operating a manufacturing facility has increased substantially. Such changes require that companies hire manufacturing engineers and technicians who are able to function effectively in this new and rapidly changing environment.

The changes in manufacturing over the last ten years, caused by the continuous advancement and implementation of computer-related automation, have been dramatic. Every business now has to master the science of manufacturing--the analysis, subdivision, and control of defined transformation tasks. Otherwise, its factories will remain hopelessly incapable of surviving in world competition. Only through the use of computer information technology can the science of manufacturing be mastered.

This "integration of the computer" is commonly referred to as computer integrated manufacturing (CIM), the use of computer technology to support the integration of all functions of a manufacturing business. Harrington (1984) argued that this technology is just what is needed in manufacturing because the discrete elements of manufacturing cannot be analyzed separately.

> Manufacturing is an indivisible, monolithic activity, incredibly diverse and complex in its fine detail. The many parts are inextricably interdependent and interconnected, so that no part may be safely separated from the rest and treated in isolation, without an adverse impact on the remainder, and thus on the whole. (p. 84)

Harrington then suggested that because interconnectivity in manufacturing is so important, the computer is ideally suited to link the acts of manufacturing together as one continuum of data.

Another major change in the manufacturing environment brought about by computer technology is greater flexibility. Rigid styles of production traditionally associated with heavy industries are being abandoned for flexible production techniques which permit industries to respond to the rapidly changing demands of consumers. This trend toward increasing automation will continue at a rapid rate as more research and development efforts discover new innovative ways of increasing production. There will be an increasing need to update those presently employed as well as an increasing need for technicians who are skilled in these new technologies. Many companies are looking to recent college graduates to assist them through this period of traumatic change (Koska & Romano, 1988).

Unfortunately, adequate numbers of graduates with the competencies and knowledge necessary to provide such leadership are not available. Without the highly automated manufacturing labs commonly found in most manufacturing facilities, graduates often remain poorly prepared. Robert Anderson (1985), Manager of Technical Education at General Electric, sees the lack of technical competence in recent graduates as a serious problem.

> Today's growing rate at which new technologies are being introduced into manufacturing has created a large demand for engineers and technicians competent in the new technologies. The colleges and universities, however, cannot produce new graduates in sufficient numbers or with adequate knowledge and skill to meet industry's need. (p. 64)

Competitive advantage has heightened the resurgence of industrial interest in how educational systems are preparing graduates for the manufacturing fields. The debate over how graduates should be prepared to function in this constantly changing environment is often heated.

Section III

Recent Curriculum Studies in the U.S.A and Taiwan

In the 1960s, several studies of technical education appeared. In an effort to better understand the changing role of the manufacturing technician, Harris (1964) defined engineering-oriented technicians in his book, Technical Education in the Junior College as follows:

> Technicians work with engineers in virtually every aspect of engineering and scientific work. One of the largest areas of employment is in research, development and design work. Technicians in this type of activity generally serve as direct supporting personnel to engineers or scientists. In the laboratory they conduct experiments or tests; set up, calibrate, and operate instruments; and make calculations. They may assist scientists and engineers in developing experimental equipment and models, do drafting, and frequently assume responsibility for certain aspects of design work under the engineer's direction. (p. 38)

He also concluded that engineering technicians are more field-oriented, and are likely to be required to apply scientific principles and technical knowledge to a broad field of engineering-related programs. On the other hand, he gave the definition of technician as follows:

> The industrial technician is one who does not require an extensive knowledge of science and engineering in depth to perform his work. When an industrial technician is working, he uses more craft and manipulative skills than he does engineering knowledge. Some technical operations are very limited in scope and level. In this group may be found such jobs as product inspection...Such jobs are clearly not far from a craft worker, but are differentiated by the necessity of the technician to apply some science and engineering knowledge. Some technical occupations deal with a large number of skills and knowledge (scope), but do not require depth of knowledge (level), and therefore are classed as "industrial technician" jobs. Such jobs include the laboratory technician who is capable of performing all the common tests but is not able to interpret the results; or a person who is accomplished in

> mechanical, electrical or aeronautical drawings but performs few layout or design functions. (Harris, 1964, p. 38)

Harris observes that the industrial technician's work relates to specific jobs, or is job-oriented. His observations have apparently had wide implications in connection with the required educational training. Some may disagree with the definitions, but they are realistic and useful as frames of reference in the design of curriculum content for technical education.

In 1966, Peterson developed a "training requirement analysis form" to serve as a basis for curriculum development. In this form, he identified two categories in curricula for mechanical technicians: the design technician concerned with the development, testing, evaluation and design function, equipment, instruments, and other mechanical services prior to production; and the production technician concerned with engineering problems involving the efficient use of manpower, materials, and process. Further, he developed several other curricula for other fields, such as drafting and electronics.

Like Harris, Peterson intended to have more subject-oriented than industrial-oriented studies in his curriculum development concept. This is similar to Super's (1965) philosophy: "It is a technical education, which results in such a firm grounding in mathematics and physics or chemistry (or all three) that the product of the training can solve unfamiliar problems, develop new methods, and adapt to changing conditions" (p. 37).

In the 1970s the British Engineering Industry Training Board suggested the following curriculum guidelines for technical education: (a) Flexibility, (b) Length of Training, (c) Assessment, (d) Standard of Craftsmanship, (e) Instruction, (f) Further Education, (g) Schedules of Instruction, and (h) Status of Technicians (Purnel, 1972). For designing an adequate curriculum for technical education, Hermann (1976), in his Trade and Technician Education, stated, "Technical curriculum development should be an integrated approach involving education, training, and the industrial experience associated with an occupation, and should be based on the needs of the individual, the needs of industry, and the needs of the society, and the resources available" (p. 45). Therefore, the determination of technical curriculum development should be concerned with a balance between the individual, the needs of industry, the needs of society, and the resources available.

Hermann (1976) also noted that for a technician to effectively perform his occupational functions, the emphasis of a technical course should be on a knowledge of skills, together with an understanding of mathematics, science, materials, etc. Thus, the technical course should contain mathematics, science, drafting, report writing, use of testing instruments, applied metallurgy, and other applied subjects. The traditional sequence of mathematics courses and the general physics course, however, are not suited to the demands of technical education programs. Earlier, Harris (1964) suggested that technicians should not be scheduled in the same mathematics and physics sections with students of science and engineering, where mathematics and physics constitute the foundation of the curriculum. He recommended specially designed courses, such as "technical mathematics" and "technical physics" for technicians.

In 1984, Foston conducted an investigation to determine the ideal content for a manufacturing technology curriculum. Under the auspices of the Industrial Research Consultative Committee, Foston surveyed 139 manufacturing professionals with knowledge of and experience in Computer Aided Production and Control Systems (CAPACS). The survey listed suggested topic areas under one of four groups: general education, professional manufacturing education, computer "basics" education, and technical education. The respondents were then asked to indicate whether a listed topic should or should not be included in a manufacturing technology curriculum. The study provided a list of topic areas which are organized according to the percentage of respondents who believed the listed course should be included in the curriculum. The proposed general curriculum structure found in the study does suggest an excellent course flow model.

The working groups at the Education for the Manufacturing World of the Future symposium also identified needs for manufacturing education (Landner, 1985). The following is an abbreviated list of recommendations: (a) Knowledge of manufacturing processes and selection criteria, (b) Implementation training beyond design problem solving, (c) Problem solving, (d) People skills, and (e) Cross disciplinary problem solving (p. 76).

The preceding studies clarify what a manufacturing technician's role might be in an industrial setting, and the types of curricula that would be necessary to prepare such a person.

Barnhart (1988) completed a study that attempted to generate a futures-oriented curriculum model related to manufacturing technology which could subsequently be used by industrial technology and manufacturing technology programs to facilitate curriculum revisions. Initially, Barnhart analyzed the manufacturing curriculum offerings of 37 industrial technology and engineering technology programs in the United States. Courses were placed in generic topic areas and ranked in order of importance, as determined by the semester credit hours required in each topic area. The second phase of the study used a delphi format involving 30 computer integrated manufacturing experts selected by Society of Manufacturing Engineers (SME) to produce and rank 149 competencies needed by manufacturing graduates from both programs in 1993. Even though the data generated by both studies provided meaningful information, Barnhart concluded that it was not possible to generate a curriculum model for either program area from his research because the data from the two groups studied did not directly correlate. The study did produce a list of existing manufacturing subject areas that were ranked according to credit hours required, and a separate list of ranked topic areas that the delphi study group perceived to be important in the future. While it was virtually impossible to precisely compare the results of the two programs, Barnhart attempted to identify those content areas where differences were clearly identifiable. The differences Barnhart noted in the responses from the two groups include:

1. The data from the analysis of degree plans ranked Metal Processing the highest, but similar competencies were rated low by the delphi panel.

2. Topic areas in the Material Science and Mechanical areas were ranked in the upper 25% of the degree plans but were rated in the lower 25% by the delphi panel.

3. Personnel Management was ranked near the top by the delphi panel but was ranked next to the bottom in the degree plans.

4. Computer Science and Communication skills were ranked high by the delphi panel but were low on the degree plans.

Barnhart (1988) concluded his study by recommending that future studies examine each content area more carefully. Furthermore, he recommended that future studies solicit more detailed industrial information about future competencies needed for manufacturing technician professionals.

Sitkins (1986) completed a limited analysis of some of the specific requirements of manufacturing technology programs. From the analysis, he identified seven general competencies that a graduate from a manufacturing technology curriculum should possess.

1. Set up, operate, and compare the function of standard machine tools and processing equipment.
2. Design, locate, evaluate, and specify the purchase of tools, tooling components for production systems.
3. Communicate effectively with production, engineering, and managerial personnel in a manufacturing environment.
4. Relate product design criteria to material selection, and alternative manufacturing processes.
5. Design and conduct tests of materials, analyze results, and/or process requirements.
6. Assess machine capabilities and personnel requirements in the selection of a manufacturing system.

7. Specify, design, implement, and test computer software and hardware installations for monitoring and/or control of manufacturing equipment and in advanced processing systems. (p. 1077)

He prefaced those competencies with this statement: "A command of both fundamental concepts and practical experiences in mathematics, basic and applied sciences, computer applications, and technical skills provides the foundation for dealing with rapidly changing technologies." Unfortunately, while very useful, Sitkins study did not include the industrial environment. Furthermore, although most educators and industrial reviewers would agree with those competencies, each might, however, develop a markedly different curriculum to teach them.

Gerelle and Stark (1988) also addressed the general competencies needed by a future manufacturing technician professional. They identified three characteristics that future manufacturing technician professionals should have.

1. Understand how systems and subsystems are interrelated.
2. Possess an interdisciplinary background with a broad background of skills in electrical, mechanical, fluid, optical, and microprocessing areas.
3. Possess a strong base of technical skills and, therefore, be capable of learning new specialties as the technology changes. (p. 97)

Some of the most significant prior research relative to this study was completed by the Society of Manufacturing Engineers (SME) of U.S.A. In 1984-85, during a period of extensive self-examination by many portions of the manufacturing community, SME conducted a survey to identify how manufacturing education was being taught in engineering technology programs across the United States. Existing course materials were collected and analyzed by a group of educators working with SME. Using the instructional materials, SME convened a meeting of 20 experienced manufacturing engineering technology educators for a workshop in August 1985 to analyze and define the minimum content of manufacturing engineering technology programs (SME, 1990a). While this research was very useful, it was void of industrial involvement and only reflected the limited focus of the 20 educators who participated. Recognizing that the results of the first study had limitations, SME initiated a second study in 1989. The second study collected data from 30 manufacturing engineering programs and 30 manufacturing engineering technology programs regarding program orientation and program content. From this data, SME divided all program content into eight subject categories: (a) Design for Production, (b) Materials, (c) Manufacturing Processes, (d) Manufacturing Systems and Automation, (e) Controls, (f) Manufacturing Management, Productivity and Quality, (g) Liberal Studies, and (h) Capstone Experience (Projects).

In April 1989, SME brought together over 90 representatives from 49 different institutions to analyze the data that had been collected and to further refine the content of ideal manufacturing engineering and manufacturing engineering technology curricula. Using the eight subject categories, the educators developed a model curriculum and SME published the results in the Curricula 2000 Workshop Proceedings (SME, 1990a).

Other studies in various countries identified staff development needs and competencies in technical areas as well as programming to develop such competencies using the Borich Needs Assessment Model. Hale (1993), Rach (1992), Ilkiuyoni (1984) and Waters and Haskell (1989) researched agricultural areas of farmers, teachers and extension service personnel using the Borich Model. Papritan (1985) and Helzer (1986) employed the Borich Model to study industrial personnel and training situations.

Curriculum Studies for Taiwan

In Taiwan, curricula for junior colleges are promulgated by the Ministry of Education. Curriculum standards for all levels of school are revised about every six years. Revision is made by subcommittees, and the members, appointed by the Ministry of Education, are teacher educators, classroom teachers, and administrators. The current two-year junior technical college curriculum standards (Ministry of Education, 1983) were promulgated in February, 1982 and have been implemented since 1983. Lee's studies (1990) indicated three major problems of this centralized junior technical college curriculum:

1. The revision interval is too long; thus standards do not promptly reflect social changes.

2. The standards lack flexibility; thus they do not reflect local variations among students.

3. The curriculum decision-making process is too weighted toward educational administrators and gives too little emphasis to the needs of industry.

The following significant objectives were established by the Ministry of Education (MOE, 1984) for the implementation of junior technical college curriculum standards:

1. To provide basic knowledge, skill, and attitude development based on a systematic analysis of the occupational domain to be served.
2. To produce a technician who is able to deal with the complex systems interactions that characterize modern technological environments.
3. To provide program options that allow in-depth study in specialized areas of the occupational domain beyond the basic skill level.
4. To provide for awarding of credit leading to an associate degree credential, as well as options toward other degree credentials.
5. To provide instruction that maximizes the application of knowledge, skills, and attitudes to real work situations.

6. To provide instruction that prepares the student for the complex problem-solving nature of highly technical occupations.
7. To fully coordinate the high-technology program with needs of business and industry through a process of school-community-business inter-cooperation. (p. 753)

The MOE was concerned that the differences in curriculum and instructional methods would lead to highly varying levels among the Junior Technical Colleges (JTCs). The work of curriculum revision for the 2-year, 3-year, and 5-year programs by educators and curriculum specialists was finally completed at the end of June, 1976. However, Chen (1992) notes that the new standard curriculum had the following problems:

1. A uniform standard curriculum could not guarantee that a JTC student would be at the same academic level because of many factors such as: capabilities of teachers and students, instructional techniques, the conditions of equipment and facilities, and the different learning environments.

2. The MOE's curriculum revision often lagged behind several years. Curriculum revision had to do with updating course and program content to incorporate new technology and practices related to changing job needs.

3. The credits required for graduation from Taiwan's JTCs were higher than in Japan and America. For example, in the 2-year program the required credits for graduation in

Taiwan, Japan, and America were 90, 62, and 62-72, respectively (Chen, 1992). In the 3-year program, the credits required for graduation in Taiwan and Japan were 120 and 93, respectively. With such a heavy burden of curriculum and extensive total class hours, the students had difficulty assimilating all that was presented. This was partly because the curriculum strained their physical health. Students lost interest in learning.

4. There were too few elective courses for students to take in order to explore and test their capacities. To illustrate, mechanical engineering (manufacturing division) curriculum patterns included in a junior technical college in Taiwan and a program in a junior college in the United States are described (see Figures 2 and 3). These curricula are actually in operation.

Curriculum revision updates course and program content to incorporate new technology and practices related to changing job needs. It may also have to do with designing competency-based curricula that will facilitate the evaluation of learning achievements, and offer broader programs for students to participate in technological fields. In Taiwan, the Committee of Curriculum Revision was a temporary agency to respond to curriculum revision under the supervision of the MOE. However, many curricular problems remain. During the present period of knowledge

Figure 2. A Model Mechanical Engineering Technology Curriculum for Junior Colleges in Georgia, U.S.A. From: "Education for The Technician: An Introduction" by Dept. of Vocational and Career Development, Georgia State University, p. 25., 1984.

Mechanical Engineering Technology
Standard Curriculum-Quarter System

First Quarter	Class	Lab	Hour	Cr
D.C. Circuits	4	3	7	5
Computer Fundamentals	3	6	9	5
Algebra	5	0	5	5
Engineering Graphics	1	6	7	3
	13	15	28	18
Second Quarter				
Physics I	4	3	7	5
Trigonometry	5	0	5	5
A.C. Circuits	4	3	7	5
English and Composition	5	0	5	5
	18	6	24	20
Third Quarter				
Physics II	4	3	7	5
Analytic Geometry and Calculus	5	0	5	5
Mechanical Devices & Systems	1	6	7	3
Elective (Group 1)	1	6	7	3
	11	15	26	16
Four Quarter				
Statics	4	3	7	5
Physics III	4	3	7	5
Technical Communications	5	0	5	5
Elective (Group 2)	1	6	7	3
	14	12	26	18
Fifth Quarter				
Electromechanical Devices	4	3	7	5
Elective (Group 3)	4	3	7	5
Economics	5	0	5	5
Dynamics	4	3	7	5
	16	10	26	20
Sixth Quarter				
Elective (Group 4)	1	6	7	3
Strength of Materials	4	3	7	5
Computer Aided Manufacturing	1	6	7	3
Machine Design	4	3	7	5
	10	18	28	16
Seventh Quarter				
Industrial Relations	5	0	5	5
Fluid Power	3	4	7	5
Elective (Any Group)	3	4	7	5
MET Problems (Elective)	0	9	9	3
	11	17	28	18

Figure 3. A Curriculum Model for Mechanical Engineering for Taiwan, R.O.C. From Standard Curriculum of Mechanical Engineering Technology for Two-Year Technical College. Department of Technological and Vocational Education of the Ministry of Education in Taiwan, R.O.C., p. 6, 1983.

Curriculum of Mechanical Engineering In Manufacturing Division

First Year

First Semester	CH	LH	CH
Dr. Sun Yat-Sen's Thoughts	2	0	2
Chinese	3	0	3
English	3	0	3
Physical Training	2	0	1
Military Training	2	0	1
Calculus	4	0	4
*Applies Mechanic	4	0	4
*Strength of Materials	2	0	2
*Shop Practice	0	3	1
*Mechanical Drawing	0	3	1
			22
Second Semester			
Chinese	3	0	3
English	3	0	3
Physical Training	2	0	1
Military Training	2	0	1
*Strength of Materials	3	0	3
*Shop Practice	0	3	1
*Mechanism	4	0	4
*Mechanical Drawing	0	3	1
*Mechanical Processing Methods	2	0	2
*Oil Hydraulics	3	0	2
*Mechanical Engineering Lab	0	3	1
*Precision Measurements & *Machinery Inspection	2	3	3
			22

Second Year

First Semester			
Chinese Modern History	2	0	2
Physical Training	2	0	1
Military Training	2	0	1
Computer Programming Design	2	0	2
*Electric Engineering	3	0	3
*Electric Engineering Lab	0	3	1
*Machine Design	4	0	4
*Machine Design and Drawing	0	2	2

(figure continues)

Curriculum of Mechanical Engineering In Manufacturing Division

First Semester			
*Jigs and Fixtures	3	0	3
*Shop Practice	0	3	1
*Mechanical Processing Methods	2	0	2
*Machine Tools	4	0	4
*Oil Hydraulics	0	3	2
*Lubrication	2	0	2
*Electives	3	0	3
			33
Second Semester			
Chinese Modern History	2	0	2
Physical Training	2	0	1
Military Training	2	0	1
*Production Control	2	0	2
*Quality Control	2	0	2
*Machine Design Drawing	0	2	1
*Shop Practice	0	3	1
*Plastic Forming	3	0	3
*Heat Treatment	2	0	2
*Casting	2	0	2
*NC Machine Tools & Lab	2	3	3
*Machine Design(II)	2	0	2
*Tool Design	2	0	2
*Electives	4	0	4
			28

Note.
* = Elective Technical Course
CH = Class Hour
LH = Lab Hour
CH = Credit Hour

explosion and changing technology, the JTC curriculum needs to be modified on a regular basis to reflect the technology used in industry. The practice in Taiwan has been to effect curricular revision years after the need has been recognized. Curriculum should be revised on a year-by-year basis in order to respond to the needs of individual schools or regions (Chang, 1980). Additionally, the revision work must be open to input from members of business, manufacturing industries, faculty members of JTCs, administrators, supervisors, psychologists, sociologists, and counselors (Chang, 1980).

Summary

Manufacturing programs have been and will continue to be changed and upgraded due to changes in industry. Knowledge of the full spectrum of manufacturing will be necessary for graduates to function effectively in industry. The manufacturing curriculum must be based on industrial needs on a national, regional or local level to be appropriate for a society.

The changes in the manufacturing world over the last decade have altered the role of the manufacturing engineer and technician. Major forces causing industrial change are the computer and computer applications, new and emerging technologies, the movement toward an international marketplace, and environmental issues. The challenge that faces educators in manufacturing related disciplines is how to develop the appropriate curriculum and necessary facilities for such a rapidly changing field. Due to the time lag required to implement curriculum changes in academia, long-range plans need to be established. These plans must consider what the future will require of employees in the way of competencies and educational background (Barnhart, 1988).

Some work has been done studying the content areas of a manufacturing engineering technology curriculum; however, no studies were found that established the relative importance of subject areas, the level of instruction needed, or the topics that will be important in the future for Taiwan.

Several themes are prominent in the literature: manufacturing engineering curricula need revising, the manufacturing technicians of the future must be more broadly-based without sacrificing technical depth, many faculty in these disciplines lack an awareness of the existing world of manufacturing, and more research is needed which addresses the relative importance of subject areas, the perceived level of instruction needed in each subject area, and the perceived future importance of subject areas.

CHAPTER III

RESEARCH METHODOLOGY

The major purpose of this study was to elicit information from people currently working in manufacturing operations in Taiwan, that can be used to evaluate and improve the curricula of Taiwan's technical education. The survey method of research was used to gather data from graduates of JTC-ME (manufacturing division) programs, their supervisors, and CEOs. Graduates who were surveyed were asked to voluntarily list the name of their immediate manufacturing supervisor and the company CEO so that these groups could also be surveyed.

Description of the Population and Sample

Three populations were surveyed: first, 1987-1991 graduates of JTC-ME (manufacturing division) programs in Taiwan; second, these graduates' supervisors at work; and third, the CEOs of the firms employing the graduates. From the population of 4347 graduates, a random sample of 353 was selected. The sample represented a broad job diversity: technical drawing, metalworking, electronics, graphic arts, and mechanical design. Most of the graduate sample worked in engineering-related organizations.

The sample of supervisors was dependent on the population of graduates. Only supervisors of graduate respondents were surveyed. The supervisors of those graduates who were employed in areas considered to be unrelated to their preparatory program in manufacturing industry were excluded from the study.

The sample of CEOs was also dependent on the population of graduates. Only CEOs of graduate respondents were surveyed. The CEOs of those graduates who were employed in areas considered to be unrelated to their preparatory program in manufacturing industry were excluded from the study. Examples of exclusions were those in commercial sales, the military, and teaching.

Description of the Instruments

Two questionnaires were developed, one for the graduates and a second for the supervisors and CEOs. According to Kidder (1981), survey research is ideally suited to study naturally occurring phenomena. The formatting of the instrument, the questioning technique, the cover letter, and the system used followed the "total design method" recommended in Dillman's (1978) Mail and Telephone Surveys.

Both questionnaires were designed to reduce the time required for completion and to present the information in a form which could be easily adapted for analysis with statistical computer software. The questionnaires were designed to elicit information about:

1. The degree of importance of present subject areas of JTC-ME (manufacturing division) curricula.

2. The preferred changes that should be made in the curricula of JTC-ME (manufacturing division) curricula.

3. Employment characteristics of graduates of JTC-ME (manufacturing division) programs, their supervisors and company CEOs.

Survey Instruments

The instruments or questionnaires consisted of three separate parts: Section I contained items pertaining to employment characteristics of the graduates in relation to their present occupations. Section II contained items related to present subject areas of the curricula which the graduates followed while they were in junior college. Section III contained subject areas that might be included in future manufacturing technology curricula that had been identified by the Society of Manufacturing Engineers in the U.S.A. (SME, 1990a). Further, the first page of each instrument briefly described its purpose.

Items in Section I of the questionnaires dealing with factual information were designed so that the respondent could check the appropriate blank or write in his/her response. Other items that required value judgments by the respondents used a Likert-Type scale with the following choices:

5: Strong agreement with the statement

4: Agreement with the statement

3: Undecided about the statement

2: Disagreement with the statement

1: Strong disagreement with the statement

Items in Section II and Section III asked for a rating of subject areas. Section II dealt with current curricula; Section III dealt with preferred changes in future curricula. In current curricula, the subject areas were separated into five categories that included 31 courses. In preferred changes for future curricula, the subject areas were divided into ten categories that included 61 courses. All of the courses were included in the survey instrument.

For Sections II and III, a five digit rating scale using bi-polar descriptors was constructed:

0: None

1: Limit

2: Average

3: Above Average

4: Extensive or Critical

Sections II and III were modeled on the one used by Papritan (1985). The instruments used for all populations can be found in Appendix A.

After consultation with experts in the field of manufacturing education in Taiwan and the United States, several modifications were made to the instrument.

The second instrument was designed to secure information from the supervisors and company CEOs. The two questionnaires used for the supervisors and CEOs were similar to the questionnaire for the graduates. For the second instrument, Section I judgements were secured by using a Likert-Type scale just as in the questionnaire for graduates. Also each supervisor was asked to evaluate certain aspects of the graduate's performance in the organization and to indicate any strengths or weaknesses of his performance. Sections II and Section III were identical to those same sections on the questionnaires for graduates.

Procedure for Obtaining Data

The questionnaires and cover letters used were reviewed by different groups of individuals. The questionnaires first were translated into a Chinese edition. Some administrators and faculty members of JTC-ME programs were asked to review the content of each questionnaire and to make suggestions for improvement.

Before the questionnaire for graduates was sent to the target population, a pilot test was conducted with a limited number of individuals (10) who graduated from Taipei Institute of Technology to develop the validity, readability and reliability of questionnaires and cover letters. These respondents were instructed to record the time required to complete the questionnaire and to make suggestions for clarity, content, and design. The second questionnaire was then sent to three supervisors and three CEOs. These supervisors and CEOs were also asked to record their completion time and to suggest improvements for the questionnaires.

The initial questionnaire was then mailed to the random sample chosen for this study. A cover letter (see Appendix B) and a stamped, self-addressed return envelope accompanied each questionnaire. A numerical check-out list was compiled for the entire sample. When a questionnaire was returned, the number of the respondent was checked on the list. After two weeks, the first follow-up letter was mailed to those graduates who had not responded. A cover letter encouraging participation in the study, a questionnaire, and a stamped, self-addressed envelope were included in this follow-up. A second follow-up was conducted after an additional two weeks to gain as many responses as possible. A telephone follow-up also was utilized after the second follow-up because of low initial response rates. There were 221 total questionnaires returned, but 56 of these were invalid and could not be used in the statistical analysis. A total of

165 valid questionnaires were returned by graduates out of the 353 that were mailed (46.7%).

It should be noted that 15 graduates returned questionnaires unanswered and indicated that they were presently unemployed. Also, 11 individuals indicated that they were working in areas that were not related to manufacturing occupations. Another eight individuals indicated that they were still students at this time. Additionally, nine individuals received Bachelor degrees. Another six graduates had no current address or a wrong address and, therefore, the letters were returned by the post office. It should be noted that three of the graduates were self-employed, and therefore, had no supervisor. Then, 12 of the graduates returned the questionnaires but their supervisor's and CEO's names and addresses were not provided. All of these individuals were excluded from the sample calculations.

Names and addresses of graduates' supervisors and CEOs obtained from the graduates' responses, were then mailed a questionnaire, cover letter, and self-addressed envelope. The same check-off and follow-up procedures were followed as for the graduates. The total return from manufacturing supervisors was 90 of the 165 mailed or 54.5%. The total return from CEOs was 72 of the 165 mailed or 43.6%.

Data Analysis Procedure

This study used the Borich Needs Assessment Model which has been applied in both educational and industrial situations to describe training needs (Papritan, 1985 & Helzer, 1986). A training need can be defined as a discrepancy between an educational goal and trainee performance in relation to this goal. The process of identifying training needs can be conceptualized as a discrepancy analysis that identifies the two polar positions of what is and what should be. Curriculum programs can apply this model by defining the measured behaviors, skills, and competencies of the trainee and what should be as the goals of the curriculum (Papritan, 1985 & Helzer, 1986). The discrepancy between these two poles can then be used as an index of the training program's effectiveness (Borich, 1980). This model provides a method of determining if the level of technical training is adequate.

In order to make this determination, a Borich Discrepancy Number (BDN) was derived for each of the subjects in the manufacturing technology curriculum. This number was derived by calculating the respondents' mean assessment of the importance of the subject, and then subtracting the respondents' mean assessment of the knowledge of the subject. This difference was multiplied by the respondents' mean assessment of the importance of the subject: Borich Discrepancy Number = (Importance Mean - Knowledge Mean) x Importance Mean. A sample of the survey format is given in the following example.

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
III. DESIGN FOR PRODUCTION			
(1) Engineering Drawing I.......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Computer Aided Design I........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Descriptive Geometry........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Engineering Drawing II......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

The sample data given was used to calculate the Borich Discrepancy Numbers (BDN) contained in the following examples. An interpretation of each of the numbers follows the calculation:

1. A high negative number indicated that manufacturing curriculum was more than adequate.

2. A high positive number indicated that more manufacturing curriculum was needed or that the curriculum could be considered inadequate.

3. Numbers close to zero (< +0.5 or > -0.5) indicated that the curriculum should be considered adequate (Papritan, 1985).

In the first example, the respondents rated their knowledge level of Engineering Drawing I as being limited and assigned it an ordinal rating of one. The respondent also rated the current importance as being average which has a rating of two and the future importance as being one as well. The calculation of the BDN for this example follows:

$$\text{Current: } [(2 - 1) \times (2)] = +2$$

$$\text{Future: } [(1 - 1) \times (1)] = 0$$

The current importance BDN is a positive two. The positive number indicates that the area of curriculum is not adequate for the present industrial demands and that it should be increased to reflect current demands. The future importance BDN of zero indicates that the curriculum can be considered adequate through the year two thousand once it has reached the current importance level previously designated. The only difference between the actual manipulation used in this study and the one done here is that the actual manipulation uses the mean value of all respondents rather than a single value.

In the second example of Computer Aided Design I the respondents rate their knowledge of Computer Aided Design I as being average which has a numerical value of two. The respondent then rated the current importance as being average, which also has a numerical value of two and the future importance as being above average which has a numerical rating of three. The current and future importance are different. Both are calculated and interpreted.

Current: $[(2 - 2) \times (2)] = 0$

Future: $[(3 - 2) \times (3)] = +3$

The BDN of zero in the current importance category indicates that the area of educational experience is adequate (Papritan, 1985). The second calculation for future importance of Computer Aided Design I is not subject to the same interpretation as the positive three was in the first example. It could not mean that the level of educational experience was adequate as the future has not yet occurred. Rather, a future curriculum demand is indicated and modifications need to be made to reflect this trend.

In the third example the respondent rated Descriptive Geometry in the following manner:

Knowledge Level - Above Average (3)

Current Importance - Limited (1)

Future Importance - Limited (1)

The BDN calculations and interpretations follow:

Current: $[(1 - 3) \times (1)] = -2$

Future: $[(1 - 3) \times (1)] = -2$

The BDN of negative two in the current importance indicates that the area of curriculum is more than adequate and that the topic could be de-emphasized in relation to the amount of time spent on the subject. In this example the future importance BDN of negative two, indicates that the amount of time spent in the curriculum should be decreased in light of other aspects of the curriculum which will require more time.

The correlations between the responses of the graduates, manufacturing supervisors, and the CEOs to current and future manufacturing curricula needs was assessed using the Pearson product moment correlation coefficient. The Pearson product moment correlation is especially useful when data occurs at the interval level of measurement. The resulting coefficient may have an index range from +1 to -1, where positive values indicate the relationship is positive and linear. When the value is negative the relationship is inverse and linear, and when it is zero the variables represented are not related, or the form of the relationship is non-linear (Kirk, 1984).

Summary

This study elicited information from graduates of JTC-ME (manufacturing division), their manufacturing supervisors and chief executive officers (CEOs) that can be used to evaluate and improve curricula of two-year mechanical engineering in manufacturing division programs. The survey method of research and computer software programs for data analysis were used in this study. Questionnaires were used to gather data from three samples of different, but interrelated, populations working in industry. The questionnaires consisted of three separate parts: Section I contained items pertaining to employment characteristics of the graduates. Section II contained items related to present subject areas of the curricula which the graduates followed while they were in junior college. Section III consisted of proposed subject areas which might be included in future manufacturing technology curricula. For Section I, judgments were secured by using a Likert-Type scale measurement. For Sections II and III, judgments were secured by using bi-polar descriptors in conjunction with a five digit rating scale.

The total return from graduates was 165 of the 353 that were mailed (46.7%). The total return from manufacturing supervisors was 90 of the 165 mailed or 54.5%. The total return from CEOs was 72 of the 165 mailed or 43.6% (see Table 1).

Table 1

Final Response Rate of Three Sample Groups

	Questionnaires Mailed	Questionnaires Returned	Percent Responded
Graduates	353	165	46.7%
Manufacturing Supervisors	165	90	54.5%
CEOs	165	72	43.6%

CHAPTER IV

ANALYSIS OF DATA

The presentation of data is divided into three sections: (a) the current and estimated future importance of each course in Taiwan's current standard curriculum for JTC-ME (manufacturing division) as judged by recent graduates, their supervisors, and their CEOs; (b) the current and estimated future importance of each course recommended for possible curricula by SME, U.S.A. as judged by graduates, their manufacturing supervisors and CEOs; (c) employment characteristics for the three populations surveyed.

Section I

Current Standard Curriculum

Respondents were asked to judge the importance of courses in the JTC-ME (manufacturing division) curricula. The 31 courses in the standard curriculum are grouped into five categories: Humanities and Social Sciences, Computer Science and Mathematics, Materials, Mechanical Design and Manufacturing Design, and Manufacturing Processes and Management (see Table 2). For each category, the BDN numbers for the courses within it along with the Pearson correlations for the three populations surveyed are presented in Tables 3 to 8. The BDN numbers were discussed first, followed by discussion of the Pearson correlations.

Table 2

The Two-Year Junior Technical College Standard Manufacturing Curriculum in Taiwan, R.O.C.

1. Humanities and Social Sciences:
    - Dr. Sun Yat-Sen's Thoughts
    - Chinese
    - English
    - Chinese Modern History
2. Computer Science and Mathematics
    - Calculus
    - Computer Programming Design
3. Materials
    - Strength of Materials
    - Mechanical Materials
    - Casting
4. Mechanical Design and Manufacturing Deign
    - Mechanism
    - Mechanical Drawing
    - Electric Engineering
    - Machine Design (I)
    - Machine Design and Drawing
    - Applied Mechanics
    - Machine Design (II)
    - Tools Design
5. Manufacturing Processes and Management
    - Jigs and Fixtures
    - Precision Measurements & Machinery Inspection
    - Shop Practice
    - Plastic Forming
    - Quality Control
    - Production Control
    - Heat Treatment
    - Machine Tools
    - Mechanical Processing Methods
    - Oil Hydraulics
    - Lubrication
    - Electric Engineering Lab.
    - Mechanical Engineering Lab.
    - NC Machine Tools & Lab.

<u>Humanities and Social Sciences</u>

In this category, the largest BDN numbers (graduates = 3.809, supervisors = 3.875, CEOs = 2.032) occur for the future value of English, indicating that the curriculum should assign greater emphasis to this subject to meet the perceived needs of students. In contrast, the negative BDN numbers (both current and future) for Dr. Sun Yet-Sen's Thoughts indicate that, in the view of respondents, the curriculum should devote less time to this subject. Similarly, the current and future BDN numbers for Chinese Modern History show that respondents consider this topic requires less emphasis in the curriculum. The Pearson correlation coefficients ($\underline{r}$ = 0.978 for graduates and supervisors, $\underline{r}$ = 0.921 for graduates and CEOs, and $\underline{r}$ = 0.949 for supervisors and CEOs) show that the three populations strongly agree on the importance of the various subjects (see Table 3).

<u>Computer Science and Mathematics</u>

Large BDN numbers from all three populations appear for both the current and future importance of Computer Programming; in contrast, the BDN numbers for Calculus are low with one exception: CEO's assign it a relatively high future value in comparison to graduates and supervisors. These numbers show that, in the view of respondents, Computer Programming needs a stronger emphasis in the

Table 3

Discrepancy Numbers for Humanities and Social Sciences Subjects for Taiwan Curriculum

Curriculum	Group	Current	Future
English	G	1.788	3.809
	S	1.659	3.875
	C	1.565	2.302
Chinese	G	-0.340	0.662
	S	0.378	1.222
	C	0.407	0.885
Chinese modern history.	G	-0.310	-0.060
	S	-0.410	-0.220
	C	-0.350	-0.280
Dr. Sun Yet-Sen's thoughts	G	-0.930	-0.680
	S	-0.970	-0.390
	C	-0.960	-0.810

r for graduates and supervisors = 0.978
r for graduates and CEOs = 0.921
r for supervisors and CEOs = 0.949

curriculum while Calculus needs less emphasis. As with the first category, the Pearson correlation coefficients (r = 0.988 for graduates and supervisors, r = 0.937 for graduates and CEOs, and r = 0.979 for supervisors and CEOs) indicate strong agreement on the degree of importance for both subjects across populations (see Table 4).

Table 4

Discrepancy Numbers for Computer Science and Mathematics Subjects for Taiwan Curriculum

Curriculum	Group	Current	Future
Computer Programming	G	2.056	3.852
	S	1.882	2.812
	C	3.229	3.395
Calculus	G	-0.062	-0.280
	S	-0.630	0.032
	C	1.081	1.823

r for graduates and supervisors = 0.988
r for graduates and CEOs = 0.937
r for supervisors and CEOs = 0.979

Materials

In this category, the largest BDN numbers (graduates = 1.508, supervisors = 2.270, CEOs = 1.392) occur for the future value of Mechanical Materials, indicating that the curriculum should assign greater emphasis to this subject to meet the perceived needs of students. In contrast, the negative BDN numbers (both current and future) for Strength of Materials are low with one exception: graduates assign it a relatively high future value in comparison to supervisors and CEOs. These number indicate that, in the view of respondents, the curriculum should devote less time to this subject. Similarly, the current BDN numbers for Mechanical

Materials and Casting show that respondents consider these topics require less emphasis in the current curriculum. The Pearson correlation coefficients (r = 0.599 for graduates and supervisors, r = 0.638 for graduates and CEOs, and r = 0.890 for supervisors and CEOs) show a general agreement about the current curriculum and the future trends as perceived by graduates, manufacturing supervisors, and CEOs. (see Table 5).

Table 5

Discrepancy Numbers for Materials Subjects Curriculum for Taiwan Curriculum

Curriculum	Group	Current	Future
Mechanical Materials	G	-0.840	1.508
	S	0.169	2.270
	C	-0.410	1.392
Casting	G	-0.160	1.305
	S	0.054	1.304
	C	0.397	1.572
Strength of Materials	G	0.025	1.305
	S	-1.150	-0.090
	C	-0.650	-0.300

r for graduates and supervisors = 0.599
r for graduates and CEOs = 0.638
r for supervisors and CEOs = 0.890

Mechanical Design and Manufacturing Design

In this category, the large BDN numbers (see Table 6) occur for the both current and future value of Mechanism, Mechanical Drawing, Machine Design and Drawing, and Tool Design, indicating that the curriculum should assign greater emphasis to this subject to meet the perceived needs of students. The Pearson correlation coefficients (r = 0.907 for graduates and supervisors, r = 0.744 for graduates and CEOs, and r = 0.872 for supervisors and CEOs) show that the three populations strongly agree on the importance of the various subjects.

Manufacturing Processes and Management

Large BDN numbers from all three populations appear for both the current and future importance of Shop Practice, Production Control, Electric Engineering Lab.; in contrast, the BDN numbers for Jigs and Fixtures, Mechanical Processing Methods are low with some exceptions: graduates assign it relatively high current and future value in Jigs and Fixtures in comparison to CEOs and supervisors. These numbers show that, in the view of respondents, Shop Practice, Production Control, Electric Engineering Lab. needs a stronger emphasis in the curriculum while Jigs and Fixtures, Mechanical Processing Methods needs less emphasis. The Pearson correlation coefficients (r = 0.883 for graduates and supervisors, r = 0.724 for graduates and CEOs,

Table 6

Discrepancy Numbers for Mechanical Design and Manufacturing Design Subject for Taiwan Curriculum

Curriculum	Group	Current	Future
Mechanism	G	1.632	2.559
	S	1.035	2.641
	C	1.537	2.596
Mechanical Drawing	G	2.077	2.503
	S	2.205	3.262
	C	3.252	3.198
Electric Engineering	G	1.049	1.124
	S	1.532	1.318
	C	2.133	1.994
Machine Design (I)	G	1.407	1.671
	S	0.905	1.257
	C	2.373	2.576
Machine Design and Drawing	G	1.745	1.870
	S	1.496	1.460
	C	1.982	1.884
Applied Mechanics	G	0.702	1.430
	S	0.278	0.875
	C	0.922	1.549
Machine Design (II)	G	0.721	1.785
	S	0.268	1.151
	C	0.855	1.332
Tools Design	G	1.014	3.477
	S	0.840	3.296
	C	1.874	3.357

r for graduates and supervisors = 0.907
r for graduates and CEOs = 0.744
r for supervisors and CEOs = 0.872

and $\underline{r}$ = 0.751 for supervisors and CEOs) indicate strong agreement on the degree of importance for both subjects across populations (see Table 7).

Table 7

Discrepancy Numbers for Manufacturing Processes and Management Subjects for Taiwan Curriculum

Curriculum	Group	Current	Future
Jigs and Fixtures	G	0.870	1.220
	S	-0.250	-0.130
	C	-0.230	-0.160
Precision Measurements & Machinery Inspection	G	1.782	1.414
	S	1.365	1.330
	C	1.621	1.046
Shop Practice	G	2.653	3.300
	S	2.411	3.055
	C	2.457	2.972
Plastic Forming	G	1.262	2.608
	S	0.950	1.833
	C	1.775	2.707
Quality Control	G	1.688	2.071
	S	1.334	1.565
	C	1.358	1.580
Production Control	G	3.681	3.079
	S	2.462	2.545
	C	2.659	2.866
Heat Treatment	G	1.960	2.860
	S	0.672	1.288
	C	2.907	2.665

(table continues)

Curriculum	Group	Current	Future
Machine Tools	G	0.691	1.368
	S	0.420	0.724
	C	2.289	3.264
Mechanical Processing Methods	G	-0.410	1.414
	S	-0.540	0.547
	C	0.481	1.381
Oil Hydraulics	G	1.252	0.599
	S	1.104	0.053
	C	1.229	0.296
Lubrication	G	1.350	2.208
	S	1.193	0.788
	C	0.181	0.386
Electric Engineering Lab.	G	1.381	3.230
	S	1.623	2.836
	C	1.657	2.834
Mechanical Engineering Lab.	G	0.867	2.005
	S	0.904	1.406
	C	1.703	1.648
NC Machine Tools & Lab.	G	1.601	4.781
	S	2.239	3.938
	C	2.749	4.401

$\underline{r}$ for graduates and supervisors = 0.883
$\underline{r}$ for graduates and CEOs = 0.724
$\underline{r}$ for supervisors and CEOs = 0.751

The BDN and Pearson Correlation for the Total Current Standard Curriculum

The data for the Pearson Product Moment Correlation Coefficient for the current and future trends are located in Table 8. Looking at the total curriculum, one can see that the highest BDN numbers occur in NC Machine Tools and Lab. The coefficient of 0.870, 0.794 and .799 for the current and 0.879, 0.775 and 0.806 for the future indicates that there is general agreement among groups with respect to the direction.

Table 8

The BDN and Pearson Correlation for All Courses in the Current Standard Curriculum

Curriculum	Group	Current	Future
Dr. Sun Yet-Sen's thoughts	G	-0.930	-0.680
	S	-0.970	-0.390
	C	-0.960	-0.810
Chinese	G	-0.340	0.662
	S	0.378	1.222
	C	0.407	0.885
English	G	1.788	3.809
	S	1.659	3.875
	C	1.565	2.302
Chinese modern history.	G	-0.310	-0.060
	S	-0.410	-0.220
	C	-0.350	-0.280
Calculus	G	-0.062	-0.280
	S	-0.630	0.032
	C	1.081	1.823
Computer Programming	G	2.056	3.852
	S	1.882	2.812
	C	3.229	3.395

(table continues)

Curriculum	Group	Current	Future
Strength of Materials	G	0.025	1.305
	S	-1.150	-0.090
	C	-0.650	-0.300
Mechanical Materials	G	-0.840	1.508
	S	0.169	2.270
	C	-0.410	1.392
Casting	G	-0.160	1.305
	S	0.054	1.304
	C	0.397	1.572
Mechanism	G	1.632	2.559
	S	1.035	2.641
	C	1.537	2.596
Mechanical Drawing	G	2.077	2.503
	S	2.205	3.262
	C	3.252	3.198
Electric Engineering	G	1.049	1.124
	S	1.532	1.318
	C	2.133	1.994
Machine Design (I)	G	1.407	1.671
	S	0.905	1.257
	C	2.373	2.576
Machine Design and Drawing	G	1.745	1.870
	S	1.496	1.460
	C	1.982	1.884
Applied Mechanics	G	0.702	1.430
	S	0.278	0.875
	C	0.922	1.549
Machine Design (II)	G	0.721	1.785
	S	0.268	1.151
	C	0.855	1.332
Tools Design	G	1.014	3.477
	S	0.840	3.296
	C	1.874	3.357

(<u>table continues</u>)

Curriculum	Group	Current	Future
Jigs and Fixtures	G	0.870	1.220
	S	-0.250	-0.130
	C	-0.230	-0.160
Precision Measurements & Machinery Inspection	G	1.782	1.414
	S	1.365	1.330
	C	1.621	1.046
Shop Practice	G	2.653	3.300
	S	2.411	3.055
	C	2.457	2.972
Plastic Forming	G	1.262	2.608
	S	0.950	1.833
	C	1.775	2.707
Quality Control	G	1.688	2.071
	S	1.334	1.565
	C	1.358	1.580
Production Control	G	3.681	3.079
	S	2.462	2.545
	C	2.659	2.866
Heat Treatment	G	1.960	2.860
	S	0.672	1.288
	C	2.907	2.665
Machine Tools	G	0.691	1.368
	S	0.420	0.724
	C	2.289	3.264
Mechanical Processing Methods	G	-0.410	1.414
	S	-0.540	0.547
	C	0.481	1.381
Oil Hydraulics	G	1.252	0.599
	S	1.104	0.053
	C	1.229	0.296
Lubrication	G	1.350	2.208
	S	1.193	0.788
	C	0.181	0.386

(table continues)

Curriculum	Group	Current	Future
Electric Engineering Lab.	G	1.381	3.230
	S	1.623	2.836
	C	1.657	2.834
Mechanical Engineering Lab.	G	0.867	2.005
	S	0.904	1.406
	C	1.703	1.648
NC Machine Tools & Lab.	G	1.601	4.781
	S	2.239	3.938
	C	2.749	4.401

_r_ for graduates and supervisors in Current Importance= 0.870
_r_ for graduates and CEOs in Current Importance = 0.794
_r_ for supervisors and CEOs in Current Importance = 0.799

_r_ for graduates and supervisors in Future Importance= 0.879
_r_ for graduates and CEOs in Future Importance = 0.775
_r_ for supervisors and CEOs in Future Importance = 0.806

Section II

SME Recommended Curriculum

Respondents were asked to judge the importance of courses in the SME recommended curriculum and to estimate the value of its courses for possible future curricula. The 61 courses in the SME recommended curriculum are grouped into 10 categories: Science and Mathematics, Human And Social Science, Design for Production, Materials, Manufacturing Processes, Manufacturing Systems and Automation, Controls Manufacturing Management, Production and Quality, Computer Applications, Capstone Experience (see Table 9). For each category, the BDN numbers for the courses within it along with the Pearson correlations for

Table 9

The SME Recommended Curricula

1. Science and Mathematics
   - Algebra and Trigonometry
   - Physics
   - Chemistry
2. Human And Social Science
   - Global Awareness
   - Social Awareness
   - Cultural Appreciation
   - Ethical & Value Sensitivity
3. Design for Production
   - Engineering Drawing I
   - Descriptive Geometry
   - Engineering Drawing II
   - Computer Aided Design I
   - Computer Aided Design II
   - Statics/Strength of Materials
   - Dynamics
   - Design of Machine Elements
   - Design for Production
   - Manufacturing Tooling
4. Materials
   - Introduction to Engineering Materials
   - Nondestructive Testing
   - Physical Metallurgy
   - Polymer Materials
   - Polymeric Composites
5. Manufacturing Processes
   - Introduction to Manufacturing Precesses
   - Fabrication and Pressworking
   - Electronics Fabrication
   - Plastics
   - Nontraditional and Emerging Material Removal Processes

(table continues)

6. Manufacturing Systems and Automation
    - Manufacturing Planning and Control
        - -Expert Systems
    - Manufacturing Planning and Control
        - -Quality Control
    - Manufacturing Planning
    - Computer Aided Manufacturing
        - -Manufacturing Simulation
    - C.A.M-Computer Aided Design
    - Computer Aided Manufacturing-Computer Aided Process Planning (CAPP)
    - Factory Automation-Assembly
    - Factory Automation-Control Strategy
    - Factory Automation-Numerical Control
    - Factory Automation-Material Handling
    - Factory Automation-Data Collection
    - Factory Automation-Cellular Manufacturing
    - Factory Automation-Controllers
    - Factory Automation-Sensors
    - Integration Group-Communications
    - Integration Group-Computer Integrated Manufacturing
7. Controls Manufacturing Management, Production and Quality
    - Electrical/Electronic Controls
    - Basic Fluid Power
    - Advanced Fluid Power
    - Control of Industrial Automation
8. Manufacturing Management Productivity and Quality
    - Business Management
    - Work Measurement
    - Quality in Manufacturing.
    - Human Relationships and Organizational Behavior
9. Computer Applications
    - Basic Programming
    - Fortran Programming
    - "C" Programming
    - Wordprocessing Software
    - Spreadsheet Software
    - Database Software
    - System Selection and Evaluation
10. Capstone Experience
    - Individual Project
    - Term Project within Disciplines
    - Term Project with Other Disciplines

the three populations surveyed are presented in Tables 10 to 20. The BDN numbers will be discussed first, followed by discussion of the Pearson correlations.

Science and Mathematics

In this category, the largest BDN numbers (graduates = 2.390, supervisors = 2.139, CEOs = 2.155) occur for the future value of Physics, indicating that the curriculum should assign greater emphasis to this subject to meet the perceived needs of students. In contrast, the negative BDN numbers (both current and future) for Algebra and Trigonometry indicate that, in the view of respondents, the curriculum should devote less time to this subject. The Pearson correlation coefficients ($\underline{r}$ = 0.816 for graduates and supervisors, $\underline{r}$ = 0.930 for graduates and CEOs, and $\underline{r}$ = 0.922 for supervisors and CEOs) show that the three populations strongly agree on the value of the various subjects (see Table 10).

Human and Social Science

Large BDN numbers from all three populations appear for the future values of Global Awareness, Social Awareness, Cultural Appreciation, Ethical & Value Sensitivity. These numbers show that, in the view of respondents, these courses need a stronger emphasis in the curriculum. The Pearson correlation coefficients ($\underline{r}$ = 0.503 for graduates and supervisors, $\underline{r}$ = 0.735 for graduates and CEOs, and $\underline{r}$ = 0.518

for supervisors and CEOs) indicate general agreement on the degree of importance for both subjects across populations (see Table 11).

Table 10

Discrepancy Numbers for Science and Mathematics Subjects for SME Curricula

Curriculum	Group	Current	Future
Algebra and Trigonometry	G	-1.050	-1.230
	S	-0.270	-0.220
	C	-0.260	-0.290
Physics	G	1.013	2.390
	S	2.178	2.139
	C	2.253	2.155
Chemistry	G	0.722	1.090
	S	0.500	0.525
	C	0.921	1.142

r for graduates and supervisors = 0.816
r for graduates and CEOs = 0.930
r for supervisors and CEOs = 0.922

Design for Production

In this category, the largest BDN numbers (graduates = 4.322, supervisors = 2.268, CEOs = 3.076) occur for the future value of Computer Aided Design I, indicating that the curriculum should assign greater emphasis to this subject to meet the perceived needs of students. Large BDN numbers from all three populations also appear for both the current and the future importance of Computer Aided Design II,

Table 11

Discrepancy Numbers for Human and Social Science Subjects for SME Curricula

Curriculum	Group	Current	Future
Global Awareness	G	0.403	1.182
	S	0.987	2.653
	C	0.356	1.753
Social Awareness	G	0.374	1.947
	S	0.875	1.234
	C	0.667	2.106
Cultural Appreciation	G	1.188	2.475
	S	0.625	1.193
	C	1.399	1.966
Ethical & Value Sensitivity	G	0.488	2.884
	S	1.210	1.991
	C	2.233	2.905

r for graduates and supervisors = 0.506
r for graduates and CEOs = 0.735
r for supervisors and CEOs = 0.518

Design for Production, Manufacturing Tooling. In contrast, the negative BDN numbers (both current and future) for Engineering Drawing I and Descriptive Geometry indicate that, in the view of respondents, the curriculum should devote less time to this subject. The Pearson correlation coefficients (r = 0.565 for graduates and supervisors, r = 0.565 for graduates and CEOs, and r = 0.698 for supervisors and CEOs) show that the three populations generally agree on the importance of the various subjects (see Table 12).

Table 12

Discrepancy Numbers for Design for Production Subjects for SME Curricula

Curriculum	Group	Current	Future
Engineering Drawing I	G	-0.120	1.009
	S	-0.760	-0.820
	C	0.843	1.096
Descriptive Geometry	G	0.014	0.901
	S	0.198	0.356
	C	-1.620	-1.460
Engineering Drawing II	G	1.208	1.785
	S	0.437	0.525
	C	1.024	1.105
Computer Aided Design I	G	4.296	4.322
	S	1.725	2.268
	C	2.562	3.076
Computer Aided Design II	G	3.450	3.576
	S	2.026	2.275
	C	2.409	3.024
Statics/Strength of Materials	G	0.901	2.049
	S	0.301	0.389
	C	0.768	0.807

(table continues)

Curriculum	Group	Current	Future
Dynamics	G	2.063	3.790
	S	0.527	0.687
	C	0.825	0.907
Design of Machine Elements	G	1.749	2.660
	S	0.527	0.687
	C	0.825	0.907
Design for Production	G	2.670	2.518
	S	1.240	1.422
	C	1.160	1.248
Manufacturing Tooling	G	1.619	1.161
	S	1.480	1.587
	C	1.531	1.621

r for graduates and supervisors = 0.565
r for graduates and CEOs = 0.565
r for supervisors and CEOs = 0.698

Materials

Large BDN numbers from all three populations appear for both the current and future importance of Nondestructive Testing, Polymeric Materials and Polymeric Composites. The BDN number for Introduction to Engineering Materials and Physical Metallurgy are high with some exceptions: supervisors assign it a low current and future value.

These numbers show that, in the view of respondents, needs a stronger emphasis in the curriculum of Nondestructive Testing, Polymeric Materials and Polymeric Composites. The Pearson correlation coefficients (r = 0.817

for graduates and supervisors, and r = 0.540 for supervisors and CEOs) indicate general agreement on the degree of importance for both subjects across populations. However, the Pearson correlation coefficients (r = 0.347 for graduates and CEOs) indicate that the agreement between graduates and CEOs is quite limited (see Table 13).

Table 13

Discrepancy Numbers for Materials Subjects for SME Curricula

Curriculum	Group	Current	Future
Introduction to Engineering Materials	G	1.140	0.888
	S	-0.030	0.052
	C	1.082	1.122
Nondestructive Testing	G	4.014	4.043
	S	3.249	3.566
	C	0.767	3.263
Physical Metallurgy	G	2.237	2.494
	S	0.103	0.182
	C	1.017	1.056
Polymer Materials	G	2.209	1.849
	S	1.284	2.102
	C	2.398	1.866
Polymeric Composites	G	1.258	2.571
	S	0.836	1.741
	C	1.444	1.524

r for graduates and supervisors = 0.817
r for graduates and CEOs = 0.347
r for supervisors and CEOs = 0.540

Manufacturing Processes

In this category, the largest BDN numbers (graduates = 3.643, supervisors = 2.591, CEOs = 2.671) occur for the future value of Nontraditional and Emerging Material Removal Processes indicating that the curriculum should assign greater emphasis to this subject to meet the perceived needs of students. In contrast, the low BDN numbers (both current and future) for Fabrication and Pressworking, Plastics indicate that, in the view of respondents, the curriculum should devote less time to these subjects. The Pearson correlation coefficients ($\underline{r}$ = 0.678 for graduates and supervisors, $\underline{r}$ = 0.606 for graduates and CEOs, and $\underline{r}$ = 0.992 for supervisors and CEOs) show that the three populations general agree on the importance of the various subjects (see Table 14).

Manufacturing Systems and Automation

Large BDN numbers from all three populations appear for both the current and future importance of all courses in this category. In this category, the largest BDN numbers (graduates = 3.505, supervisors = 3.425, CEOs = 3.356) occur for the future value of Integration Group-Computer Integrated Manufacturing. Large BDN numbers from all three populations indicated that all curricula should assign greater emphasis to this subject to meet the perceived needs of students. The Pearson correlation coefficients ($\underline{r}$ =

0.447 for graduates and supervisors) indicate general agreement between graduates and supervisors. The Pearson correlation coefficients (r = 0.359 for graduates and CEOs

Table 14

Discrepancy Numbers for Manufacturing Processes Subjects for SME Curricula

Curriculum	Group	Current	Future
Introduction to Manufacturing Precesses	G	0.267	1.178
	S	-0.030	0.052
	C	0.421	0.456
Fabrication and Pressworking	G	0.012	0.534
	S	-0.320	-0.210
	C	0.151	0.247
Electronics Fabrication	G	1.310	2.530
	S	0.057	0.691
	C	1.092	1.204
Plastics	G	1.772	1.630
	S	-1.090	-0.980
	C	-0.840	-0.760
Nontraditional and Emerging Material Removal Processes	G	3.587	3.643
	S	2.631	2.591
	C	2.774	2.671

r for graduates and supervisors = 0.678
r for graduates and CEOs = 0.606
r for supervisors and CEOs = 0.992

and r = 0.360 for supervisors and CEOs) indicate that the agreement between graduates and CEOs is quite limited (see Table 15).

Table 15

Discrepancy Numbers for Manufacturing Systems and Automation Subjects for SME Curricula

Curriculum	Group	Current	Future
Manufacturing Planning and Control - Expert Systems	G	2.634	2.830
	S	2.610	3.073
	C	3.394	3.340
Manufacturing Planning and Control - Quality Control	G	2.453	2.805
	S	2.565	2.398
	C	2.345	2.727
Manufacturing Planning	G	2.890	3.276
	S	1.017	2.947
	C	2.231	3.012
Computer Aided Manufacturing -Manufacturing Simulation	G	2.372	3.383
	S	2.520	3.022
	C	2.395	3.179
C.A.M-Computer Aided Design	G	2.680	3.331
	S	3.420	3.373
	C	3.190	3.474
Computer Aided Manufacturing- Computer Aided Process Planning (CAPP)	G	2.067	3.325
	S	3.531	3.484
	C	2.262	2.314
Factory Automation -Assembly	G	3.101	3.089
	S	2.535	2.984
	C	2.262	2.314
Factory Automation-Control Strategy	G	2.805	3.619
	S	2.850	3.250
	C	3.022	3.338
Factory Automation- Numerical Control	G	3.197	3.397
	S	2.980	3.026
	C	3.050	3.422

(table continues)

Curriculum	Group	Current	Future
Factory Automation-Material Handling	G	2.893	3.343
	S	2.707	3.008
	C	2.155	2.985
Factory Automation-Data Collection	G	2.597	3.351
	S	3.209	3.392
	C	3.049	3.328
Factory Automation-Cellular Manufacturing	G	2.716	3.145
	S	3.339	3.479
	C	3.312	3.488
Factory Automation-Controllers	G	2.568	2.996
	S	3.123	3.176
	C	3.102	3.188
Factory Automation-Sensors	G	2.284	3.471
	S	2.699	3.136
	C	2.672	3.030
Integration Group-Communications	G	2.350	3.131
	S	3.093	3.005
	C	3.048	3.165
Integration Group-Computer Integrated Manufacturing	G	2.481	3.505
	S	2.524	3.425
	C	3.181	3.356

$\underline{r}$ for graduates and supervisors = 0.447
$\underline{r}$ for graduates and CEOs = 0.359
$\underline{r}$ for supervisors and CEOs = 0.360

Controls

In this category, the large BDN numbers (see Table 16) occur for both the current and future value of Electrical/Electronic Controls and Control of Industrial Automation, indicating that the curriculum should assign greater emphasis to this subject to meet the perceived needs of students. The Pearson correlation coefficients (r = 0.819 for graduates and supervisors, r = 0.763 for graduates and CEOs, and r = 0.953 for supervisors and CEOs) show that the three populations strongly agree on the importance of the various subjects (see Table 16).

Manufacturing Management Productivity and Quality

Large BDN numbers from all three populations appear for both the current and future importance of Quality in Manufacturing and Human Relationship and Organizational Behavior. These numbers show that, in the view of respondents, these subjects need a stronger emphasis in the curriculum. The Pearson correlation coefficients (r = 0.520 for graduates and supervisors, r = 0.429 for graduates and CEOs and r = 0.726 for supervisors and CEOs) indicate general agreement on the degree of importance for both subjects across populations (see Table 17).

Computer Applications

Large BDN numbers from all three populations appear for both the current and future importance of all courses in this category. In this category, the largest BDN numbers (graduates = 2.175, supervisors = 2.206, CEOs = 2.605) occur for the future value of Fortran Programming. Large BDN numbers indicate that the curriculum should assign greater emphasis to these subjects to meet the perceived needs of

Table 16

Discrepancy Numbers for Controls Subjects for SME Curricula

Curriculum	Group	Current	Future
Electrical/Electronic Controls	G	2.574	2.412
	S	1.346	1.486
	C	1.648	2.065
Basic Fluid Power	G	1.715	2.617
	S	1.058	1.120
	C	1.056	1.017
Advanced Fluid Power	G	0.353	1.931
	S	0.318	0.430
	C	0.484	0.543
Control of Industrial Automation	G	2.479	4.793
	S	2.358	2.603
	C	2.276	2.479

r for graduates and supervisors = 0.819
r for graduates and CEOs = 0.763
r for supervisors and CEOs = 0.953

students. The Pearson correlation coefficients (r = 0.517 for supervisors and CEOs) indicate general agreement between supervisors and CEOs. The Pearson correlation coefficients (*r* = 0.353 for graduates and supervisors and *r* = 0.425 for graduates and CEOs) indicate that the agreement between graduates and CEOs is limited (see Table 18).

Capstone Experience

In this category, the large BDN numbers (see Table 19) occur for the both current and future value of Term Project

Table 17

Discrepancy Numbers for Manufacturing Management Productivity and Quality Subjects for SME Curricula

Curriculum	Group	Current	Future
Business Management	G	1.777	2.138
	S	0.366	0.349
	C	0.632	1.481
Work Measurement	G	1.394	2.505
	S	0.145	0.235
	C	0.110	0.185
Quality in Manufacturing	G	2.725	2.822
	S	1.528	1.600
	C	1.479	1.497
Human Relationship and Organizational Behavior	G	1.440	3.475
	S	1.315	1.347
	C	1.412	2.647

r for graduates and supervisors = 0.520
r for graduates and CEOs = 0.429
r for supervisors and CEOs = 0.726

Within Discipline, indicating that the curriculum should assign greater emphasis to this subject to meet the perceived needs of students. The Pearson correlation coefficients (r = 0.868 for graduates and supervisors, r = 0.695 for graduates and CEOs, and r = 0.919 for supervisors and CEOs) show that the three populations strongly agree on the importance of the various subjects.

Table 18

Discrepancy Numbers for Computer Applications Subjects for SME Curricula

Curriculum	Group	Current	Future
Basic Programming	G	2.295	2.282
	S	2.090	2.209
	C	2.516	2.310
Fortran Programming	G	1.955	2.175
	S	1.857	2.206
	C	2.362	2.605
"C" Programming	G	1.705	1.709
	S	2.057	2.347
	C	2.115	2.162
Wordprocessing Software	G	2.364	2.060
	S	1.921	1.999
	C	1.753	1.573
Spreadsheet Software	G	2.080	1.810
	S	1.919	1.119
	C	1.573	1.757
Database Software	G	1.038	2.203
	S	1.639	2.411
	C	1.127	1.948
System Selection and Evaluation	G	2.055	2.423
	S	1.985	1.910
	C	1.559	1.595

r for graduates and supervisors = 0.353
r for graduates and CEOs = 0.425
r for supervisors and CEOs = 0.517

Table 19

Discrepancy Numbers for Capstone Experience Subjects for SME Curricula

Curriculum	Group	Current	Future
Individual Project	G	2.505	2.711
	S	1.980	2.017
	C	1.497	1.775
Term Project within Discipline	G	2.250	2.475
	S	2.574	2.492
	C	2.408	2.903
Term Project with Other Disciplines	G	1.264	0.505
	S	0.798	0.762
	C	0.878	0.947

r for graduates and supervisors = 0.868
r for graduates and CEOs = 0.695
r for supervisors and CEOs = 0.919

The BDN and Pearson Correlation for All Courses in the SME Recommended Curriculum

The data for the Pearson Product Moment Correlation Coefficient for the current and future trends are located in Table 20. Looking at the total curriculum, one can see that the highest BDN numbers occur in Computer Aided Design I. The coefficient of 0.699, 0.683 and .838 for the current and 0.68, 0.705 and 0.881 for the future indicates that there is general agreement among groups with respect to the direction.

Table 20

The BDN Numbers and Pearson Correlations for SME Curricula

Curriculum	Group	Current	Future
Algebra and Trigonometry	G	-1.050	-1.230
	S	-0.270	-0.220
	C	-0.260	-0.290
Physics	G	1.013	2.390
	S	2.178	2.139
	C	2.253	2.155
Chemistry	G	0.722	1.090
	S	0.500	0.525
	C	0.921	1.142
Global Awareness	G	0.403	1.182
	S	0.987	2.653
	C	0.356	1.753
Social Awareness	G	0.374	1.947
	S	0.875	1.234
	C	0.667	2.106
Cultural Appreciation	G	1.188	2.475
	S	0.625	1.193
	C	1.399	1.966
Ethical & Value Sensitivity	G	0.488	2.884
	S	1.210	1.991
	C	2.233	2.905
Engineering Drawing I	G	-0.120	1.009
	S	-0.760	-0.820
	C	0.843	1.096
Descriptive Geometry	G	0.014	0.901
	S	0.198	0.356
	C	-1.620	-1.460
Engineering Drawing II	G	1.208	1.785
	S	0.437	0.525
	C	1.024	1.105

(table continues)

Curriculum	Group	Current	Future
Computer Aided Design I	G	4.296	4.320
	S	1.725	2.268
	C	2.562	3.076
Computer Aided Design II	G	3.450	3.576
	S	2.026	2.275
	C	2.409	3.024
Statics/Strength of Materials	G	0.901	2.049
	S	0.301	0.389
	C	0.768	0.807
Dynamics	G	2.063	3.790
	S	0.527	0.687
	C	0.825	0.907
Design of Machine Elements	G	1.749	2.660
	S	0.527	0.687
	C	0.825	0.907
Design for Production	G	2.670	2.518
	S	1.240	1.422
	C	1.160	1.248
Manufacturing Tooling	G	1.619	1.161
	S	1.480	1.587
	C	1.531	1.621
Introduction to Engineering Materials	G	1.140	0.888
	S	-0.030	0.052
	C	1.082	1.122
Nondestructive Testing	G	4.014	4.043
	S	3.249	3.566
	C	0.767	3.263
Physical Metallurgy	G	2.237	2.494
	S	0.103	0.182
	C	1.017	1.056
Polymer Materials	G	2.209	1.849
	S	1.284	2.102
	C	2.398	1.866

(table continues)

Curriculum	Group	Current	Future
Polymeric Composites	G	1.258	2.571
	S	0.836	1.741
	C	1.444	1.524
Introduction to Manufacturing Precesses	G	0.267	1.178
	S	-0.030	0.052
	C	0.421	0.456
Fabrication and Pressworking	G	0.012	0.534
	S	-0.320	-0.210
	C	0.151	0.247
Electronics Fabrication	G	1.310	2.530
	S	0.057	0.691
	C	1.092	1.204
Plastics	G	1.772	1.630
	S	-1.090	-0.980
	C	-0.840	-0.760
Nontraditional and Emerging Material Removal Processes	G	3.587	3.643
	S	2.631	2.591
	C	2.774	2.671
Manufacturing Planning and Control-Expert Systems	G	2.634	2.830
	S	2.610	3.073
	C	3.394	3.340
Manufacturing Planning and Control-Quality Control	G	2.453	2.805
	S	2.565	2.398
	C	2.345	2.727
Manufacturing Planning	G	2.890	3.276
	S	1.017	2.947
	C	2.231	3.012
Computer Aided Manufacturing -Manufacturing Simulation	G	2.372	3.383
	S	2.520	3.022
	C	2.395	3.179
C.A.M-Computer Aided Design	G	2.680	3.331
	S	3.420	3.373
	C	3.190	3.474

(table continues)

Curriculum	Group	Current	Future
Computer Aided Manufacturing-Computer Aided Process Planning (CAPP)	G	2.067	3.325
	S	3.531	3.484
	C	2.262	2.314
Factory Automation-Assembly	G	3.101	3.089
	S	2.535	2.984
	C	2.262	2.314
Factory Automation-Control Strategy	G	2.805	3.619
	S	2.850	3.250
	C	3.022	3.338
Factory Automation-Numerical Control	G	3.197	3.397
	S	2.980	3.026
	C	3.050	3.422
Factory Automation-Material Handling	G	2.893	3.343
	S	2.707	3.008
	C	2.155	2.985
Factory Automation-Data Collection	G	2.597	3.351
	S	3.209	3.392
	C	3.049	3.328
Factory Automation-Cellular Manufacturing	G	2.716	3.145
	S	3.339	3.479
	C	3.312	3.488
Factory Automation-Controllers	G	2.568	2.996
	S	3.123	3.176
	C	3.102	3.188
Factory Automation-Sensors	G	2.284	3.471
	S	2.699	3.136
	C	2.672	3.030
Integration Group-Communications	G	2.350	3.131
	S	3.093	3.005
	C	3.048	3.165
Integration Group-Compute Integrated Manufacturing	G	2.481	3.505
	S	2.524	3.425
	C	3.181	3.356

(*table continues*)

Curriculum	Group	Current	Future
Electrical/Electronic controls	G	2.574	2.412
	S	1.346	1.486
	C	1.648	2.065
Basic Fluid Power	G	1.715	2.617
	S	1.058	1.120
	C	1.056	1.017
Advanced Fluid Power	G	0.353	1.931
	S	0.318	0.430
	C	0.484	0.543
Control of Industrial Automation	G	2.479	4.793
	S	2.358	2.603
	C	2.276	2.479
Business Management	G	1.777	2.138
	S	0.366	0.349
	C	0.632	1.481
Work Measurement	G	1.394	2.505
	S	0.145	0.235
	C	0.110	0.185
Quality in Manufacturing	G	2.725	2.822
	S	1.528	1.600
	C	1.479	1.497
Human Relationship and Organizational Behavior	G	1.440	3.475
	S	1.315	1.347
	C	1.412	2.647
Basic Programming	G	2.295	2.282
	S	2.090	2.209
	C	2.516	2.310
Fortran Programming	G	1.955	2.175
	S	1.857	2.206
	C	2.362	2.605
"C" Programming	G	1.705	1.709
	S	2.057	2.347
	C	2.115	2.162

(*table continues*)

Curriculum	Group	Current	Future
Wordprocessing Software	G	2.364	2.660
	S	1.921	1.999
	C	1.753	1.573
Spreadsheet Software	G	2.080	1.810
	S	1.919	1.119
	C	1.573	1.757
Database Software	G	1.038	2.203
	S	1.639	2.411
	C	1.127	1.948
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	S	1.985	1.910
	C	1.559	1.595
Individual Project	G	2.505	2.711
	S	1.980	2.017
	C	1.497	1.775
Term Project within Discipline	G	2.250	2.475
	S	2.574	2.492
	C	2.408	2.903
Term Project with Other Disciplines	G	1.264	0.505
	S	0.798	0.762
	C	0.878	0.947

r for graduates and supervisors in Current Importance= 0.699
r for graduates and CEOs in Current Importance = 0.683
r for supervisors and CEOs in Current Importance = 0.838

r for graduates and supervisors in Future Importance = 0.680
r for graduates and CEOs in Future Importance = 0.705
r for supervisors and CEOs in Future Importance = 0.881

Section III

Descriptions of Employment Characteristics

Employment characteristics from the survey show the following profile for the graduates:

The majority of two-year manufacturing program graduates were employed in occupations which required technical skills or specific knowledge, such as engineering drawing or manufacturing processes. Over 32.7% were employed in engineering occupations, while 13.3% worked in production occupations, 10.3% in quality control and 11.5% in servicing and repair occupations. Most of the graduates (58 or 35.2% less than one year and 69 or 41.8% between one to two years) had worked at their present organizations for less than two years.

A number of the employment characteristics surveyed are closely related to the curriculum of the JTC-ME (manufacturing division). Five of these are discussed here:

Preparation For Initial Employment

Manufacturing supervisors were asked to respond to the statement, "The employee that I have supervised who graduated from the 2-year junior technical college mechanical engineering in manufacturing division program were adequately prepared for initial employment." Only three or 3.3% of 90 supervisors strongly agreed. Twenty-four or 26.7% agreed and 19 or 21.1% were undetermined. Almost half disagreed.

CEOs were asked to respond to the statement, "The employee that I have supervised who graduated from the two-year junior technical college mechanical engineering in manufacturing division program were adequately prepared for initial employment." Two or 2.8% of 72 CEOs strongly agreed. Twenty two or 30.6% agreed and 14 or 19.4% were undetermined. As with the supervisors, almost half disagreed (see Table 21).

Table 21

Preparation for Initial Employment of Graduates

Adequately Prepared for Initial Employment	Supervisors	CEOs
Strongly agreed	3 or 3.3%	2 or 2.8%
Agreed	24 or 26.7%	22 or 30.6%
Undetermined	19 or 21.1%	14 or 19.4%
Disagreed	41 or 45.6%	32 or 44.4%
Strongly disagreed	3 or 3.3%	2 or 2.8%

Performance of the Graduates

Manufacturing supervisors were asked to respond to the statement, "In general, how would you rate the performance of the employee who graduated from the two-year junior technical college mechanical engineering in manufacturing division program?" Eight or 8.9% of 90 supervisors said "Excellent," thirty-six or 40%, said "Above Average," 40 or 44.4%, "Average." Five or 5.6% said "Below Average," and one or 1.1% "Poor."

Company CEOs were asked to respond to the same statement, "In general, how would you rate the performance of the employee who graduate from the two-year junior technical college mechanical engineering in manufacturing division program?" Six or 8.3% of 72 CEOs said "Excellent," twenty-nine or 40.3% said "Above Average," 29 or 40.3% "Average." Seven or 9.7% said "Below Average," and only one or 1.4% "Poor" (see Table 22).

Table 22

Graduate's Performance Evaluation by Supervisors and CEOs

Evaluation of the Performance	Supervisors	CEOs
Excellent	8 or 8.9%	6 or 8.3%
Above Average	36 or 40%	29 or 40.3%
Average	40 or 44%	29 or 40.3%
Below Average	5 or 5.6%	7 or 9.7%
Poor	1 or 1.1%	1 or 1.4%

Technical Proficiency

Graduates were asked to respond to the statement, "I am technically proficient at the job I now hold." Over 90% of the graduates affirmed their proficiency. While 9 or 5.5% were undecided, only 2 or 1.2% disagreed and 1 or 0.6% strongly disagreed.

Graduates' manufacturing supervisors were asked to respond to the statement, "Do you think the graduate is technically proficient at the job he/she now holds?" There were 12 or 13.5% of the 90 supervisors who strongly agreed with the statement and 46 or 51.7% who agreed. Eighteen or 20.2% were undetermined. Only 13 or 14.6% disagreed.

Graduates' CEOs were asked to respond to the statement, "Do you think the graduate is technically proficient at the job he/she now holds?" There are 10 or 14.1% of the 72 CEOs who strongly agreed with the statement and 38 or 53.5% who agreed. Fifteen or 21.1% were undetermined. Only eight or 11.1% disagreed (see Table 23).

Need for Technical Skills

Graduates were asked to respond to the statement, "My technical skills (such as metals, drafting, etc) are essential for my job." This statement was used to obtain a measurement of the importance of technical skills for employment. Eighty-five or 51.8% of the 165 graduates

Table 23

Technical Proficiency of Graduates

Technical Proficiency	Graduates	Supervisors	CEOs
Strongly agreed	78 or 47.6%	12 or 13.5%	10 or 14.1%
Agreed	74 or 44.8%	46 or 51.7%	38 or 53.5%
Undetermined	9 or 5.5%	18 or 20.2%	15 or 21.1%
Disagreed	2 or 1.2%	13 or 14.6%	8 or 11.1%
Strongly disagreed	1 or 0.6%	-	-

strongly agreed while 67 or 40.6% agreed. Eight or 4.9% of graduates undetermined. Only five or 3% disagreed.

Graduates' supervisors were asked to respond to the statement, "Technical skills (such as metals, drafting, etc) are essential for the graduate's job." Fifty-three or 58.9% of the 90 manufacturing supervisors strongly agreed and 32 or 35.6% agreed. Five or 5.6% of supervisors undetermined.

Graduates' CEOs were asked to respond to the same statement as manufacturing supervisors. Forty-three or 59.7% of the 72 CEOs strongly agreed and 25 or 34.7% agreed. Four or 5.6% of CEOs undetermined (see Table 24).

Preparation for Advancement

Graduates' supervisors were asked to respond to the statement, "The employees mentioned in the about statement

Table 24

Need for Graduates' Technical Skills

Technical Skills	Graduates	Supervisors	CEOs
Strongly agreed	85 or 51.8%	53 or 58.9%	43 or 59.7%
Agreed	67 or 40.6%	32 or 35.6%	25 or 34.7%
Undetermined	8 or 4.9%	5 or 5.6%	4 or 5.6%
Disagreed	5 or 3%	-	-

are adequately prepared for advancement in this organization." Eight or 8.9% of the 72 supervisors strongly agreed and 47 or 52.2% agreed with the statement. Sixteen or 17.6% of supervisors were undetermined. Seventeen or 18.9% of the 72 supervisors disagreed and only two or 2.2% strongly disagreed.

Graduates' CEOs were asked to respond to the same statement as manufacturing supervisors. Six or 8.3% of the 72 CEOs strongly agreed and 36 or 50% agreed with the statement. Seventeen or 23.6% of CEOs were undetermined. Eleven or 15.3% of the CEOs disagreed and two or 2.8% strongly disagreed (see Table 25).

Miscellaneous other employment characteristics gathered in the survey can be found in Appendix F (Tables 26 to 36).

Table 25

Preparation for Advancement of Graduates in Their Employment Organization

Adequately Prepared for Advancement	Supervisors	CEOs
Strongly agreed	8 or 8.9%	6 or 8.3%
Agreed	47 or 52.2%	36 or 50.0%
Undetermined	16 or 17.6%	17 or 23.6%
Disagreed	17 or 18.9%	11 or 15.3%
Strongly disagreed	2 or 2.2%	2 or 2.8%

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to evaluate the current curriculum and estimate possible changes in JTC-ME (manufacturing division) programs in Taiwan, based on the responses of recent graduates of these programs, their supervisors, and their CEOs. In order to accomplish the purpose of the study, answers to the following questions were sought:

1. What current subject areas of JTC-ME (manufacturing division) program curriculum were important for graduates in their employment?

2. What possible subject area should be emphasized in future (manufacturing division) program curriculum?

3. What are the employment characteristics of two-year JTC-ME (manufacturing division) program graduates as identified by their manufacturing supervisors and company CEOs?

4. With these questions answered, then recommendations for Taiwan's JTC-ME (manufacturing division) education can be developed to make technical education more responsive to the needs of industry.

Three populations were surveyed: first, 1987-1991 graduates of JTC-ME (manufacturing division) programs in

Taiwan; second, these graduates' supervisors at work; and third, the CEOs of the firms employing the graduates. From the population of 4347 graduates, a random sample of 353 was selected.

The questionnaires consisted of three separate parts: Section I contained items pertaining to employment characteristics of the graduates in relation to their present occupations. Section II contained items related to present subject areas of the curricula which the graduates followed while they were in junior college. Section III contained subject areas that might be included in future manufacturing technology curricula. These subject areas were identified by the Society of Manufacturing Engineers in U.S.A. (SME, 1990a). In Section I of the questionnaire, judgements were secured by using a Likert-Type scale. For Sections II and III judgements were secured by using bi-polar descriptors: 0: None, 1: Limit, 2: Average, 3: Above Average, 4: Extensive or Critical.

Return rates were 46.7% for graduates, 54.5% for supervisors and 43.6% for CEOs. The data were statistically analyzed using the Borich Discrepancy Model to measure the degree of importance respondents assigned to subjects in the current curriculum and possible future curricula. A Pearson product moment correlation coefficient was then used to calculate pair sets between groups.

Conclusions

From the theory that serves as a basis for the Borich model, a significant correlation was found between graduates, their manufacturing supervisors and CEOs among curriculum subjects. The Pearson Correlation Coefficient verified that this high degree of positive correlation existed between graduates, their manufacturing supervisors and CEOs.

An examination of the Borich discrepancy numbers was a very important part of analyzing the relationship between the current importance and the future importance for each subject within the welding curriculum. The discrepancy numbers ranged from a minus -1.62 to a positive +4.793. with the maximum positive discrepancy number of 16.00. The subjects with the greater positive numbers should have the higher priority for being offered or receiving increased emphasis in either current or future manufacturing programs.

The Current Standard Curricula

One can find 23 subjects with positive numbers (BDN > +0.5) among the graduates, 19 subjects with positive numbers among the manufacturing supervisors and 22 subjects with positive numbers among the CEOs (see Appendix D). Fifteen subjects important to both groups of respondent within the current manufacturing curriculum are English, Computer Programming, Mechanism, Mechanical Drawing, Electric

Engineering, Machine Design, Machine Design and Drawing, Tools Design, Precision Measurements & Machinery Inspection, Shop Practice, Plastic Forming, Quality Control, Production Control, Heat Treatment, Oil Hydraulics, Electric Engineering Lab., Mechanical Engineering Laboratory, and NC Machine Tools and Laboratory. The respondents are saying that these subjects need to be stressed now in JTC-ME (manufacturing division) programs. Educators and Industry should take immediate steps to either add these subjects or enhance their importance within the current manufacturing curricula. Another important subject for graduates and supervisors is Lubrication, while the CEOs feel that Calculus should be considered for enhanced training within the current curriculum. Although same ratings were not significantly common among the three groups of respondents, these subjects were rated by each group as important for additional instruction and training within the current JTC-ME manufacturing curriculum.

SME Recommended Curricula

In the SME recommended curricula, both groups of respondents strongly recommended both current and future manufacturing curricula to include additional training in computer based manufacturing curricula. Within our high-tech society, this subject has become, and will continue in the future, to be increasingly important to students within JTC-ME (manufacturing division) programs. The lack of equipment or funds for computer based manufacturing curricula instruction can no longer be used as an excuse for not providing this instruction to Taiwan's manufacturing students. These students need not necessarily become computer experts, but it is important that they become literate and comfortable working with computers. If the microcomputer can be connected up to a robot or automatic manufacturing system, it can add realism to the utilization of computers in today's manufacturing industry. Until students receive this instructions and become literate with computers, they will definitely be ill-prepared for a tomorrow manufacturing occupation.

Appendix D summarizes the trends for the SME recommended manufacturing curriculum. A list was developed of the subjects needed in manufacturing curriculum. These are subjects which all three groups feel should receive additional training impetus. These subjects include: Physics, Ethical and Value Sensitivity, Computer Aided Design, Nondestructive Testing, Nontraditional and Emerging Material Removal Processes, Integration Group-Computer Integrated Manufacturing, Control of Industrial Automation, Human Relationships and Organizational Behavior, System Selection and Evaluation, and Individual Project that definitely need to receive increased training within the future manufacturing curriculum.

The remaining subjects which were not specifically recommended for either current or future manufacturing curricula; should by no means be eliminated. In fact, if the subjects received a positive discrepancy number by either graduates, manufacturing supervisors, and CEOs, or both, then consideration should be given to their possible enhancement in the manufacturing program. The manufacturing programs administrators should compare current standard curricula to these SME, U.S.A. recommended subjects. The importance of subjects within current and future manufacturing curricula emphasized the ultimate goal of manufacturing education: to train the graduates for either current or future success in his or her chosen field. Thus, one can use the discrepancy numbers for any subject to evaluate their worth in Taiwan's JTC-ME programs.

Recommendations

The recommendations are organized into two sections:

1. Recommendations for the standard curriculum of the JTC-ME (manufacturing division) program as defined by the Curricula and Equipment Standard Committee in Taiwan.

2. Recommendations for possible future manufacturing technology curricula as proposed by the Society of Manufacturing Engineers of U.S.A.

Recommendations for the current standard curriculum of Taiwan follow:

1. The manufacturing curriculum should be more directed toward engineering and more enhanced in the areas of engineering fundamentals in the technical subject areas.

2. The following subject areas (see Appendix D) should be given greater emphasis: English, Computer Programming, Mechanical Materials, Mechanical Drawing, Tools Design, Shop Practice, Production Control, Quality Control, Electric Engineering, Electric Engineering Laboratory, NC Machine Tools and Lab., and Machine Design.

3. Courses in industrial management introduction curriculum should place more emphasis on technical aspects of manufacturing such as Quality Control.

4. The curriculum revision interval should be shortened, so courses work can promptly reflect technology and societal changes.

5. Curriculum should be more flexible to meet the varying needs of different locales and different students.

6. Curriculum decision-making should be more industry-oriented rather than determined by educational administrators.

7. A permanent advisory organization should be organized to design, implement, and evaluate curriculum content.

Recommendations for possible future manufacturing technology curricula are:

1. The possible manufacturing curriculum should be more directed toward computer-based subject matter topics and also more enhanced in the areas of engineering fundamentals in the technical subject areas.

2. The following subject areas (see Appendix D) should be stressed in the future: Physics, Ethical and Value Sensitivity, Computer Aided Design, Nondestructive Testing, Nontraditional and Emerging Material Removal Processes, Control of Industrial Automation, Human Relationship and Organizational Behavior, System Selection and Evaluation, Individual Project, Computer Integrated Manufacturing and subject areas of Manufacturing Systems and Automation.

Recommendations for Further Study

For technical education to keep pace with changes in technology and manufacturing, on-going research is needed. Recommendations for further studies follow:

1. A study to replicate this one in 3 to 5 years.

2. A study to develop in-depth model curricula for two-year manufacturing programs in Taiwan.

3. A study to determine what specific information should be included in course work to implement a model curriculum.

4. A similar study to compare opinions from industries and education.

5. A study to determine a manufacturing curriculum for the future period of the next decade.

6. A similar study for other nations (The United States, Japan or Germany).

7. A study to compare the nature of the jobs held by graduates of junior technical college with the nature of the training they receive at school.

8. A study of technical training programs within manufacturing industries in Taiwan.

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APPENDIX A

Questionnaires

Graduate Questionnaire

Section I
Employment Information About the Graduate

Explanation: This section deals with certain types of information related to your employment. Please check the appropriate response to the following questions.

1. Which occupational category listed below most closely describes your present employment? (Check only one item please)
(1) _______ Engineering
(2) _______ Management or supervision
(3) _______ Marketing & Sales
(4) _______ Product design
(5) _______ Production worker
(6) _______ Quality control
(7) _______ Inventory control
(8) _______ Research and development
(9) _______ Servicing or repair
(10) _______ Other, please specify ___________________

2. How long have you been employed by the industry or business where you now work?

(1) _____ Less than 1 year (2) _____ 1 to 2 years
(3) _____ 2 to 3 years (4) _____ 3 to 4 years
(5) _____ 4 to 5 years (6) _____ 5 to 6 years
(7) _____ More than 6 years

3. How many times have you been changed jobs since graduation from college?

(1) _____ None (2) _____ One time
(3) _____ Two times (4) _____ Three times
(5) _____ Four times (6) _____ Five times
(7) _____ More than five times

4. What was your starting salary (approximately) per month upon graduation from school?

(1) ______ Less than 15,000.00 NT Dollars
(2) ______ NT $ 15,000 to 18,000
(3) ______ NT $ 18,000 to 21,000
(4) ______ NT $ 21,000 to 24,000
(5) ______ NT $ 24,000 to 27,000
(6) ______ More than NT $ 27,000

* 1 US Dollar equal about 36 NT Dollars in Sep. 1987
* 1 US Dollar equal about 27 NT Dollars in Sep. 1993

5. What is your <u>present salary</u> (approximately) per month?
(1) ______ Less than 15,000.00 NT Dollars
(2) ______ NT $ 15,000 to 20,000
(3) ______ NT $ 20,000 to 25,000
(4) ______ NT $ 25,000 to 30,000
(5) ______ NT $ 30,000 to 35,000
(6) ______ More than NT $ 35,000

6. How many times have you been <u>promoted</u> to a higher position by the company where you are now employed?

(1) _____ None (2) _____ One time
(3) _____ Two times (4) _____ Three times
(5) _____ Four times (6) _____ Five times
(7) _____ More than five times

Explanation:
For the following statement, please check one "category of agreement" which is your true feeling:

7. I am <u>satisfied</u> with my present work responsibilities.
(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

8. I presently hold a position in which I <u>supervise</u> other workers
(1) ______ Yes
(2) ______ No

8-a. If "Yes" -- My technical background (drafting, design, others) was essential for advancement to this position.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

8-b. If "No" -- I would like to hold a supervisory or management position.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

9. I am technically proficient at the job I now hold.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

10. My technical skills (such as metals, drafting, etc.) are essential for my job.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

11. My attitude toward further college preparation is desirable.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

12. What is the title of the position you hold (such as quality control engineer, supervisor, electronics technician, etc.)
Title: ______________________________

13. Year of graduate from school: ______________

14. What is your degree now : ______________

Section II

Current Curriculum Evaluation

Explanation: The purpose of this section is to evaluate present subject areas of the Two-Year Technical College Mechanical Engineering (Manufacturing Division) Program curriculum. Please rate your knowledge and the perceived importance (both current and future) of the following manufacturing curricula. Consider only the subject areas you were actually employ or will be employing in the future. For each process mark your level of knowledge and perception of its importance both currently and in the future. If it is none, circle zero; if it is limited , circle one; if it is average, circle two, if it is about average, circle the three; if it is extensive or critical, circle the four.

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
I. HUMANITIES AND SOCIAL SCIENCES			
(1) Dr. Sun Yat-Sen's Thoughts...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Chinese............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) English............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Chinese Modern History............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
II. COMPUTER SCIENCE AND MATHEMATICS			
(1) Calculus...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Computer Programming Design.............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
III. MATERIALS			
(1) Strength of Materials............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Mechanical Materials.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Casting..............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
IV. MECHANICAL DESIGN AND MANUFACTURING DESIGN			
(1) Mechanism...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Mechanical Drawing..	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Electric Engineering	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Machine Design (I)..	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) Machine Design and Drawing.............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(6) Applied Mechanics...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(7) Machine Design(II)..	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(8) Tools Design........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
V. MANUFACTURING PROCESSES			
(1) Jigs and Fixtures...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Precision Measurements & Machinery Inspection.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Shop Practice.......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Plastic Forming.....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) Quality Control.....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(6) Production Control..	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(7) Heat Treatment......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(8) Machine Tools.......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(9) Mechanical Processing Methods.............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(10) Oil Hydraulics.....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(11) Lubrication........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(12) Electric Engineering Lab................	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(13) Mechanical Engineering Lab................	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
VI. MANUFACTURING SYSTEMS AND AUTOMATION			
(1) NC Machine Tools & Lab.................	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Others			
(1) ________________	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) ________________	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) ________________	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Section III
Possible Future Curriculum Evaluation

Explanation: The purpose of this section is to evaluate future (1994-2000) subject areas of the Two-Year Technical College Mechanical Engineering (Manufacturing Division) Program curriculum. Please rate your knowledge and the perceived importance (both current and future) of the following manufacturing curricula. Consider only the subject areas you were actually employ or will be employing in the future. For each process mark your level of knowledge and perception of its importance both currently and in the future. If it is none, circle zero; if it is limited , circle one; if it is average, circle two, if it is about average, circle the three; if it is extensive or critical, circle the four.

Possible Future Subject Areas of Curriculum

1. Evaluate the importance of subject areas of the manufacturing curriculum listed below for your present employment. Circle one of the numbers found at the right of each subject area.

* Please omit any subject area which is not applicable.

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
I. SCIENCE AND MATHEMATICS			
(1) Algebra and Trigonometry........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Physics.............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Chemistry...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
II. HUMAN AND SOCIAL SCIENCE			
(1) Global Awareness....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Social Awareness....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Cultural Appreciation........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Ethical & Value Sensitivity.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
III. DESIGN FOR PRODUCTION			
(1) Engineering Drawing I.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Descriptive Geometry..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Engineering Drawing II........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Computer Aided Design I..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) Computer Aided Design II.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(6) Statics/Strength of Materials.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(7) Dynamics..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(8) Design of Machine Elements..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(9) Design for Production........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(10) Manufacturing Tooling...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
IV. MATERIALS			
(1) Introduction to Engineering Materials...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Nondestructive Testing.............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Physical Metallurgy.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Polymer Materials...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) Polymeric Composites..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
V. MANUFACTURING PROCESSES			
(1) Introduction to Manufacturing Processes..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Fabrication and Pressworking.......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Electronics Fabrication........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Plastics...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
(6) Nontraditional and Emerging Material Removal Processes	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
VI. MANUFACTURING SYSTEMS AND AUTOMATION			
(1) Manufacturing Planning and Control -Expert Systems	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Manufacturing Planning and Control -Quality Control	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Manufacturing Planning	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Computer Aided Manufacturing-Manufacturing Simulation	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) C.A.M - Computer Aided Design	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(6) Computer Aided Manufacturing-Computer Aided Process Planning (CAPP)	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(7) Factory Automation -Assembly	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(8) Factory Automation-Control Strategy	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(9) Factory Automation-Numerical Control	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(10) Factory Automation-Material Handling	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(11) Factory Automation-Data Collection	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(12) Factory Automation-Cellular Manufacturing	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(13) Factory Automation-Controllers	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(14) Factory Automation -Sensors	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(15) Integration Group-Communications	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
(16) Integration Group -Computer Integrated Manufacturing......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
VII. Controls			
(1) Electrical/Electronic Controls...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Basic Fluid Power..	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Advanced Fluid Power..............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Control of Industrial Automation.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
VIII. MANUFACTURING MANAGEMENT, PRODUCTIVITY AND QUALITY			
(1) Business Management.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Work Measurement...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Quality in Manufacturing......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Human Relationship and Organizational Behavior...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
IX. COMPUTER APPLICATIONS			
(1) Basic Programming...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Fortran Programming.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) "C" Programming.....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Wordprocessing Software............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) Spreadsheet Software............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(6) Database Software...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(7) System Selection and Evaluation..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
X. CAPSTONE EXPERIENCE			
(1) Individual Project..	0 1 2 3 4	0 2 3 4	0 1 2 3 4
(2) Term Project within Discipline..........	0 1 2 3 4	0 2 3 4	0 1 2 3 4

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
(3) Term Project with other Disciplines...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
OTHERS			
(1) ____________....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) ____________....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) ____________....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

In the space below, please give the name and address of the organization where you are now employed, and the name of your manufacturing supervisor and general manager.

Name of Company:______________________________

Address:______________________________

Name of Manufacturing Supervisor:______________________________

Name of General Manager (CEO):______________________________

Control Code: G # ____

Supervisor Questionnaire

Section I
Employment Information about The Graduate

Explanation: This section deals with certain type of information related to the two-year junior technical college mechanical engineering employee. Please check the appropriate response to the following questions.

1. What is starting salary for the employee who graduated from two-year junior technical college mechanical engineering (approximately) per month upon graduation from school?

(1) ______ Less than 15,000.00 NT Dollars
(2) ______ NT $ 15,000 to 18,000
(3) ______ NT $ 18,000 to 21,000
(4) ______ NT $ 21,000 to 24,000
(5) ______ NT $ 24,000 to 27,000
(6) ______ More than NT $ 27,000

* 1 US Dollar equal about 36 NT Dollars in Sep. 1987
* 1 US Dollar equal about 27 NT Dollars in Sep. 1993

2. What is present salary for the employee who graduated from two-year junior technical college mechanical engineering (approximately) per month?

(1) ______ Less than 15,000.00 NT Dollars
(2) ______ NT $ 15,000 to 20,000
(3) ______ NT $ 20,000 to 25,000
(4) ______ NT $ 25,000 to 30,000
(5) ______ NT $ 30,000 to 35,000
(6) ______ More than NT $ 35,000

3. In average, how many times has the employee who graduated from two-year junior technical college mechanical engineering been promoted to a higher position by the company where he/she is presently employed?

(1) _____ None (2) _____ One time
(3) _____ Two times (4) _____ Three times
(5) _____ Four times (6) _____ Five times
(7) _____ More than five times

Explanation:
For the following statements, please check one "category of agreement" which is your true feeling:

4. Does the employee who graduated from a two-year junior technical college mechanical engineering in manufacturing division program hold a position in which he/she supervises other workers?
(1) ______ Yes
(2) ______ No

4-a. If "Yes" -- The graduate technical background (drafting, design, others) was essential for advancement to this position.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

4-b. If "No" -- In your observation, would the graduate desire to hold a supervisory or management position?

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

5. Do you think the graduate is technically proficient at the job he/she now holds?

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

6. The graduate has technical skills (such as metals, drafting, etc.) which are essential for his/her job.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

7. The graduate's attitude toward further college preparation is desirable.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

Explanation: For the following statements, please check one "category of agreement" which is your true feeling.

8. The employees that I have supervised who graduated from the two-year junior technical college mechanical engineering in manufacturing division program were adequately prepared for initial employment.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

9. The employees mentioned in the above statement are adequately prepared for advancement in this organization.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

10. The need for the two-year junior technical college mechanical engineering in manufacturing division program graduates will increase substantially during the next five years.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

11. Management or supervisory skills are important for two-year junior technical college mechanical engineering in manufacturing division program graduates to possess.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

Explanation: Please respond to the following question which are in reference to the employee who graduated from two-year junior technical college mechanical engineering in manufacturing division program.

12. In general, how would you rate the performance of the employee who graduated from two-year junior technical college mechanical engineering in manufacturing division program

(1) ______ Excellent
(2) ______ About average
(3) ______ Average
(4) ______ Below average
(5) ______ Poor

13. If possible, please comment on the followings:

a. What strengths have you noted among two-year junior technical college mechanical engineering in manufacturing division program graduates. who are employed in your company?

Strengths:

____

____

b. What inadequacies have you noted among these graduates?
Weaknesses:

____

____

Section II
Present Curriculum Evaluation

Explanation: The purpose of this section is to evaluate present subject areas of the Two-Year Technical College Mechanical Engineering (Manufacturing Division) Program curriculum. Please rate your knowledge and the perceived importance (both current and future) of the following manufacturing curricula. Consider only the subject areas you were actually supervise or will be supervising in the future. For each process mark your level of knowledge and perception of its importance both currently and in the future. If it is none, circle zero; if it is limited , circle one; if it is average, circle two, if it is about average, circle the three; if it is extensive or critical, circle the four.

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
I. HUMANITIES AND SOCIAL SCIENCES			
(1) Dr. Sun Yat-Sen's Thoughts...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Chinese............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) English............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Chinese Modern History............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
II. COMPUTER SCIENCE AND MATHEMATICS			
(1) Calculus...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Computer Programming Design.............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
III. MATERIALS			
(1) Strength of Materials............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Mechanical Materials.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Casting..............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
IV. MECHANICAL DESIGN AND MANUFACTURING DESIGN			
(1) Mechanism...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Mechanical Drawing..	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Electric Engineering	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Machine Design (I)..	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) Machine Design and Drawing.............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(6) Applied Mechanics...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(7) Machine Design(II)..	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(8) Tools Design........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
V. MANUFACTURING PROCESSES			
(1) Jigs and Fixtures...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Precision Measurements & Machinery Inspection.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Shop Practice.......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Plastic Forming.....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) Quality Control.....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(6) Production Control..	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(7) Heat Treatment......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(8) Machine Tools.......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(9) Mechanical Processing Methods.............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(10) Oil Hydraulics.....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(11) Lubrication........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(12) Electric Engineering Lab................	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(13) Mechanical Engineering Lab................	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
VI. MANUFACTURING SYSTEMS AND AUTOMATION			
(1) NC Machine Tools & Lab.................	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Others			
(1) ________________	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) ________________	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) ________________	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Section III
Possible Future Curriculum Evaluation

Explanation: The purpose of this section is to evaluate future (1994-2000) subject areas of the Two-Year Technical College Mechanical Engineering (Manufacturing Division) Program curriculum. Please rate your knowledge and the perceived importance (both current and future) of the following manufacturing curricula. Consider only the subject areas you were actually supervise or will be supervising in the future. For each process mark your level of knowledge and perception of its importance both currently and in the future. If it is none, circle zero; if it is limited , circle one; if it is average, circle two, if it is about average, circle the three; if it is extensive or critical, circle the four.

Possible Future Subject Areas of Curriculum

1. Evaluate the importance of subject areas of the manufacturing curriculum listed below for your present employment. Circle one of the numbers found at the right of each subject area.

* Please omit any subject area which is not applicable.

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
I. SCIENCE AND MATHEMATICS			
(1) Algebra and Trigonometry........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Physics.............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Chemistry...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
II. HUMAN AND SOCIAL SCIENCE			
(1) Global Awareness....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Social Awareness....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Cultural Appreciation........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Ethical & Value Sensitivity.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
III. DESIGN FOR PRODUCTION			
(1) Engineering Drawing I.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Descriptive Geometry..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Engineering Drawing II........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Computer Aided Design I..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) Computer Aided Design II.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(6) Statics/Strength of Materials.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(7) Dynamics..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(8) Design of Machine Elements..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(9) Design for Production........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(10) Manufacturing Tooling...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
IV. MATERIALS			
(1) Introduction to Engineering Materials...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Nondestructive Testing............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Physical Metallurgy.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Polymer Materials...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) Polymeric Composites..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
V. MANUFACTURING PROCESSES			
(1) Introduction to Manufacturing Processes..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Fabrication and Pressworking.......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Electronics Fabrication........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Plastics...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
(6) Nontraditional and Emerging Material Removal Processes	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
VI. MANUFACTURING SYSTEMS AND AUTOMATION			
(1) Manufacturing Planning and Control -Expert Systems	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Manufacturing Planning and Control -Quality Control	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Manufacturing Planning	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Computer Aided Manufacturing-Manufacturing Simulation	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) C.A.M - Computer Aided Design	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(6) Computer Aided Manufacturing-Computer Aided Process Planning (CAPP)	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(7) Factory Automation -Assembly	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(8) Factory Automation-Control Strategy	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(9) Factory Automation-Numerical Control	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(10) Factory Automation-Material Handling	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(11) Factory Automation-Data Collection	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(12) Factory Automation-Cellular Manufacturing	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(13) Factory Automation-Controllers	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(14) Factory Automation -Sensors	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(15) Integration Group-Communications	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
(16) Integration Group-Computer Integrated Manufacturing......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
VII. Controls			
(1) Electrical/Electronic Controls...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Basic Fluid Power..	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Advanced Fluid Power.............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Control of Industrial Automation.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
VIII. MANUFACTURING MANAGEMENT, PRODUCTIVITY AND QUALITY			
(1) Business Management.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Work Measurement...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Quality in Manufacturing......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Human Relationship and Organizational Behavior...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
IX. COMPUTER APPLICATIONS			
(1) Basic Programming...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Fortran Programming.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) "C" Programming.....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Wordprocessing Software............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) Spreadsheet Software............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(6) Database Software...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(7) System Selection and Evaluation..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
X. CAPSTONE EXPERIENCE			
(1) Individual Project..	0 1 2 3 4	0 2 3 4	0 1 2 3 4
(2) Term Project within Discipline..........	0 1 2 3 4	0 2 3 4	0 1 2 3 4

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
(3) Term Project with other Disciplines...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
OTHERS			
(1) ________________....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) ________________....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) ________________....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Control Code: S #____

CEO Questionnaire

Section I
Employment Information of The Graduate

Explanation: This section deals with certain type of information related to the two-year junior technical college mechanical engineering employee. Please check the appropriate response to the following questions.

1. What is starting salary for the employee who graduated from two-year junior technical college mechanical engineering (approximately) per month upon graduation from school?

(1) ______ Less than 15,000.00 NT Dollars
(2) ______ NT $ 15,000 to 18,000
(3) ______ NT $ 18,000 to 21,000
(4) ______ NT $ 21,000 to 24,000
(5) ______ NT $ 24,000 to 27,000
(6) ______ More than NT $ 27,000

* 1 US Dollar equal about 36 NT Dollars in Sep. 1987
* 1 US Dollar equal about 27 NT Dollars in Sep. 1993

2. What is present salary for the employee who graduated from two-year junior technical college mechanical engineering (approximately) per month?

(1) ______ Less than 15,000.00 NT Dollars
(2) ______ NT $ 15,000 to 20,000
(3) ______ NT $ 20,000 to 25,000
(4) ______ NT $ 25,000 to 30,000
(5) ______ NT $ 30,000 to 35,000
(6) ______ More than NT $ 35,000

3. In average, how many times has the employee who graduated from two-year junior technical college mechanical engineering been promoted to a higher position by the company where he/she is presently employed?

(1) _____ None
(2) _____ One time
(3) _____ Two times
(4) _____ Three times
(5) _____ Four times
(6) _____ Five times
(7) _____ More than five times

Explanation:
For the following statements, please check one "category of agreement" which is your true feeling:
4. Does the employee who graduated from two-year junior technical college mechanical engineering in manufacturing division program hold a position in which he/she supervises other workers?
(1) ______ Yes
(2) ______ No

4-a. If "Yes" -- The graduate technical background (drafting, design, others) was essential for advancement to this position.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

4-b. If "No" -- In your observation, would the graduate desire to hold a supervisory or management position?

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

5. Do you think the graduate is technically proficient at the job he/she now holds?

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

6. The graduate has technical skills (such as metals, drafting, etc.) which are essential for his/her job.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

7. The graduate's attitude toward further college preparation is desirable.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

Explanation: For the following statements, please check one "category of agreement" which is your true feeling.

8. The employees that I have supervised who graduated from the two-year junior technical college mechanical engineering in manufacturing division program were adequately prepared for initial employment.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

9. The employees mentioned in the above statement are adequately prepared for advancement in this organization.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

10. The need for the two-year junior technical college mechanical engineering in manufacturing division program graduates will increase substantially during the next five years.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

11. Management or supervisory skills are important for two-year junior technical college mechanical engineering in manufacturing division program graduates to possess.

(1) ______ Strongly agree
(2) ______ Agree
(3) ______ Undetermined
(4) ______ Disagree
(5) ______ Strongly disagree

Explanation: Please respond to the following question which are in reference to the employee who graduated from two-year junior technical college mechanical engineering in manufacturing division program.

12. In general, how would you rate the performance of the employee who graduated from two-year junior technical college mechanical engineering in manufacturing division program

(1) ______ Excellent
(2) ______ About average
(3) ______ Average
(4) ______ Below average
(5) ______ Poor

13. If possible, please comment on the followings:

a. What strengths have you noted among two-year junior technical college mechanical engineering in manufacturing division program graduates. who are employed in your company?

Strengths:

____

____

b. What inadequacies have you noted among these graduates?

Weaknesses:

____

____

Section II
Present Curriculum Evaluation

Explanation: The purpose of this section is to evaluate present subject areas of the Two-Year Technical College Mechanical Engineering (Manufacturing Division) Program curriculum. Please rate your knowledge and the perceived importance (both current and future) of the following manufacturing curricula. Consider only the subject areas you were actually supervise or will be supervising in the future. For each process mark your level of knowledge and perception of its importance both currently and in the future. If it is none, circle zero; if it is limited , circle one; if it is average, circle two, if it is about average, circle the three; if it is extensive or critical, circle the four.

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
I. HUMANITIES AND SOCIAL SCIENCES			
(1) Dr. Sun Yat-Sen's Thoughts..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Chinese...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) English...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Chinese Modern History...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
II. COMPUTER SCIENCE AND MATHEMATICS			
(1) Calculus..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Computer Programming Design............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
III. MATERIALS			
(1) Strength of Materials............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Mechanical Materials.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Casting.............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
IV. MECHANICAL DESIGN AND MANUFACTURING DESIGN			
(1) Mechanism...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Mechanical Drawing..	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Electric Engineering	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Machine Design (I)..	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) Machine Design and Drawing.............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(6) Applied Mechanics...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(7) Machine Design(II)..	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(8) Tools Design........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
V. MANUFACTURING PROCESSES			
(1) Jigs and Fixtures...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Precision Measurements & Machinery Inspection.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Shop Practice.......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Plastic Forming.....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) Quality Control.....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(6) Production Control..	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(7) Heat Treatment......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(8) Machine Tools.......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(9) Mechanical Processing Methods............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(10) Oil Hydraulics.....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(11) Lubrication........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(12) Electric Engineering Lab................	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(13) Mechanical Engineering Lab................	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
VI. MANUFACTURING SYSTEMS AND AUTOMATION			
(1) NC Machine Tools & Lab.................	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
OTHER			
(1) ____________	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) ____________	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Section III
Possible Future Curriculum Evaluation

Explanation: The purpose of this section is to evaluate future (1994-2000) subject areas of the Two-Year Technical College Mechanical Engineering (Manufacturing Division) Program curriculum. Please rate your knowledge and the perceived importance (both current and future) of the following manufacturing curricula. Consider only the subject areas you were actually supervise or will be supervising in the future. For each process mark your level of knowledge and perception of its importance both currently and in the future. If it is none, circle zero; if it is limited , circle one; if it is average, circle two, if it is about average, circle the three; if it is extensive or critical, circle the four.

Possible Future Subject Areas of Curriculum

1. Evaluate the importance of subject areas of the manufacturing curriculum listed below for your present employment. Circle one of the numbers found at the right of each subject area.

* Please omit any subject area which is not applicable.

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
I. SCIENCE AND MATHEMATICS			
(1) Algebra and Trigonometry........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Physics.............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Chemistry...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
II. HUMAN AND SOCIAL SCIENCE			
(1) Global Awareness....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Social Awareness....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Cultural Appreciation........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Ethical & Value Sensitivity.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
III. DESIGN FOR PRODUCTION			
(1) Engineering Drawing I.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Descriptive Geometry..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Engineering Drawing II........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Computer Aided Design I..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) Computer Aided Design II.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(6) Statics/Strength of Materials.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(7) Dynamics..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(8) Design of Machine Elements..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(9) Design for Production........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(10) Manufacturing Tooling...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
IV. MATERIALS			
(1) Introduction to Engineering Materials...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Nondestructive Testing............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Physical Metallurgy.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Polymer Materials...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) Polymeric Composites..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
V. MANUFACTURING PROCESSES			
(1) Introduction to Manufacturing Processes..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Fabrication and Pressworking.......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Electronics Fabrication........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Plastics...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
(6) Nontraditional and Emerging Material Removal Processes	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
VI. MANUFACTURING SYSTEMS AND AUTOMATION			
(1) Manufacturing Planning and Control -Expert Systems	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Manufacturing Planning and Control -Quality Control	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Manufacturing Planning	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Computer Aided Manufacturing-Manufacturing Simulation	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) C.A.M - Computer Aided Design	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(6) Computer Aided Manufacturing-Computer Aided Process Planning (CAPP)	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(7) Factory Automation -Assembly	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(8) Factory Automation-Control Strategy	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(9) Factory Automation-Numerical Control	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(10) Factory Automation-Material Handling	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(11) Factory Automation-Data Collection	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(12) Factory Automation-Cellular Manufacturing	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(13) Factory Automation-Controllers	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(14) Factory Automation -Sensors	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(15) Integration Group-Communications	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
(16) Integration Group-Computer Integrated Manufacturing......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
VII. Controls			
(1) Electrical/Electronic Controls...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Basic Fluid Power..	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Advanced Fluid Power..............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Control of Industrial Automation.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
VIII. MANUFACTURING MANAGEMENT, PRODUCTIVITY AND QUALITY			
(1) Business Management.........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Work Measurement...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) Quality in Manufacturing......	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Human Relationship and Organizational Behavior...........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
IX. COMPUTER APPLICATIONS			
(1) Basic Programming...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) Fortran Programming.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) "C" Programming.....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(4) Wordprocessing Software............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(5) Spreadsheet Software............	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(6) Database Software...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(7) System Selection and Evaluation..........	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
X. CAPSTONE EXPERIENCE			
(1) Individual Project..	0 1 2 3 4	0 2 3 4	0 1 2 3 4
(2) Term Project within Discipline..........	0 1 2 3 4	0 2 3 4	0 1 2 3 4

Subject Area	Knowledge Level	Current Importance (1993-1994)	Future Importance (1995-2000)
(3) Term Project with other Disciplines...	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
OTHERS			
(1) ________________....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(2) ________________....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
(3) ________________....	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Control Code: C #____

二專機械科畢業生問卷
第一部份
畢業生就業相關資訊

說明：

此一部份請回答您相關的就業資訊。

1．您現在的就業工作是屬於那種職業種類？（請只選擇其中的一項作答）

（1）＿＿＿＿ 工程
（2）＿＿＿＿ 管理
（3）＿＿＿＿ 市場分析和推銷
（4）＿＿＿＿ 產品設計
（5）＿＿＿＿ 生產技術
（6）＿＿＿＿ 品質控制
（7）＿＿＿＿ 庫存控制
（8）＿＿＿＿ 研究發展
（9）＿＿＿＿ 維修與服務
（10）＿＿＿＿ 其它

2．您在目前的工作單位工作多久？

（1）＿＿＿＿ 少於一年
（2）＿＿＿＿ 1年至2年
（3）＿＿＿＿ 2年至3年
（4）＿＿＿＿ 3年至4年
（5）＿＿＿＿ 4年至5年
（6）＿＿＿＿ 多於5年

3．在您畢業後，您曾換了幾次工作？

（1）＿＿＿＿ 沒換過工作
（2）＿＿＿＿ 一次
（3）＿＿＿＿ 二次
（4）＿＿＿＿ 三次
（5）＿＿＿＿ 四次
（6）＿＿＿＿ 五次
（7）＿＿＿＿ 多於五次

4．您畢業時的起薪大約是多少？

（1）＿＿＿＿ 一萬伍仟至一萬捌仟
（2）＿＿＿＿ 一萬捌仟至二萬一仟
（3）＿＿＿＿ 二萬一仟至二萬四仟
（4）＿＿＿＿ 二萬四仟至二萬柒仟
（5）＿＿＿＿ 二萬柒仟至三萬
（6）＿＿＿＿ 多於三萬

5．您目前的薪資大約一個月多少？

（1）＿＿＿＿ 少於一萬五仟
（2）＿＿＿＿ 一萬伍仟至二萬
（3）＿＿＿＿ 二萬至二萬伍仟
（4）＿＿＿＿ 二萬五仟至三萬
（5）＿＿＿＿ 三萬至三萬伍仟
（6）＿＿＿＿ 多於三萬伍仟

6．在目前您就業的公司您曾經幾次被升職到更高的職位？

（1）＿＿＿＿ 無
（2）＿＿＿＿ 一次
（3）＿＿＿＿ 二次
（4）＿＿＿＿ 三次
（5）＿＿＿＿ 四次
（6）＿＿＿＿ 五次
（7）＿＿＿＿ 多於五次

說明：

從下面的敘述，根據您的眞實感覺，選出適當的答案。

7．我滿意我目前所負的工作職責

（1）＿＿＿＿ 非常同意
（2）＿＿＿＿ 同意
（3）＿＿＿＿ 尚未決定
（4）＿＿＿＿ 不同意
（5）＿＿＿＿ 非常不同意

8．我目前擁有監督管理其它工作人員的職位

（1）______ 是　　（2）______ 否

如果回答″是″請答8－a
如果回答″否″請答8－b

8－a．我的技術性背景（如製圖，設計等），對我目前的工作職位非常必要。
（1）______ 非常同意　　（4）______ 不同意
（2）______ 同意　　（5）______ 非常不同意
（3）______ 尚未決定

8－b．如果回答″否″，我希望擁有一個監督與管理的職位。
（1）______ 非常同意　　（4）______ 不同意
（2）______ 同意　　（5）______ 非常不同意
（3）______ 尚未決定

9．我目前擁有工作所需要的熟練技術
（1）______ 非常同意　　（4）______ 不同意
（2）______ 同意　　（5）______ 非常不同意
（3）______ 尚未決定

10．技術性質的技巧（如金屬材料，製圖，對在我的工作職位是必須的。
（1）______ 非常同意　　（4）______ 不同意
（2）______ 同意　　（5）______ 非常不同意
（3）______ 尚未決定

11．我覺的對將來繼續升學的準備是必須的。
（1）______ 非常同意　　（4）______ 不同意
（2）______ 同意　　（5）______ 非常不同意
（3）______ 尚未決定

12．您目前的工作職位是什麼（如品管工程師、課長或電子技師等）
職稱：______________________________

13．您是那一年從二專畢業？ ______________________

14．您現在的學位是什麼？ ______________________

第二部份
對目前二專機械科製造組課程評估

說明：

此一部份的目的在於評估現有二專機械科製造組的課程・請評估您自己對這些科目的了解程度（Ｋｎｏｗｌｅｄｇｃ　ｌｅｖｅｌ）・

0：代表非常不熟悉・
1：代表不太熟悉・
2：尙熟悉・
3：熟悉・
4：非常熟悉。

然後跟據您的感覺，請圈選出課程的現在重要性以及未來重要性・

0：代表完全不重要・
1：代表不是很重要・
2：代表尙重要・
3：代表重要・
4：代表非常重要・

課 程 種 類	了解程度	目前目要性	將來重要性
	Knowledge Level	(1994)	(1994～2000)
I．人文和社會科學			
國父思想	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
國文	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
英文	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
中國現代史	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
II．數學和電腦課程			
微積分	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
計算機程式	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Ⅲ・材料			
鑄造學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
材料強度	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械材料	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Ⅳ・機械設計和製造設計			
機構學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械製圖	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電機學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械設計（一）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械設計製圖	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
應用力學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械設計（二）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

課 程 種 類	了解程度	目前目要性	將來重要性
	Knowledge Level	(1994)	(1994~2000)
IV・機械設計和製造設計（續）			
工具設計	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
V・製造程序			
鑽模與夾具	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
精密量具&機件檢驗	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠管理	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
塑性加工	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
品質管製	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠管理	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
熱處理	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工具機	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械加工法	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
氣液壓學及實習	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
潤滑學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電機實驗	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械工程實驗	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
數控工具機及實習	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
其它您認爲重要科目			
	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

第三部份
對未來可能課程之評估

說明：

此項部份的目的，在於評估二專機械科製造組未來可能的課程。請評估您自己對這些科目的了解程度（Knowledge Level）。

0：非不常熟悉。
1：代表不太熟悉。
2：尙熟悉。
3：熟悉。
4：非常熟悉。

然後跟據您的感覺，請圈選出課程的現在重要性以及未來重要性。

0：代表完全不重要。
1：代表不是很重要。
2：代表尙重要。
3：代表重要。
4：代表非常重要。

課 程 種 類	了解程度	目前重要性	將來重要性
	Knowledge Level	(1994)	(1994～2000)
I．人文科學			
幾何及三角函數	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
物理	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
化學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
II．人文及社會科學			
世界意識	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
社會意識	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
文化欣賞	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
道德與價值	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
III．生產設計			
工程製圖（I）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
圖形幾何學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工程製圖（II）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦輔助設計（I）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦輔助設計（II）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
材料力學及靜力學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
動力學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械設計元件	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
生產設計	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
製造工具	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Ⅳ・材料			
工程材料介紹	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
非破壞性測試	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
冶金學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
多分子材料	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
多分子結構	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Ⅴ・製造程序			
製造過程介紹	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
沖壓製造	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電子學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
塑性學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
非傳統材料加工過程	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Ⅵ.製造系統/自動化			
製造和計劃控製（專家系統）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
製造計劃和控製（品管）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
製造計劃	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦輔助製造（模擬）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦輔助製造與設計（ＣＡＤ／ＣＡＭ）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦輔助製造（電腦輔助生產計劃・ＣＡＰＰ）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（裝配）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化控制策略）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（數值控制）（ＣＮＣ）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（材料搬運）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（資料處理）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（製造單元）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（可寫程式控製器）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（感應器）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
整合群體製造（Ｇｒｏｕｐ Ｔｅｃｈ）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦整合製造（ＣＩＭ）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Ⅶ.控制			
電機及電子控製	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
基本流體力學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
進階流體力學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

工業自動化控制	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Ⅷ·製造管理生產及品管			
商業管理	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工作測量評估	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
人際關係及組織行爲	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
製造品管	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Ⅸ·電腦應用			
Basic 程式設計	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Fortran 程式設計	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
C語言	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
文書處軟體應用	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
圖表軟體應用	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
資料庫軟體應用	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
系統選擇和評估	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
X·階段性實習			
個人實驗設計企劃 (Project)	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
小組實驗設計企劃 (Term Project) 一 相關領域方面	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
小組實驗設計企劃一非相關領域方面	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
其它您認爲重要的科目			
1.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
2.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
3.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

請提供目前您工作公司的名稱與地址。

公司名稱：______________________________

地　　址：______________________________

公司生產或製造部門主管姓名：______________________

公司總經理或董事長姓名：________________________

編號：G# __________

製造部門相關主管問卷

第一部份
被僱用之二專機械科畢業生相關就業資訊

說明：

此一部份包括了二專機械科畢業生在貴公司的相關就業資訊，請回答下列的問題。

1．被貴公司雇用的此二專畢業生剛畢業的起薪大概是多少？

(1) ______ 一萬伍仟 至一萬捌仟
(2) ______ 一萬捌仟至二萬一仟
(3) ______ 二萬一仟至二萬四仟
(4) ______ 二萬四仟至二萬柒仟
(5) ______ 二萬柒仟至三萬
(6) ______ 多於三萬

2．目前被貴公司雇用的此二專機械科（製造組）畢業生的薪資大概是多少？

(1) ______ 少於一萬五仟
(2) ______ 一萬伍仟至二萬
(3) ______ 二萬至二萬伍仟
(4) ______ 二萬五仟至三萬
(5) ______ 三萬至三萬伍仟
(6) ______ 多於三萬伍仟

3．目前在貴公司工作的此二專機械科畢業生曾幾次昇遷到更高的職務？

(1) ______ 無
(2) ______ 一次
(3) ______ 二次
(4) ______ 三次
(5) ______ 四次
(6) ______ 五次
(7) ______ 多於五次

說明： 從下列敘述中，請依照您自己的感覺選出適當的答案。

4．目前在貴公司工作的此二專機械科畢業生是否擁有一個監督管理其他工作人員的職位？

(1) ______ 是
(2) ______ 否

如果回答"是"請答4－a
如果回答"否"請答4－b

4－a．二專機械科畢業生的技術性背景（如製圖、機械設計）對這個職位是必要的。

(1) ______ 非常同意
(2) ______ 同意
(3) ______ 尚未決定
(4) ______ 不同意
(5) ______ 非常不同意

4－b．如果回答"否"，依您的觀察，此二專機械科畢業生是否非常渴望擁有此一職務。

(1) ______ 非常同意
(2) ______ 同意
(3) ______ 尚未決定
(4) ______ 不同意
(5) ______ 非常不同意

5・依您觀察，二專機械科畢業生是否在其負責的工作上，擁有足夠的工作技術熟練度？

（1）______ 非常同意　（4）______ 不同意
（2）______ 同意　（5）______ 非常不同
（3）______ 尙未決定

6・二專機械科畢業生的技術（如金屬加工、製圖）對其工作職位是必要的。

（1）______ 非常同意　（4）______ 不同意
（2）______ 同意　（5）______ 非常不同意
（3）______ 尙未決定

7・二專畢業生的升學進修是必須的。

（1）______ 非常同意　（4）______ 不同意
（2）______ 同意　（5）______ 非常不同意
（3）______ 尙未決定

說明：

請依照您自己的感覺，從下列的敘述選出適合的答案。

8・在我監督管理的此二專機械科畢業生在剛出校園時有足夠的最初就業準備。

（1）______ 非常同意　（4）______ 不同意
（2）______ 同意　（5）______ 非常不同意
（3）______ 尙未決定

9・目前在我們公司受僱的此二專畢業生對就業後的進修有充分的準備。

（1）______ 非常同意　（4）______ 不同意
（2）______ 同意　（5）______ 非常不同意
（3）______ 尙未決定

10・往後5年裏，二專機械科畢業生的需求量將大增。

（1）______ 非常同意　（4）______ 不同意
（2）______ 同意　（5）______ 非常不同意
（3）______ 尙未決定

11・監督管理的技能對二專畢業生是重要的。

（1）______ 非常同意　（4）______ 不同意
（2）______ 同意　（5）______ 非常不同意
（3）______ 尙未決定

12・一般而言，您如何評估二專機械科（製造組）畢業生的工作表現？

（1）______ 非常優秀　（4）______ 不很優秀
（2）______ 優秀　（5）______ 很差
（3）______ 平均

13・您認爲二專畢業生的長處及優點是什麼，缺點或弱點是什麼？
優：______________________________
缺：______________________________

第二部份
對目前二專機械科製造組課程評估

說明：

此一部份的目的在於評估現有二專機械科製造組的課程。請評估您自己對這些科目的了解程度（Knowledge level）。

0：代表非常不熟悉。
1：代表不太熟悉。
2：尚熟悉。
3：熟悉。
4：非常熟悉。

然後跟據您的感覺，請圈選出課程的現在重要性以及未來重要性。

0：代表完全不重要。
1：代表不是很重要。
2：代表尚重要。
3：代表重要。
4：代表非常重要。

課程種類	了解程度	目前目要性	將來重要性
	Knowledge Level	(1994)	(1994～2000)
I．人文和社會科學			
國父思想	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
國文	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
英文	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
中國現代史	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
II．數學和電腦課程			
微積分	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
計算機程式	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
III．材料			
鑄造學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
材料強度	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械材料	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
IV．機械設計和製造設計			
機構學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械製圖	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電機學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械設計（一）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械設計製圖	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
應用力學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械設計（二）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

課 程 種 類	了解程度	目前目要性	將來重要性
	Knowledge Level	(1994)	(1994～2000)
IV・機械設計和製造設計（續）			
工具設計	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
V・製造程序			
鑽模與夾具	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
精密量具&機件檢驗	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠管理	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
塑性加工	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
品質管製	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠管理	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
熱處理	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工具機	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械加工法	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
氣液壓學及實習	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
潤滑學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電機實驗	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械工程實驗	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
數控工具機及實習	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
其它您認爲重要科目			
	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

第三部份
對未來可能課程之評估

說明：

此項部份的目的，在於評估二專機械科製造組未來可能的課程。請評估您自己對這些科目的了解程度（Knowledge Level）。

0：非不常熟悉。
1：代表不太熟悉。
2：尙熟悉。
3：熟悉。
4：非常熟悉。

然後跟據您的感覺，請圈選出課程的現在重要性以及未來重要性。

0：代表完全不重要。
1：代表不是很重要。
2：代表尙重要。
3：代表重要。
4：代表非常重要。

課程種類	了解程度	目前重要性	將來重要性
	Knowledge Level	(1994)	(1994～2000)
I・人文科學			
幾何及三角函數	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
物理	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
化學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
II・人文及社會科學			
世界意識	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
社會意識	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
文化欣賞	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
道德與價值	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
III・生產設計			
工程製圖（I）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
圖形幾何學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工程製圖（II）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦輔助設計（I）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦輔助設計（II）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
材料力學及靜力學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
動力學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械設計元件	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
生產設計	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
製造工具	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

IV・材料			
工程材料介紹	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
非破壞性測試	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
冶金學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
多分子材料	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
多分子結構	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
V・製造程序			
製造過程介紹	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
沖壓製造	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電子學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
塑性學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
非傳統材料加工過程	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
VI.製造系統/自動化			
製造和計劃控製（專家系統）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
製造計劃和控製（品管）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
製造計劃	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦輔助製造（模擬）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦輔助製造與設計（CAD／CAM）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦輔助製造（電腦輔助生產計劃・CAPP）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（裝配）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化控制策略）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（數値控制）（CNC）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（材料搬運）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（資料處理）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（製造單元）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（可寫程式控製器）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（感應器）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
整合群體製造（Group Tech）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦整合製造（CIM）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
VII.控制			
電機及電子控製	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
基本流體力學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
進階流體力學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

工業自動化控制	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Ⅷ・製造管理生產及品管			
商業管理	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工作測量評估	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
人際關係及組織行爲	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
製造品管	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Ⅸ・電腦應用			
Basic 程式設計	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Fortran 程式設計	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
C語言	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
文書處軟體應用	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
圖表軟體應用	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
資料庫軟體應用	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
系統選擇和評估	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
X・階段性實習			
個人實驗設計企劃 (Project)	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
小組實驗設計企劃 (Term Project) 一 相關領域方面	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
小組實驗設計企劃一非相關領域方面	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
其它您認爲重要的科目			
1.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
2.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
3.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

編號：S# ＿＿＿＿＿＿

公司決策主管問卷

第一部份
被僱用之二專機械科畢業生相關就業資訊

說明：

此一部份包括了此二專機械科畢業生在貴公司的相關就業資訊，請回答下列的問題。

1．被貴公司雇用的此二專畢業生剛畢業的起薪大概是多少？

（1）_______ 一萬伍仟至一萬捌仟　（4）_______ 二萬四仟至二萬柒仟
（2）_______ 一萬捌仟至二萬一仟　（5）_______ 二萬柒仟至三萬
（3）_______ 二萬一仟至二萬四仟　（6）_______ 多於三萬

2．目前被貴公司雇用的此二專機械科（製造組）畢業生的薪資大概是多少？

（1）_______ 少於一萬五仟　（4）_______ 二萬五仟至三萬
（2）_______ 一萬伍仟至二萬　（5）_______ 三萬至三萬伍仟
（3）_______ 二萬至二萬伍仟　（6）_______ 多於三萬伍仟

3．目前在貴公司工作的此二專機械科畢業生曾幾次昇遷到更高的職務？

（1）_______ 無　（5）_______ 四次
（2）_______ 一次　（6）_______ 五次
（3）_______ 二次　（7）_______ 多於五次
（4）_______ 三次

說明：從下列敘述中，請依照您自己的感覺選出適當的答案。

4．目前在貴公司工作的此二專機械科畢業生是否擁有一個監督管理其他工作人員的職位？

（1）_______ 是　（2）_______ 否

如果回答〞是〞請答4－a
如果回答〞否〞請答4－b

4－a．二專機械科畢業生的技術性背景（如製圖、機械設計）對這個職位是必要的。

（1）_______ 非常同意　（4）_______ 不同意
（2）_______ 同意　（5）_______ 非常不同意
（3）_______ 尚未決定

4－b．如果回答〞否〞，依您的觀察，此二專機械科畢業生是否非常渴望擁有此一職務。

（1）_______ 非常同意　（4）_______ 不同意
（2）_______ 同意　（5）_______ 非常不同意
（3）_______ 尚未決定

5・依您觀察，此二專機械科畢業生是否在其負責的工作上，擁有足夠的工作技術熟練度？

(1) ______ 非常同意
(2) ______ 同意
(3) ______ 尚未決定
(4) ______ 不同意
(5) ______ 非常不同

6・二專機械科畢業生的技術（如金屬加工、製圖）對其工作職位是必要的。

(1) ______ 非常同意
(2) ______ 同意
(3) ______ 尚未決定
(4) ______ 不同意
(5) ______ 非常不同意

7・二專畢業生的升學進修是必須的。

(1) ______ 非常同意
(2) ______ 同意
(3) ______ 尚未決定
(4) ______ 不同意
(5) ______ 非常不同意

說明：

請依照您自己的感覺，從下列的敘述選出適合的答案。

8・在我監督管理的此二專機械科畢業生在剛出校園時有足夠的最初就業準備。

(1) ______ 非常同意
(2) ______ 同意
(3) ______ 尚未決定
(4) ______ 不同意
(5) ______ 非常不同意

9・目前在我們公司受僱的此二專畢業生對就業後的進修有充分的準備。

(1) ______ 非常同意
(2) ______ 同意
(3) ______ 尚未決定
(4) ______ 不同意
(5) ______ 非常不同意

10・往後5年裏，二專機械科畢業生的需求量將大增。

(1) ______ 非常同意
(2) ______ 同意
(3) ______ 尚未決定
(4) ______ 不同意
(5) ______ 非常不同意

11・監督管理的技能對二專畢業生是重要的。

(1) ______ 非常同意
(2) ______ 同意
(3) ______ 尚未決定
(4) ______ 不同意
(5) ______ 非常不同意

12・一般而言，您如何評估二專機械科（製造組）畢業生的工作表現？

(1) ______ 非常優秀
(2) ______ 優秀
(3) ______ 平均
(4) ______ 不很優秀
(5) ______ 很差

13・您認爲二專畢業生的長處及優點是什麼，缺點或弱點是什麼？

優：________________________________

缺：________________________________

第二部份
對目前二專機械科製造組課程評估

說明：

此一部份的目的在於評估現有二專機械科製造組的課程。請評估您自己對這些科目的了解程度（Knowledge level）。

0：代表非常不熟悉。
1：代表不太熟悉。
2：尚熟悉。
3：熟悉。
4：非常熟悉。

然後跟據您的感覺，請圈選出課程的現在重要性以及未來重要性。

0：代表完全不重要。
1：代表不是很重要。
2：代表尚重要。
3：代表重要。
4：代表非常重要。

課程種類	了解程度	目前目要性	將來重要性
	Knowledge Level	(1994)	(1994～2000)
I．人文和社會科學			
國父思想	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
國文	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
英文	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
中國現代史	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
II．數學和電腦課程			
微積分	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
計算機程式	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
III・材料			
鑄造學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
材料強度	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械材料	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
IV・機械設計和製造設計			
機構學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械製圖	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電機學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械設計（一）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械設計製圖	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
應用力學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械設計（二）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

課 程 種 類	了解程度	目前目要性	將來重要性
	Knowledge Level	(1994)	(1994～2000)
Ⅳ・機械設計和製造設計（續）			
工具設計	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
V・製造程序			
鑽模與夾具	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
精密量具&機件檢驗	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠管理	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
塑性加工	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
品質管製	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠管理	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
熱處理	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工具機	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械加工法	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
氣液壓學及實習	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
潤滑學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電機實驗	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械工程實驗	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
數控工具機及實習	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
其它您認爲重要科目			
	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

第三部份
對未來可能課程之評估

說明：

此項部份的目的，在於評估二專機械科製造組未來可能的課程。請評估您自己對這些科目的了解程度（Ｋｎｏｗｌｅｄｇｅ　Ｌｅｖｅｌ）。

0：非不常熟悉。
1：代表不太熟悉。
2：尙熟悉。
3：熟悉。
4：非常熟悉。

然後跟據您的感覺，請圈選出課程的現在重要性以及未來重要性。

0：代表完全不重要。
1：代表不是很重要。
2：代表尙重要。
3：代表重要。
4：代表非常重要。

課 程 種 類	了 解 程 度	目前重要性	將來重要性
	Knowledge Level	(1994)	(1994～2000)
I・人文科學			
幾何及三角函數	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
物理	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
化學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
II・人文及社會科學			
世界意識	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
社會意識	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
文化欣賞	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
道德與價值	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
III・生產設計			
工程製圖（I）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
圖形幾何學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工程製圖（II）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦輔助設計（I）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦輔助設計（II）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
材料力學及靜力學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
動力學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
機械設計元件	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
生產設計	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
製造工具	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

Ⅳ・材料			
工程材料介紹	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
非破壞性測試	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
冶金學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
多分子材料	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
多分子結構	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Ⅴ・製造程序			
製造過程介紹	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
沖壓製造	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電子學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
塑性學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
非傳統材料加工過程	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Ⅵ.製造系統/自動化			
製造和計劃控製（專家系統）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
製造計劃和控製（品管）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
製造計劃	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦輔助製造（模擬）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦輔助製造與設計（ＣＡＤ／ＣＡＭ）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦輔助製造（電腦輔助生產計劃・ＣＡＰＰ）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（裝配）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化控制策略）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（數値控制）（ＣＮＣ）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（材料搬運）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（資料處理）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（製造單元）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（可寫程式控製器）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工廠自動化（感應器）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
整合群體製造（Ｇｒｏｕｐ Ｔｅｃｈ）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
電腦整合製造（ＣＩＭ）	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Ⅶ.控制			
電機及電子控製	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
基本流體力學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
進階流體力學	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

工業自動化控制	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Ⅷ·製造管理生產及品管			
商業管理	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
工作測量評估	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
人際關係及組織行爲	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
製造品管	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
Ⅸ·電腦應用			
Basic 程式設計	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
F o r t r a n 程式設計	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
C語言	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
文書處軟體應用	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
圖表軟體應用	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
資料庫軟體應用	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
系統選擇和評估	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
X·階段性實習			
個人實驗設計企劃 (Project)	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
小組實驗設計企劃 (Term Project) — 相關領域方面	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
小組實驗設計企劃— 非相關領域方面	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
其它您認爲重要的科目			
1.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
2.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4
3.	0 1 2 3 4	0 1 2 3 4	0 1 2 3 4

編號：C# ________

Appendix B

Cover Letters

The University of Northern Iowa

Dear Graduate:

The enclosed survey deals with the curriculum of mechanical engineering (manufacturing division) of two-year junior technical college. The purpose of this study is to determine the most appropriate curriculum to prepare manufacturing technicians for Taiwan industries. Data obtained from this research will be made available to all Taiwan junior technical colleges having mechanical engineering programs. The information will assist in revising curricula to prepare graduates for industry.

You have been selected because you are a graduate of mechanical engineering (manufacturing division) of two-year junior technical college. This being the case, you would be able to indicate curricula most appropriate and relevant to your particular industry.

It would be appreciated if you could complete the questionnaire and return it prior to ________. Other phases of this study cannot be completed until the survey data has been collected.

On the last page, I am asking you to give your name and the name and mailing address of your employer. With your permission, I would like to send a questionnaire to both your manufacturing supervisor and CEO (general manager or president). Through this type of evaluation, we can provide a more relevant educational program. Please help by returning the questionnaire and providing the name of your manufacturing supervisor and CEO of your employment company. It no way will your responses be identified with you.

I would be most happy to answer any questions you might have. Please write or call (07) 3810007. Thank you for your assistance. I will send you a summary copy of the results of the survey. Your cooperation and input are important and deeply appreciated.

Sincerely,

Chuan-Chun Wu
Jan. 1994

Department of Industrial Technology
Industrial Technology Center 25 Cedar Falls, Iowa 50614-0178 (319) 273-2561 FAX (319) 273-5818

The University of Northern Iowa

Dear : Manufacturing Supervisor/Manager

The enclosed survey deals with the curriculum of mechanical engineering (manufacturing division) of two-year junior technical college. The purpose of this study is to determine the most appropriate curriculum to prepare manufacturing technicians for Taiwan industries. Data obtained from this research will be made available to all Taiwan junior technical colleges having mechanical engineering programs. The information will assist in revising curricula to prepare graduates for industry.

I understand that ____________________ is employed by your organization. This individual graduated from two-year junior college mechanical engineering technology in manufacturing division. We are interested in your evaluation of his performance in your organization, as well as your evaluation of the two-year junior college mechanical engineering technology in manufacturing division program. In no way will your responses on the questionnaire be identified with you or your organization. Individual responses will be strictly confidential.

You have been selected because you are a manufacturing supervisor/manager. This being the case, you would be able to indicate curricula most appropriate and relevant to your particular industry.

It would be appreciated if you could complete the questionnaire and return it prior to ________. Other phases of this study cannot be completed until the survey data has been collected.

I would be most happy to answer any questions you might have. Please write or call (07) 3810007. Thank you for your assistance. I will send you a summary copy of the results of the survey. Your cooperation and input are important and deeply appreciated.

Sincerely,

Chuan-Chun Wu
Jan. 1994

Department of Industrial Technology
Industrial Technology Center 25 Cedar Falls, Iowa 50614-0178 (319) 273-2561 FAX (319) 273-5818

The University of Northern Iowa

Dear : General Manager (CEO)

The enclosed survey deals with the curriculum of mechanical engineering (manufacturing division) of two-year junior technical college. The purpose of this study is to determine the most appropriate curriculum to prepare manufacturing technicians for Taiwan industries. Data obtained from this research will be made available to all Taiwan junior technical colleges having mechanical engineering programs. The information will assist in revising curricula to prepare graduates for industry.

I understand that ____________________ is employed by your organization. This individual graduated from two-year junior college mechanical engineering technology in manufacturing division. We are interested in your evaluation of his performance in your organization, as well as your evaluation of the two-year junior college mechanical engineering technology in manufacturing division program. In no way will your responses on the questionnaire be identified with you or your organization. Individual responses will be strictly confidential.

You have been selected because you are a CEO of this company. This being the case, you would be able to indicate curricula most appropriate and relevant to your particular industry.

It would be appreciated if you could complete the questionnaire and return it prior to ________. Other phases of this study cannot be completed until the survey data has been collected.

I would be most happy to answer any questions you might have. Please write or call (07) 3810007. Thank you for your assistance. I will send you a summary copy of the results of the survey. Your cooperation and input are important and deeply appreciated.

Sincerely,

Chuan-Chun Wu
Jan. 1994

Department of Industrial Technology
Industrial Technology Center 25 Cedar Falls, Iowa 50614-0178 (319) 273-2561 FAX (319) 273-5818

The University of Northern Iowa

敬啓者：

這是美國北愛俄華大學工業技術研究所的一項博士論文研究，研究者很誠懇的邀請您的參與。此項研究的目的在於調查二專機械科製造組畢業生的工作表現以及對現在以及未來台灣二專機械科製造組課程的評估。研究看深信您的參與及合作必然有助於台灣技術教育的改進。此項研究的結果將提供作爲相關單位的參考，做爲就業輔導的根據。

此項研究的價值，端賴您的參與及合作，所有的資料，研究者將以審愼的態度處理，所有的資料將以綜合性的方式整理出來，並保証資料的保密度。

研究者非常感激，如果這些問卷可以在__月___日以前被寄回，所有的研究分析過程端賴閣下的合作與幫忙。

如果有任何關於此項研究的問題，閣下可以和研究者連絡，電話是（０７）－３８１０００７。當此項研究完成之後，研究者將寄給您一份研究簡報。您的合作與投入將非常的感激。

敬 祝 時 祺

吳 傳 春　敬上
北愛俄華大學博士候選人
１９９４年１月２０日

Department of Industrial Technology
Industrial Technology Center 25　Cedar Falls, Iowa 50614-0178　(319) 273-2561　FAX (319) 273-5818

The University of Northern Iowa

敬啓者：

這是美國北愛俄華大學工業技術研究所的一項博士論文研究，研究者很誠懇的邀請您的參與。此項研究的目的在於調查被貴公司僱用之二專機械科製造組畢業生 ____________的工作表現以及對現在以及未來台灣二專機械科製造組課程的評估。研究看深信您的參與及合作必然有助於台灣技術教育的改進。此項研究的結果將提供作爲相關單位的參考，做爲就業輔導的根據。

此項研究的價值，端賴您的參與及合作，所有的資料，研究者將以審慎的態度處理，所有的資料將以綜合性的方式整理出來，並保証資料的保密度。

研究者非常感激，如果這些問卷可以在__月___日以前被寄回，所有的研究分析過程端賴閣下的合作與幫忙。

如果有任何關於此項研究的問題，閣下可以和研究者連絡，電話是（０７）－３８１０００７。當此項研究完成之後，研究者將寄給您一份研究簡報。您的合作與投入將非常的感激。

敬 祝 時 祺

吳 傳 春　敬上
北愛俄華大學博士候選人
１９９４年１月２０日

Department of Industrial Technology
Industrial Technology Center 25　Cedar Falls, Iowa 50614-0178　(319) 273-2561　FAX (319) 273-5818

The University of Northern Iowa

敬啓者：

閣下曾在四個星期前收到一份博士論文研究的調查問卷。此問卷調查的主要目的在調查台灣二專畢業生工作表現以及對現在和未來課程的評估。自調查者發出問卷後，我們已經陸續接到部份寄回的資料。然而部份的被調查者尚未寄回問卷，這會影響此項研究結果的可靠度與眞實性。

如閣下已回發問卷，請不必顧慮此封信。反之；則請閣下能在百忙中抽空回答上述問卷，以助調查研究者能夠順利的完成此項重要的研究。

再次謝謝您的關心與幫忙。

敬祝時祺

吳傳春 敬上

中華民國八十三年二月四日

Department of Industrial Technology
Industrial Technology Center 25 Cedar Falls, Iowa 50614-0178 (319) 273-2561 FAX (319) 273-5818

The University of Northern Iowa

Critique From

Educational Survey

1. Rate the readability of the questionnaire:

   ( ) Excellent ( ) Good ( ) Fair ( ) Poor

2. Rate the understandability of the questionnaire:

   ( ) Excellent ( ) Good ( ) Fair ( ) Poor

3. Estimate the length of time it will take to complete the questionnaire:

   ( ) 10-15 minutes
   ( ) 16-20 minutes
   ( ) 21-25 minutes
   ( ) 26-30 minutes
   ( ) More than 31 minutes

4. Overall opinion of the questionnaire:

   ( ) Excellent ( ) Good ( ) Fair ( ) Poor

5. Remarks:

____

____

____

____

____

____

____

Name:______________________________

Department of Industrial Technology
Industrial Technology Center 25 Cedar Falls, Iowa 50614-0178 (319) 273-2561 FAX (319) 273-5818

The University of Northern Iowa

January 18, 1994

Chuan-Chun Wu
301 G Street
Cedar Falls, IA 50613

Dear Chuan-Chun Wu:

Your project, "Manufacturing Curriculum Issues of Two-Year Mechanical Engineering Technology Program in Taiwan, R.O.C.", which you submitted for human subjects review on December 20, 1993 has been determined to be exempt from further review under the guidelines stated in the UNI Human Subjects Handbook. You may commence participation of human research subjects in your project.

Your project need not be submitted for continuing review unless you alter it in a way that increases the risk to the participants. If you make any such changes in your project, you should notify the Graduate College Office.

If you decide to seek federal funds for this project, it would be wise not to claim exemption from human subjects review on your application. Should the agency to which you submit the application decide that your project is not exempt from review, you might not be able to submit the project for review by the UNI Institutional Review Board within the federal agency's time limit (30 days after application). As a precaution against applicants' being caught in such a time bind, the Board will review any projects for which federal funds are sought. If you do seek federal funds for this project, please submit the project for human subjects review no later than the time you submit your funding application.

If you have any further questions about the Human Subjects Review System, please contact me. Best wishes for your project.

Sincerely,

Norris M. Durham, Ph.D.
Chair, Institutional Review Board

cc: Dr. David A. Walker, Associate Dean

Graduate College 1 Seerley Cedar Falls, Iowa 50614-0702 (319) 273-2748

Appendix C

Statistics Data

Pearson Correlation (Current Standard Curriculum)

			Current Curriculum						
	Grad.	Supvr.	CEO	C.P. of xy	C.P. of xz	C.P. of xy	sqd. x	sqd. y	sqd.z
	x	y	z	xy	xz	yz			
No.									
1	-0.93	-0.97	-0.96	0.9021	0.8928	0.9312	0.8649	0.9409	0.9216
2	-0.34	0.378	0.407	-0.12852	-0.13838	0.153846	0.1156	0.14288	0.16565
3	1.788	1.659	1.565	2.966292	2.79822	2.596335	3.19694	2.75228	2.44923
4	-0.31	-0.41	-0.35	0.1271	0.1085	0.1435	0.0961	0.1681	0.1225
5	-0.06	-0.63	1.081	0.0378	-0.06486	-0.68103	0.0036	0.3969	1.16856
6	2.056	1.882	3.229	3.869392	6.638824	6.076978	4.22714	3.54192	10.4264
7	0.025	-1.115	-0.65	-0.027875	-0.01625	0.72475	0.00063	1.24323	0.4225
8	-0.84	0.169	-0.41	-0.14196	0.3444	-0.06929	0.7056	0.02856	0.1681
9	-0.16	0.054	0.397	-0.00864	-0.06352	0.021438	0.0256	0.00292	0.15761
10	1.632	1.035	1.537	1.68912	2.508384	1.590795	2.66342	1.07123	2.36237
11	2.077	2.205	3.252	4.579785	6.754404	7.17066	4.31393	4.86203	10.5755
12	1.409	1.532	2.133	2.158588	3.005397	3.267756	1.98528	2.34702	4.54969
13	1.407	0.905	2.373	1.273335	3.338811	2.147565	1.97965	0.81903	5.63113
14	1.745	1.496	1.982	2.61052	3.45859	2.965072	3.04503	2.23802	3.92832
15	0.702	0.278	0.922	0.195156	0.647244	0.256316	0.4928	0.07728	0.85008
16	0.721	0.268	0.855	0.193228	0.616455	0.22914	0.51984	0.07182	0.73103
17	1.014	0.84	1.874	0.85176	1.900236	1.57416	1.0282	0.7056	3.51188
18	0.87	-0.25	-0.23	-0.2175	-0.2001	0.0575	0.7569	0.0625	0.0529
19	1.782	1.365	1.621	2.43243	2.888622	2.212665	3.17552	1.86323	2.62764
20	2.653	2.411	2.457	6.396383	6.518421	5.923827	7.03841	5.81292	6.03685
21	1.262	0.95	1.775	1.1989	2.24005	1.68625	1.59264	0.9025	3.15063
22	1.688	1.334	1.358	2.251792	2.292304	1.811572	2.84934	1.77956	1.84416
23	3.681	2.462	2.659	9.062622	9.787779	6.546458	13.5498	6.06144	7.07028
24	1.96	0.672	2.907	1.31712	5.69772	1.953504	3.8416	0.45158	8.45065
25	0.691	0.42	2.289	0.29022	1.581699	0.96138	0.47748	0.1764	5.23952
26	-0.41	-0.54	0.481	0.2214	-0.19721	-0.25974	0.1681	0.2916	0.23136
27	1.252	1.104	1.229	1.382208	1.538708	1.356816	1.5675	1.21882	1.51044
28	1.35	1.193	0.181	1.61055	0.24435	0.215933	1.8225	1.42325	0.03276
29	1.381	1.623	1.657	2.241363	2.288317	2.689311	1.90716	2.63413	2.74565
30	0.867	0.904	1.703	0.783768	1.476501	1.539512	0.75169	0.81722	2.90021
31	1.601	2.239	2.749	3.584639	4.401149	6.155011	2.5632	5.01312	7.557
	r for Graduates(x) and Supervisors(y)=					0.8697313			
	r for Graduates(x) and CEOs(z)=					0.7944255			
	r for Supervisors(y) and CEOs(z)=					0.799294			

Pearson Correlation (Current Standard Curriculum)

			Future Curriculum						
	Grad.	Supvr.	CEO	C.P. of xy	C.P. of xz	C.P. of xy	sqd. x	sqd. y	sqd.z
	x	y	z	xy	xz	yx			
No.									
1	-0.68	-0.39	-0.81	0.2652	0.5508	0.3159	0.4624	0.1521	0.6561
2	0.662	1.222	0.885	0.808964	0.58587	1.08147	0.43824	1.49328	0.78323
3	3.809	3.875	2.302	14.759875	8.768318	8.92025	14.5085	15.0156	5.2992
4	-0.06	-0.22	-0.28	0.0132	0.0168	0.0616	0.0036	0.0484	0.0784
5	-0.28	0.032	1.823	10.7559	12.985875	9.54674	14.6306	7.90734	11.526
6	3.825	2.812	3.395	-0.11745	-0.3915	0.027	1.70303	0.0081	0.09
7	1.305	-0.09	-0.3	3.42316	2.099136	3.15984	2.27406	5.1529	1.93766
8	1.508	2.27	1.392	1.70172	2.05146	2.049888	1.70303	1.70042	2.47118
9	1.305	1.304	1.572	6.758319	6.643164	6.856036	6.54848	6.97488	6.73922
10	2.559	2.641	2.596	8.164786	8.004594	10.431876	6.26501	10.6406	10.2272
11	2.503	3.262	3.198	1.481432	2.241256	2.628092	1.26338	1.73712	3.97604
12	1.124	1.318	1.994	2.100447	4.304496	3.238032	2.79224	1.58005	6.63578
13	1.671	1.257	2.576	2.7302	3.52308	2.75064	3.4969	2.1316	3.54946
14	1.87	1.46	1.884	1.25125	2.21507	1.355375	2.0449	0.76563	2.3994
15	1.43	0.875	1.549	2.054535	2.35977	1.521622	3.18623	1.3248	1.74768
16	1.785	1.151	1.322	11.460192	11.672289	11.064672	12.0895	10.8636	11.2694
17	3.477	3.296	3.357	-0.1586	-0.1952	0.0208	1.4884	0.0169	0.0256
18	1.22	-0.13	-0.16	1.88062	1.479044	1.39118	1.9994	1.7689	1.09412
19	1.414	1.33	1.046	10.0815	9.8076	9.07946	10.89	9.33303	8.83278
20	3.3	3.055	2.972	4.780464	7.059856	4.961931	6.80166	3.35989	7.32785
21	2.608	1.833	2.707	3.241115	3.27218	2.4727	4.28904	2.44923	2.4964
22	2.071	1.565	1.58	7.836055	8.824414	7.29397	9.48024	6.47703	8.21396
23	3.079	2.545	2.866	3.68368	7.6219	3.43252	8.1796	1.65894	7.10223
24	2.86	1.288	2.665	0.990432	4.465152	2.363136	1.87142	0.52418	10.6537
25	1.368	0.724	3.264	0.773458	1.952734	0.755407	1.9994	0.29921	1.90716
26	1.414	0.547	1.381	0.031747	0.177304	0.015688	0.3588	0.00281	0.08762
27	0.599	0.053	0.296	1.739904	0.852288	0.304168	4.87526	0.62094	0.149
28	2.208	0.788	0.386	9.16028	9.15382	8.037224	10.4329	8.0429	8.03156
29	3.23	2.836	2.834	2.81903	3.30424	2.317088	4.02003	1.97684	2.7159
30	2.005	1.406	1.648	2.81903	3.30424	2.317088	4.02003	1.97684	2.7159
31	4.781	3.938	4.401	18.827578	21.041181	17.331138	22.858	15.5078	19.3688
	r for Graduates(x) and Supervisors(y)=					0.8786908			
	r for Graduates(x) and CEOs(z)=					0.775077			
	r for Supervisors(y) and CEOs(z)=					0.8062458			

Pearson Correlation (Future Curriculum BDN)

	Grad	Supvr	CEO	C.P. of	CURRENT BDN C.P. of	C.P. of	sqd. x	sqd. y	sqd.z
	x	y	z	xy	xz	yz			
No.									
1	-1.1	-0.27	-0.3	0.2835	0.273	0.0702	1.1025	0.0729	0.0676
2	1.01	2.178	2.25	2.206314	2.282289	4.907034	1.0262	4.7437	5.076
3	0.77	0.5	0.92	0.386	0.711012	0.4605	0.596	0.25	0.8482
4	0.4	0.987	0.36	0.397761	0.143468	0.351372	0.1624	0.9742	0.1267
5	0.37	0.875	0.67	0.32725	0.249458	0.583625	0.1399	0.7656	0.4449
6	1.19	0.625	1.4	0.7425	1.662012	0.874375	1.4113	0.3906	1.9572
7	-0.1	-0.76	0.84	0.0912	-0.10116	-0.64068	0.0144	0.5776	0.7106
8	0.01	0.198	-1.6	0.002772	-0.02268	-0.32076	0.0002	0.0392	2.6244
9	1.21	0.437	1.02	0.527896	1.236992	0.447488	1.4593	0.191	1.0486
10	4.3	1.725	2.56	7.4106	11.00635	4.41945	18.456	2.9756	6.5638
11	3.45	2.026	2.41	6.9897	8.31105	4.880634	11.903	4.1047	5.8033
12	0.9	0.301	0.77	0.271201	0.691968	0.231168	0.8118	0.0906	0.5898
13	2.06	0.527	0.83	1.087201	1.701975	0.434775	4.256	0.2777	0.6806
14	1.75	0.527	0.83	0.921723	1.442925	0.434775	3.059	0.2777	0.6806
15	2.67	1.24	1.16	3.3108	3.0972	1.4384	7.1289	1.5376	1.3456
16	1.62	1.48	1.53	2.39612	2.478689	2.26588	2.6212	2.1904	2.344
17	1.14	-0.03	1.08	-0.0342	1.23348	-0.03246	1.2996	0.0009	1.1707
18	4.01	3.249	0.77	13.04149	3.078738	2.491983	16.112	10.556	0.5883
19	2.24	0.103	1.02	0.230411	2.275029	0.104751	5.0042	0.0106	1.0343
20	2.21	1.284	2.4	2.836356	5.297182	3.079032	4.8797	1.6487	5.7504
21	1.26	0.836	1.44	1.051688	1.816552	1.207184	1.5826	0.6989	2.0851
22	0.27	-0.03	0.42	-0.00801	0.112407	-0.01263	0.0713	0.0009	0.1772
23	0.01	-0.32	0.15	-0.00384	0.001812	-0.04832	0.0001	0.1024	0.0228
24	1.31	0.057	0.15	0.07467	0.19781	0.008607	1.7161	0.0032	0.0228
25	1.31	0.057	1.09	0.07467	1.43052	0.062244	1.7161	0.0032	1.1925
26	1.77	-1.09	-0.8	-1.93148	-1.48848	0.9156	3.14	1.1881	0.7056
27	3.59	2.631	2.77	9.437397	9.950338	7.298394	12.867	6.9222	7.6951
28	2.63	2.61	3.39	6.87474	8.939796	8.85834	6.938	6.8121	11.519
29	2.45	2.565	2.35	6.291945	5.752285	6.014925	6.0172	6.5792	5.499
30	2.89	1.071	2.23	3.09519	6.44759	2.389401	8.3521	1.147	4.9774
31	2.37	2.52	2.4	5.97744	5.68094	6.0354	5.6264	6.3504	5.736
32	2.68	3.42	3.19	9.1656	8.5492	10.9098	7.1824	11.696	10.176
33	2.07	3.531	2.26	7.298577	4.675554	7.987122	4.2725	12.468	5.1166
34	3.1	2.535	2.26	7.861035	7.014462	5.73417	9.6162	6.4262	5.1166
35	2.81	2.805	3.02	7.868025	8.47671	8.47671	7.868	7.868	9.1325
36	3.2	2.98	3.05	9.52706	9.75085	9.089	10.221	8.8804	9.3025
37	2.89	2.707	2.16	7.831351	6.234415	5.833585	8.3694	7.3278	4.644
38	2.58	3.209	3.05	8.276011	7.863371	9.784241	6.6512	10.298	9.2964
39	2.72	3.339	3.31	9.068724	8.995392	11.05877	7.3767	11.149	10.969
40	2.57	3.123	3.1	8.019864	7.965936	9.687546	6.5946	9.7531	9.6224
41	2.28	2.699	2.67	6.164516	6.102848	7.211728	5.2167	7.2846	7.1396
42	2.35	3.093	3.05	7.26855	7.1628	9.427464	5.5225	9.5666	9.2903
43	2.48	2.524	3.18	6.262044	7.892061	8.028844	6.1554	6.3706	10.119
44	2.55	1.364	1.68	3.474108	4.289148	2.296976	6.4872	1.8605	2.8359
45	1.72	1.058	1.06	1.81447	1.81104	1.117248	2.9412	1.1194	1.1151
46	0.35	0.318	0.48	0.112254	0.170852	0.153912	0.1246	0.1011	0.2343
47	2.48	2.358	2.28	5.845482	5.642204	5.366808	6.1454	5.5602	5.1802
48	1.78	0.366	0.63	0.650382	1.123064	0.231312	3.1577	0.134	0.3994
49	1.39	0.145	0.11	0.20213	0.15334	0.01595	1.9432	0.021	0.0121
50	2.73	1.528	1.48	4.1638	4.030275	2.259912	7.4256	2.3348	2.1874
51	1.44	1.315	1.41	1.8936	2.03328	1.85678	2.0736	1.7292	1.9937
52	2.3	2.09	2.52	4.79655	5.77422	5.25844	5.267	4.3681	6.3303
53	1.96	1.857	2.36	3.630435	4.61771	4.386234	3.822	3.4484	5.579
54	1.71	2.057	2.12	3.507185	3.606075	4.350555	2.907	4.2312	4.4732
55	2.36	1.921	1.75	4.541244	4.144092	3.367513	5.5885	3.6902	3.073
56	2.08	1.919	1.57	3.99152	3.27184	3.018587	4.3264	3.6826	2.4743
57	1.04	1.639	1.13	1.701282	1.169826	1.847153	1.0774	2.6863	1.2701
58	2.06	1.985	1.56	4.079175	3.203745	3.094615	4.223	3.9402	2.4305
59	2.51	1.98	1.5	4.9599	3.749985	2.96406	6.275	3.9204	2.241
60	2.25	2.574	2.41	5.7915	5.418	6.198192	5.0625	6.6255	5.7985
61	1.26	0.798	0.88	1.008672	1.109792	0.700644	1.5977	0.6368	0.7709
	r for Graduates(x) and Supervisors					0.699871			
	r for Graduates(x) and CEOs(z)=					0.68331			
	r for Supervisors(y) and CEOs(z)=					0.837796			

Pearson Correlation (Future Curriculum BDN)

						FUTURE BDN			
	Grad	Supvr	CEO	C.P. of	C.P. of	C.P. of	sqd. x	sqd. y	sqd.z
	x	y	z	xy	xz	yz			
No.									
1	-1.2	-0.22	-0.3	0.2706	0.3567	0.0638	1.5129	0.0484	0.0841
2	2.39	2.139	2.16	5.11221	5.15045	4.609545	5.7121	4.5753	4.644
3	1.09	0.525	1.14	0.57225	1.24478	0.59955	1.1881	0.2756	1.3042
4	1.18	2.653	1.75	3.135846	2.072046	4.650709	1.3971	7.0384	3.073
5	1.95	1.234	2.11	2.402598	4.100382	2.598804	3.7908	1.5228	4.4352
6	2.48	1.193	1.97	2.952675	4.86585	2.345438	6.1256	1.4232	3.8652
7	2.88	1.991	2.91	5.742044	8.37802	5.783855	8.3175	3.9641	8.439
8	1.01	-0.82	1.1	-0.82738	1.105864	-0.89872	1.0181	0.6724	1.2012
9	0.9	0.356	-1.5	0.320756	-1.31546	-0.51976	0.8118	0.1267	2.1316
10	1.79	0.525	1.11	0.937125	1.972425	0.580125	3.1862	0.2756	1.221
11	4.32	2.268	3.08	9.802296	13.29447	6.976368	18.68	5.1438	9.4618
12	3.58	2.275	3.02	8.1354	10.81382	6.8796	12.788	5.1756	9.1446
13	2.05	0.389	0.81	0.797061	1.653543	0.313923	4.1984	0.1513	0.6512
14	3.79	0.687	0.91	2.60373	3.43753	0.623109	14.364	0.472	0.8226
15	2.66	0.687	0.91	1.82742	2.41262	0.623109	7.0756	0.472	0.8226
16	2.52	1.422	1.25	3.580596	3.142464	1.774656	6.3403	2.0221	1.5575
17	1.62	1.587	1.62	2.564592	2.619536	2.572527	2.6115	2.5186	2.6276
18	0.89	0.052	1.12	0.046176	0.996336	0.058344	0.7885	0.0027	1.2589
19	4.04	3.566	3.26	14.41734	13.19231	11.63586	16.346	12.716	10.647
20	2.49	0.182	1.06	0.453908	2.633664	0.192192	6.22	0.0331	1.1151
21	1.85	2.102	1.87	3.886598	3.450234	3.922332	3.4188	4.4184	3.482
22	2.57	1.741	1.52	4.476111	3.918204	2.653284	6.61	3.0311	2.3226
23	1.18	0.052	0.46	0.061256	0.537168	0.023712	1.3877	0.0027	0.2079
24	0.53	-0.21	0.25	-0.11214	0.131898	-0.05187	0.2852	0.0441	0.061
25	2.53	0.691	1.2	1.74823	3.04612	0.831964	6.4009	0.4775	1.4496
26	1.63	-0.98	-0.8	-1.5974	-1.2388	0.7448	2.6569	0.9604	0.5776
27	3.64	2.591	2.67	9.439013	9.730453	6.920561	13.271	6.7133	7.1342
28	2.83	3.073	3.34	8.69659	9.4522	10.26382	8.0089	9.4433	11.156
29	2.81	2.398	2.73	6.72639	7.649235	6.539346	7.868	5.7504	7.4365
30	3.28	2.947	3.01	9.654372	9.867312	8.876364	10.732	8.6848	9.0721
31	3.38	3.022	3.18	10.22343	10.75456	9.606938	11.445	9.1325	10.106
32	3.33	3.373	3.47	11.23546	11.57189	11.7178	11.096	11.377	12.069
33	3.33	3.484	2.31	11.5843	7.69405	8.061976	11.056	12.138	5.3546
34	3.09	2.984	2.31	9.217576	7.147946	6.904976	9.5419	8.9043	5.3546
35	3.62	3.25	3.34	11.76175	12.08022	10.8485	13.097	10.563	11.142
36	3.4	3.026	3.42	10.27932	11.62453	10.35497	11.54	9.1567	11.71
37	3.34	3.008	2.99	10.05574	9.978855	8.97888	11.176	9.0481	8.9102
38	3.35	3.392	3.33	11.36659	11.15213	11.28858	11.229	11.506	11.076
39	3.15	3.479	3.49	10.94146	10.96976	12.13475	9.891	12.103	12.166
40	3	3.176	3.19	9.515296	9.551248	10.12509	8.976	10.087	10.163
41	3.47	3.136	3.03	10.88506	10.51713	9.50208	12.048	9.8345	9.1809
42	3.13	3.005	3.17	9.408655	9.909615	9.510825	9.8032	9.03	10.017
43	3.51	3.425	3.36	12.00463	11.76278	11.4943	12.285	11.731	11.263
44	2.41	1.486	2.07	3.584232	4.98078	3.06859	5.8177	2.2082	4.2642
45	2.62	1.12	1.02	2.93104	2.661489	1.13904	6.8487	1.2544	1.0343
46	1.93	0.43	0.54	0.83033	1.048533	0.23349	3.7288	0.1849	0.2948
47	4.79	2.603	2.48	12.47618	11.88185	6.452837	22.973	6.7756	6.1454
48	2.14	0.349	1.48	0.746162	3.166378	0.516869	4.571	0.1218	2.1934
49	2.51	0.235	0.19	0.588675	0.463425	0.043475	6.275	0.0552	0.0342
50	2.82	1.6	1.5	4.5152	4.224534	2.3952	7.9637	2.56	2.241
51	3.48	1.347	2.65	4.680825	9.198325	3.565509	12.076	1.8144	7.0066
52	2.28	2.209	2.31	5.040938	5.27142	5.10279	5.2075	4.8797	5.3361
53	2.18	2.206	2.61	4.79805	5.665875	5.74663	4.7306	4.8664	6.786
54	1.71	2.347	2.16	4.011023	3.694858	5.074214	2.9207	5.5084	4.6742
55	2.66	1.999	1.57	5.31734	4.18418	3.144427	7.0756	3.996	2.4743
56	1.81	1.119	1.76	2.02539	3.18017	1.966083	3.2761	1.2522	3.087
57	2.2	2.411	1.95	5.311433	4.291444	4.696628	4.8532	5.8129	3.7947
58	2.42	1.91	1.6	4.62793	3.864685	3.04645	5.8709	3.6481	2.544
59	2.71	2.017	1.78	5.468087	4.812025	3.580175	7.3495	4.0683	3.1506
60	2.48	2.492	2.9	6.1677	7.184925	7.234276	6.1256	6.2101	8.4274
61	0.51	0.762	0.95	0.38481	0.478235	0.721614	0.255	0.5806	0.8968
	r for Graduates(x) and Supervisors					0.680017			
	r for Graduates(x) and CEOs(z)=					0.705464			
	r for Supervisors(y) and CEOs(z)=					0.880521			

Appendix D

Recommended Curriculum in Subject Areas

The Most Important Subject Areas of Current Standard Curriculum

The Important Subject Areas of Standard Curriculum
English, Computer Programming, Mechanical Materials, Mechanical Drawing, Tools Design, Shop Practice, Production Control, Quality Control, Electric Engineering, Electric Engineering Lab., NC Machine Tools & Lab., Machine Design (I)

The Ten Most Important Subject Areas of SME Curriculum

Current Trends	Future Trends
Physics Ethical & Value Sensitivity Computer Aided Design Nondestructive Testing Nontraditional and Emerging Material Removal Processes Integration Group-Computer Integrated Manufacturing Control of Industrial Automation Human Relationship and Organizational Behavior System Selection and Evaluation Individual Project	

Current Standard Curriculum

Current Trends	Future Trends
English	English
Computer Programming	Mechanical Materials
Mechanism	Computer Programming
Mechanical Drawing	Casting (C)
Electric Engineering	Mechanism
Machine Design (I)	Mechanical Drawing
Machine Design & Drawing	Electric Engineering
Tools Design	Machine Design (I)
Precision Measurements & Machinery Inspection	Precision Measurements & Machinery Inspection
Shop Practice	Machine Design & Drawing
Plastic Forming	Applied Mechanics
Quality Control	Machine Design (II)
Heat Treatment	Tools Design
Machine Tools	Jigs and Fixtures (G)
Oil Hydraulics	Shop Practice
Lubrication (G)	Plastic Forming
Electric Engineering Lab.	Quality Control
NC Machine Tools & Lab.	Production Control
	Heat Treatment (G)
	Machine Tools
	Electric Engineering Lab.
	Mechanical Engineering Lab.

Note. G: Graduate
S: Supervisor
C: CEOs

SME Recommended Curriculum

Current Trends	Future Trends
Physics	Physics
Chemistry (G,S)	Chemistry (G,S)
Global Awareness (S)	Global Awareness (G,S,C)
Social Awareness (S,C)	Social Awareness
Cultural Appreciation	Cultural Appreciation
Ethical & Value Sensitivity	Ethical & Value Sensitivity
Descriptive Geometry (G)	Engineering Drawing I (G, C)
Engineering Drawing II (G,C)	Engineering Drawing II (G,C)
Computer Aided Design I	Computer Aided Design I
Computer Aided Design II	Computer Aided Design II
Statics/Strength of	Statics/Strength of
Materials (G,C)	Materials (G,C)
Dynamics (G,C)	Dynamics (G,C)
Design of Machine	Design of Machine Elements(G,C)
Elements(G,C)	Design for Production
Design for Production	Manufacturing Tooling
Manufacturing Tooling	
Introduction to	Introduction to
Engineering Materials(G,C)	Engineering Materials(G,C)
Nondestructive Testing(G,S)	Nondestructive Testing
Physical Metallurgy (G,C)	Physical Metallurgy (G,C)
Polymer Materials	Polymer Materials
Polymeric Composites	Polymeric Composites
Electronics Fabrication(G,C)	Introduction to
Plastics (G)	Manufacturing Precesses (G)
Nontraditional and Emerging	Electronics Fabrication(G,C)
Plastics (G)	Plastics (G)
Manufacturing Planning and	Manufacturing Planning and
Control - Expert Systems	Control - Expert Systems
Manufacturing Planning and	Manufacturing Planning and
Control-Quality Control	Control-Quality Control
Manufacturing Planning	Manufacturing Planning
Computer Aided Manufacturing	Computer Aided Manufacturing
-Manufacturing Simulation	-Manufacturing Simulation
C.A.M-Computer Aided Design	C.A.M-Computer Aided Design
Computer Aided Manufacturing-	Computer Aided Manufacturing-
Computer Aided Process	Computer Aided Process
Planning (CAPP)	Planning (CAPP)
Factory Automation-Assembly	Factory Automation-Assembly
Factory Automation-Control	Factory Automation-Control
Strategy	Strategy
Factory Automation-	Factory Automation-
Numerical Control	Numerical Control

Table continues

SME Recommended Curriculum

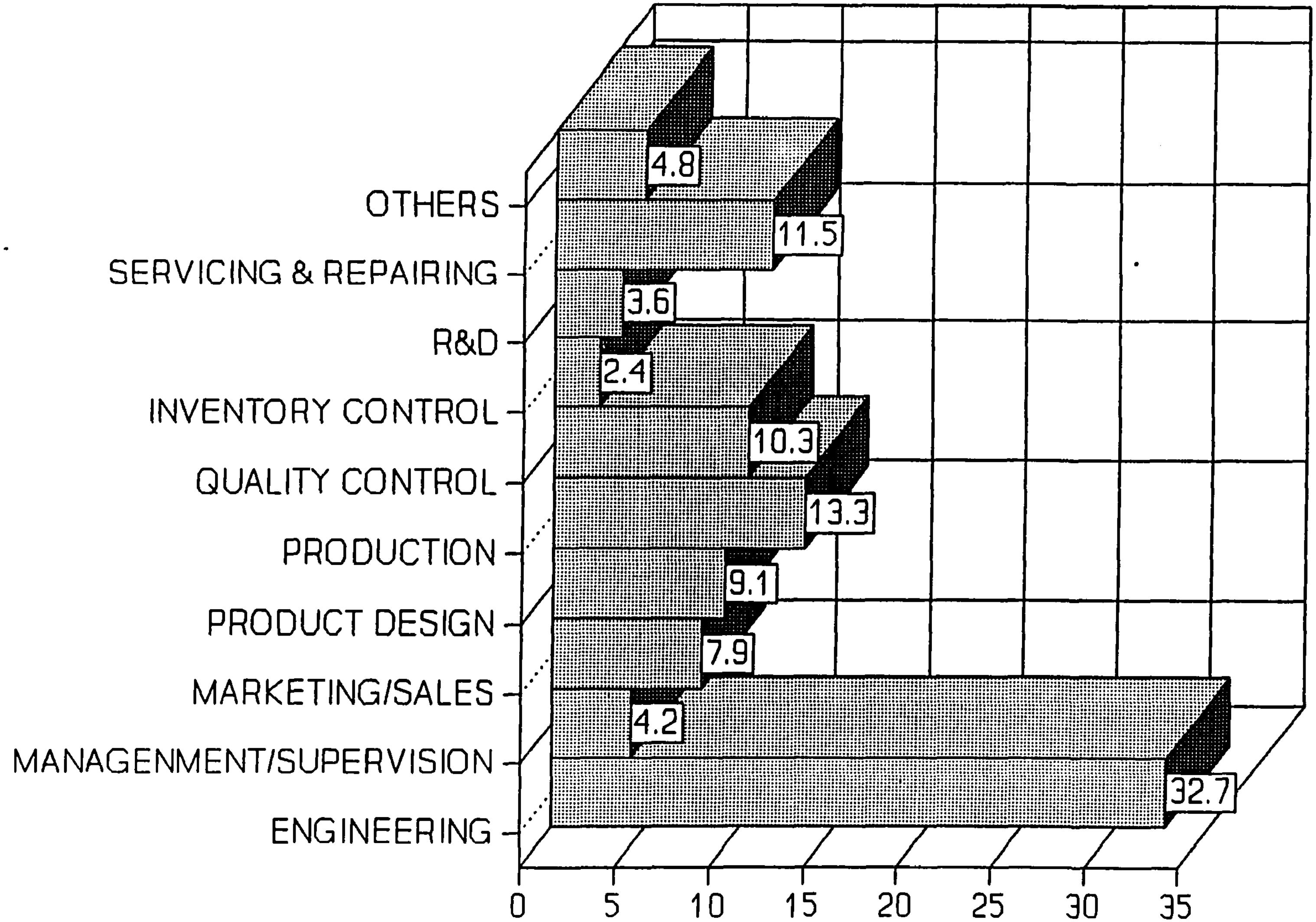
Current Trends	Future Trends
Factory Automation-Material Handling	Factory Automation-Material Handling
Factory Automation-Data Collection	Factory Automation-Data Collection
Factory Automation-Cellular Manufacturing	Factory Automation-Cellular Manufacturing
Factory Automation-Controllers	Factory Automation-Controllers
Factory Automation-Sensors	Factory Automation-Sensors
Integration Group-Communications	Integration Group-Communications
Integration Group-Compute Integrated Manufacturing	Integration Group-Compute Integrated Manufacturing
Electrical/Electronic Controls	Electrical/Electronic Controls
Basic Fluid Power	Basic Fluid Power
	Advanced Fluid Power (G)
Control of Industrial Automation	Control of Industrial Automation
Business Management (G)	Business Management (G,C)
Work Measurement (G)	Work Measurement (G)
Quality in Manufacturing	Quality in Manufacturing
Human Relationship and Organizational Behavior	Human Relationship and Organizational Behavior
Basic Programming	Basic Programming
Fortran Programming	Fortran Programming
"C" Programming	"C" Programming
Wordprocessing Software	Wordprocessing Software
Spreadsheet Software	Spreadsheet Software
Database Software	Database Software
System Selection and Evaluation	System Selection and Evaluation
Individual Project	Individual Project
Term Project within Discipline	Term Project within Discipline
Term Project with Other Disciplines	Term Project with Other Disciplines (S,C)

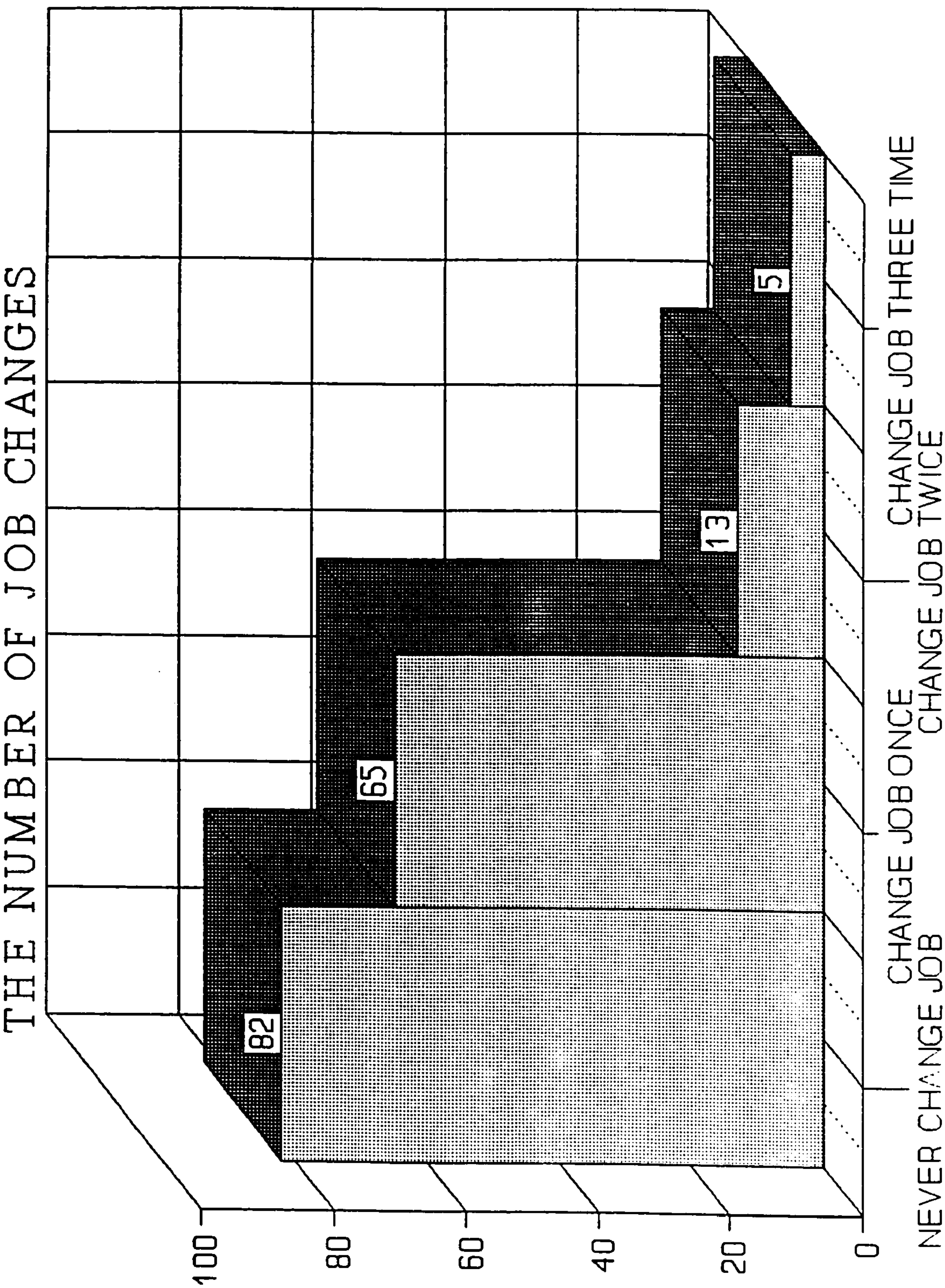
Note. G: Graduate
S: Supervisor
C: CEOs

Appendix E

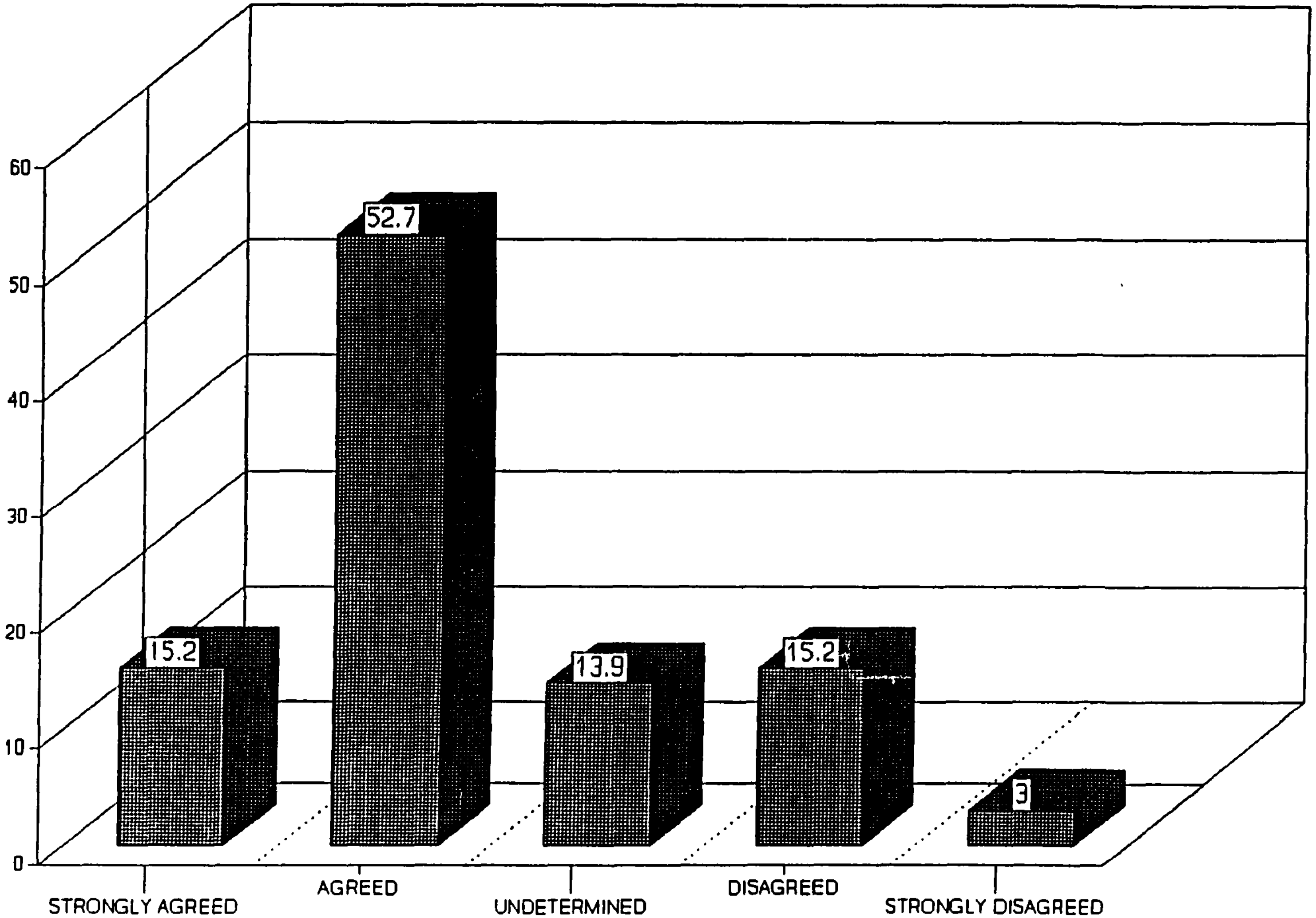
Figures of Employment Characteristics

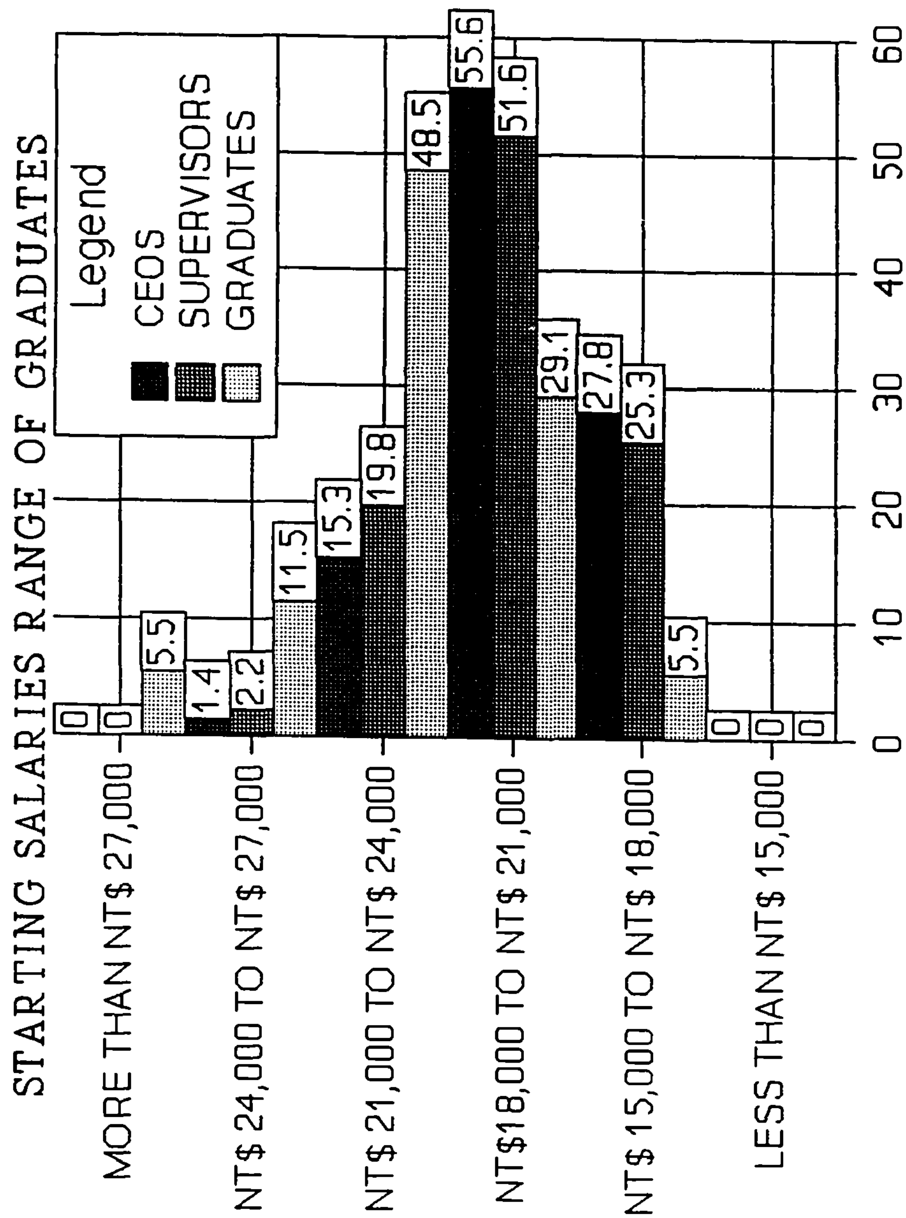
OCCUPATIONAL CATEGORY

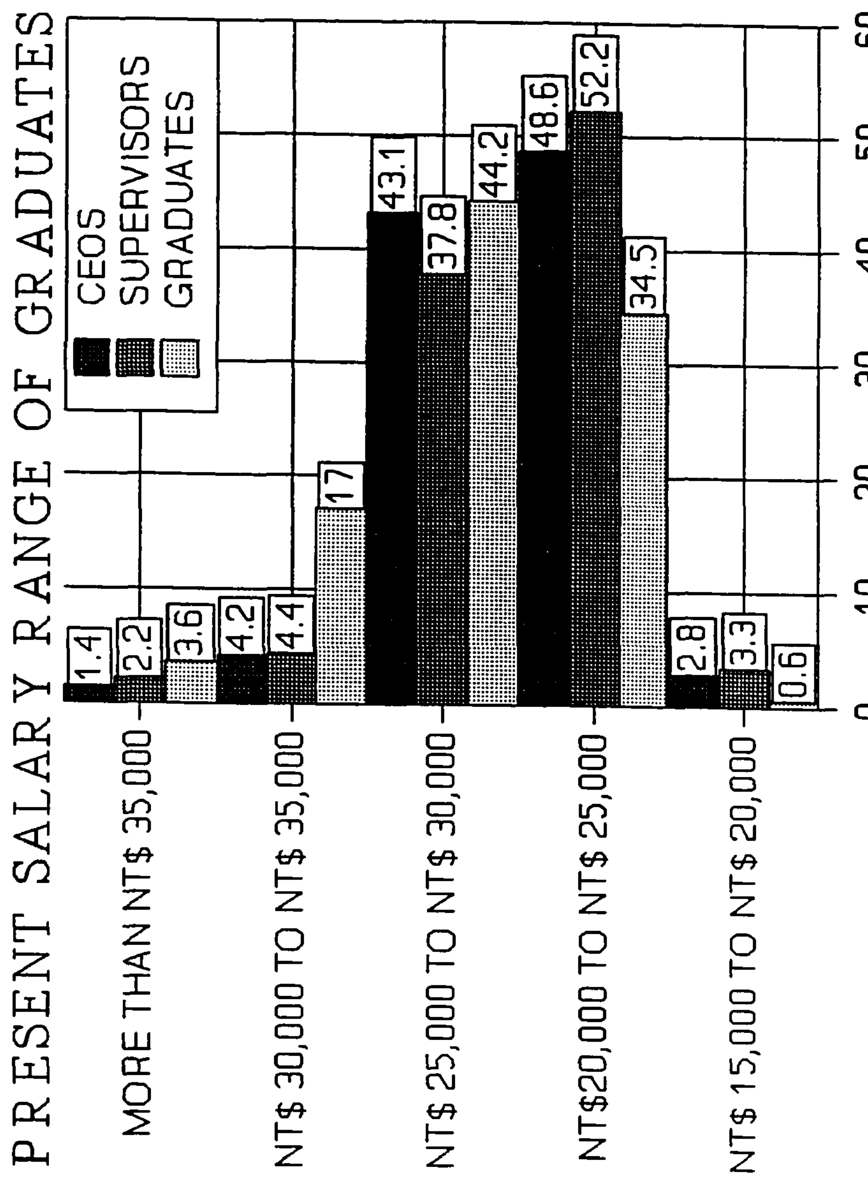



THE NUMBER OF JOB CHANGES
100
80
60
40
20
0
82
65
13
5
NEVER CHANGE JOB
CHANGE JOB ONCE
CHANGE JOB TWICE
CHANGE JOB THREE TIME

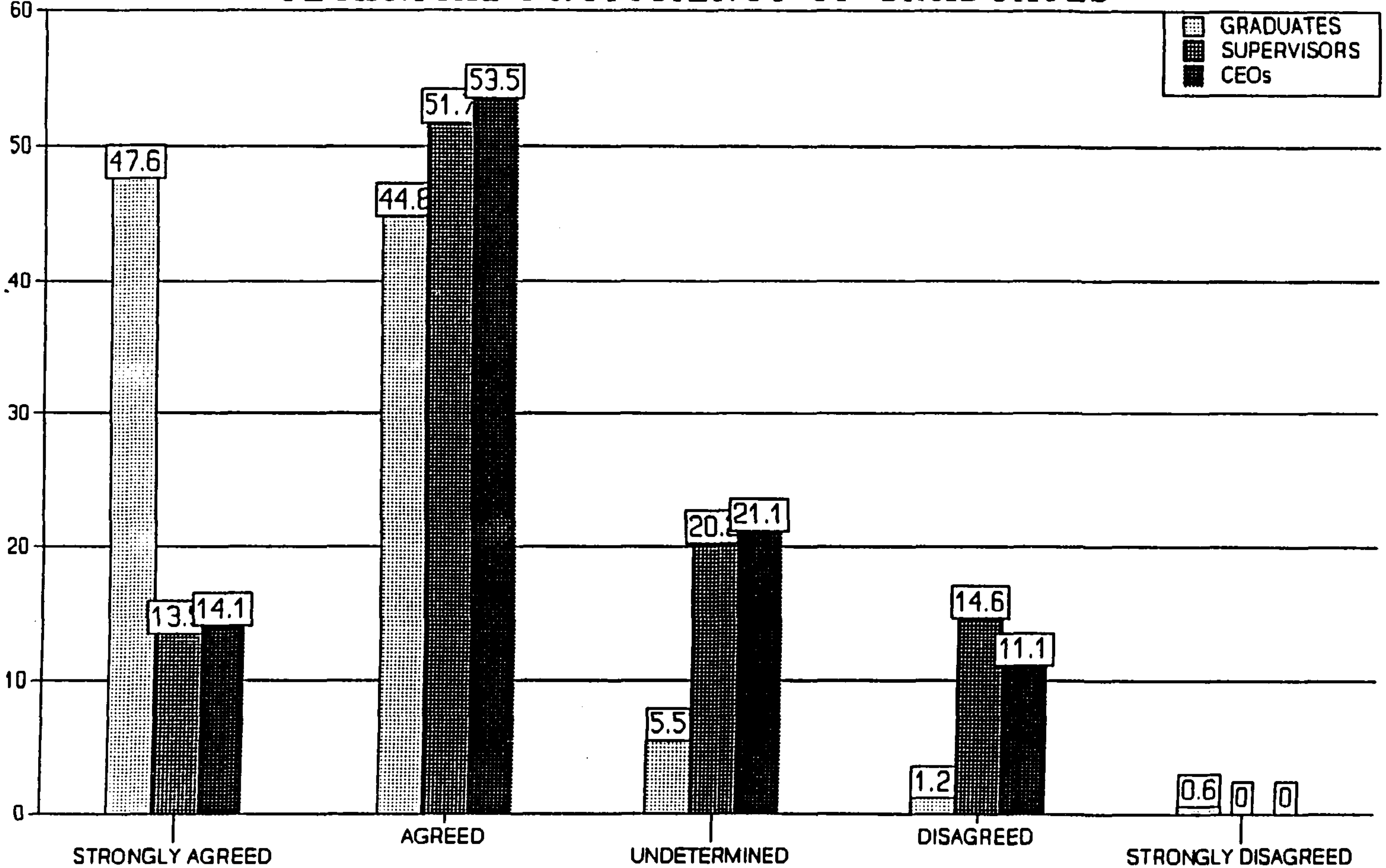
WORK SATISFACTION OF GRADUATES




STARTING SALARIES RANGE OF GRADUATES
Legend
CEOS
SUPERVISORS
GRADUATES
MORE THAN NT$ 27,000
NT$ 24,000 TO NT$ 27,000
NT$ 21,000 TO NT$ 24,000
NT$18,000 TO NT$ 21,000
NT$ 15,000 TO NT$ 18,000
LESS THAN NT$ 15,000
0
0
5.5
1.4
2.2
11.5
15.3
19.8
48.5
55.6
51.6
29.1
27.8
25.3
5.5
0
0
0
0
10
20
30
40
50
60


PRESENT SALARY RANGE OF GRADUATES
CEOS
SUPERVISORS
GRADUATES
MORE THAN NT$ 35,000
NT$ 30,000 TO NT$ 35,000
NT$ 25,000 TO NT$ 30,000
NT$20,000 TO NT$ 25,000
NT$ 15,000 TO NT$ 20,000
1.4
2.2
3.6
4.2
4.4
17
43.1
37.8
44.2
48.6
52.2
34.5
2.8
3.3
0.6
0
10
20
30
40
50
60

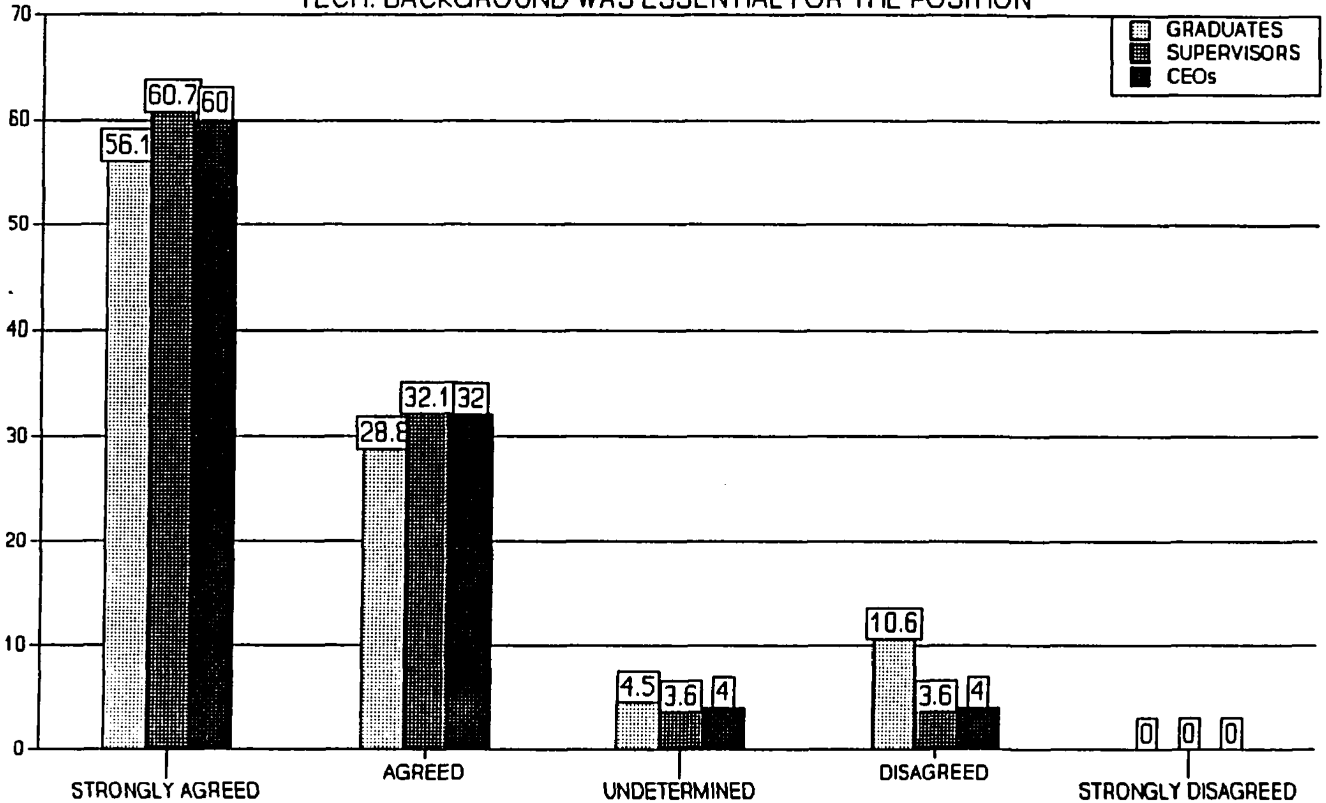
TECHNICAL PROFICIENCY OF GRADUATES



GRADUATES	47.6	44.8	5.5	1.2	0.6
SUPERVISORS	13.5	51.7	20.2	14.6	0
CEOs	14.1	53.5	21.1	11.1	0

SUPERVISORY WORK OF GRADUATES

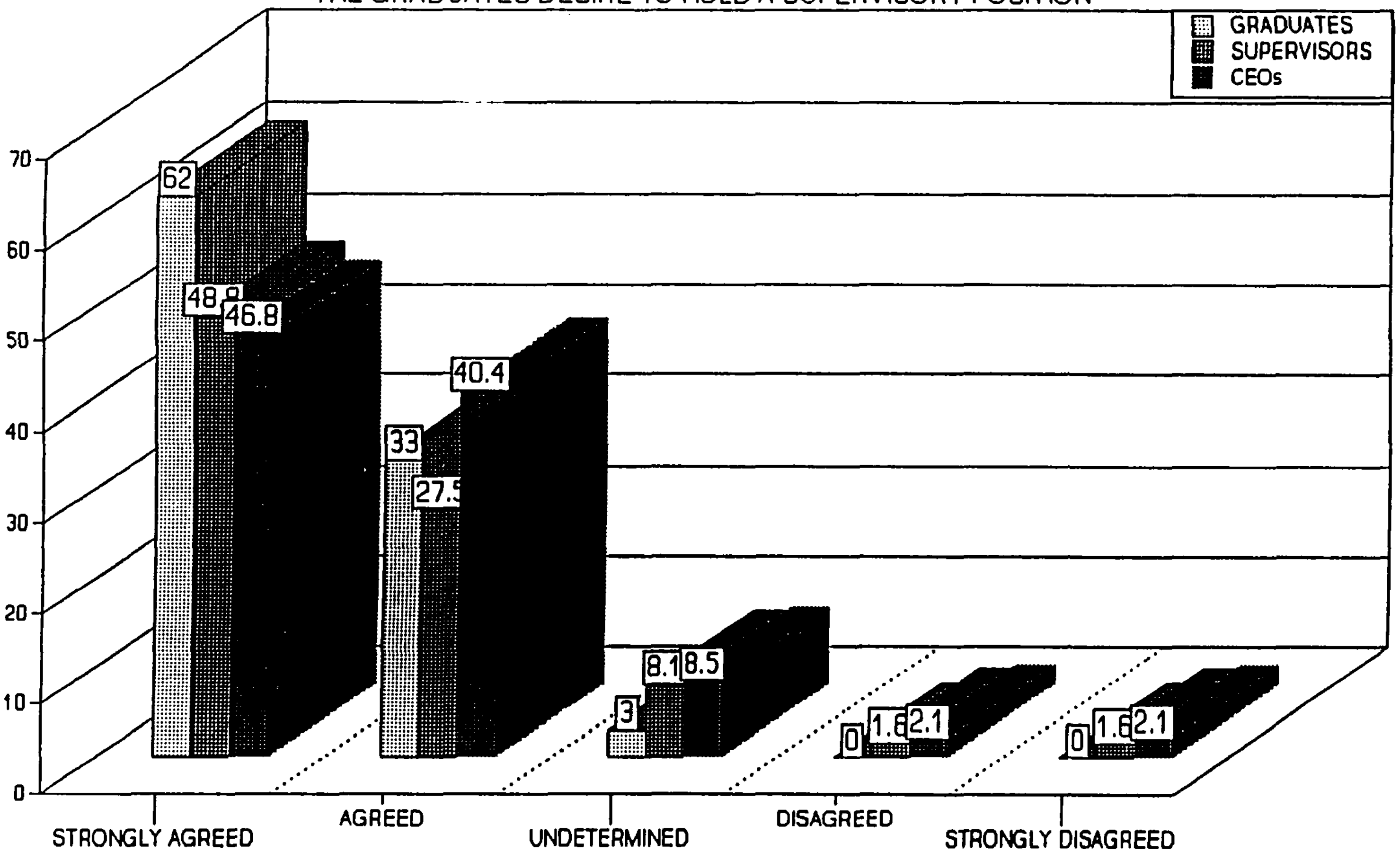
TECH. BACKGROUND WAS ESSENTIAL FOR THE POSITION



GRADUATES	56.1	28.8	4.5	10.6	0
SUPERVISORS	60.7	32.1	3.6	3.6	0
CEOs	60	32	4	4	0

SUPERVISORY WORK OF GRADUATES

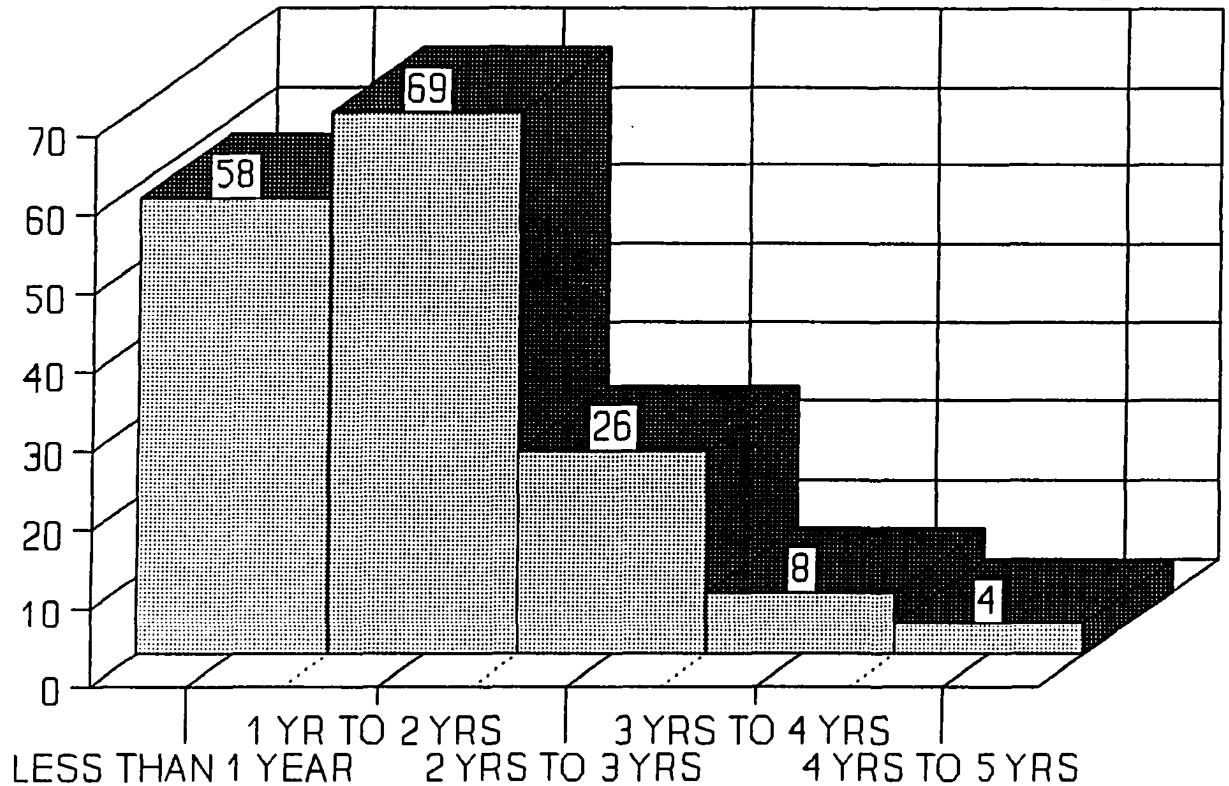
THE GRADUATES DESIRE TO HOLD A SUPERVISORY POSITION

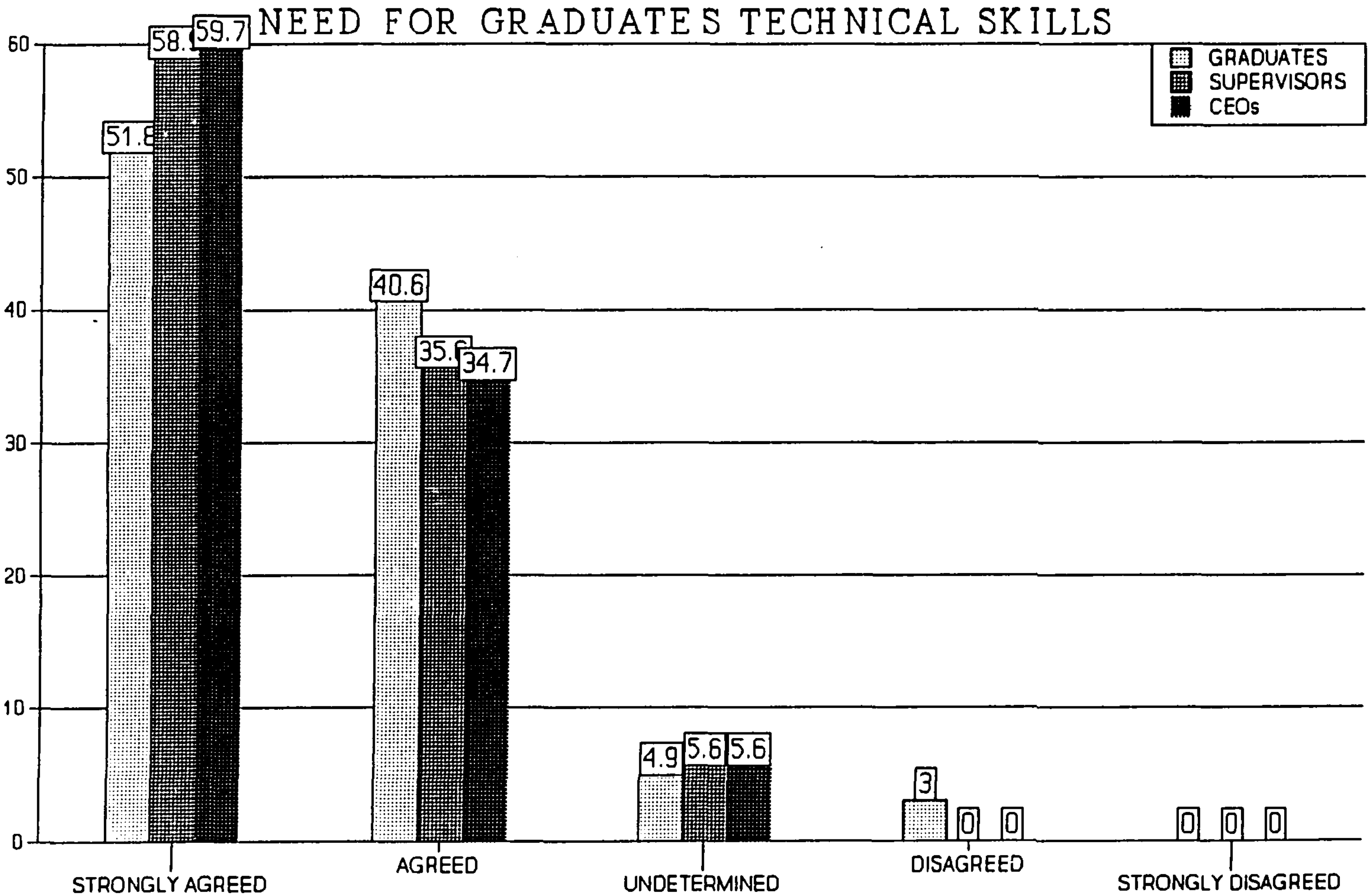


GRADUATES	62	33	3	0	0
SUPERVISORS	48.8	27.5	8.1	1.6	1.6
CEOs	46.8	40.4	8.5	2.1	2.1

NUMBER OF YEARS

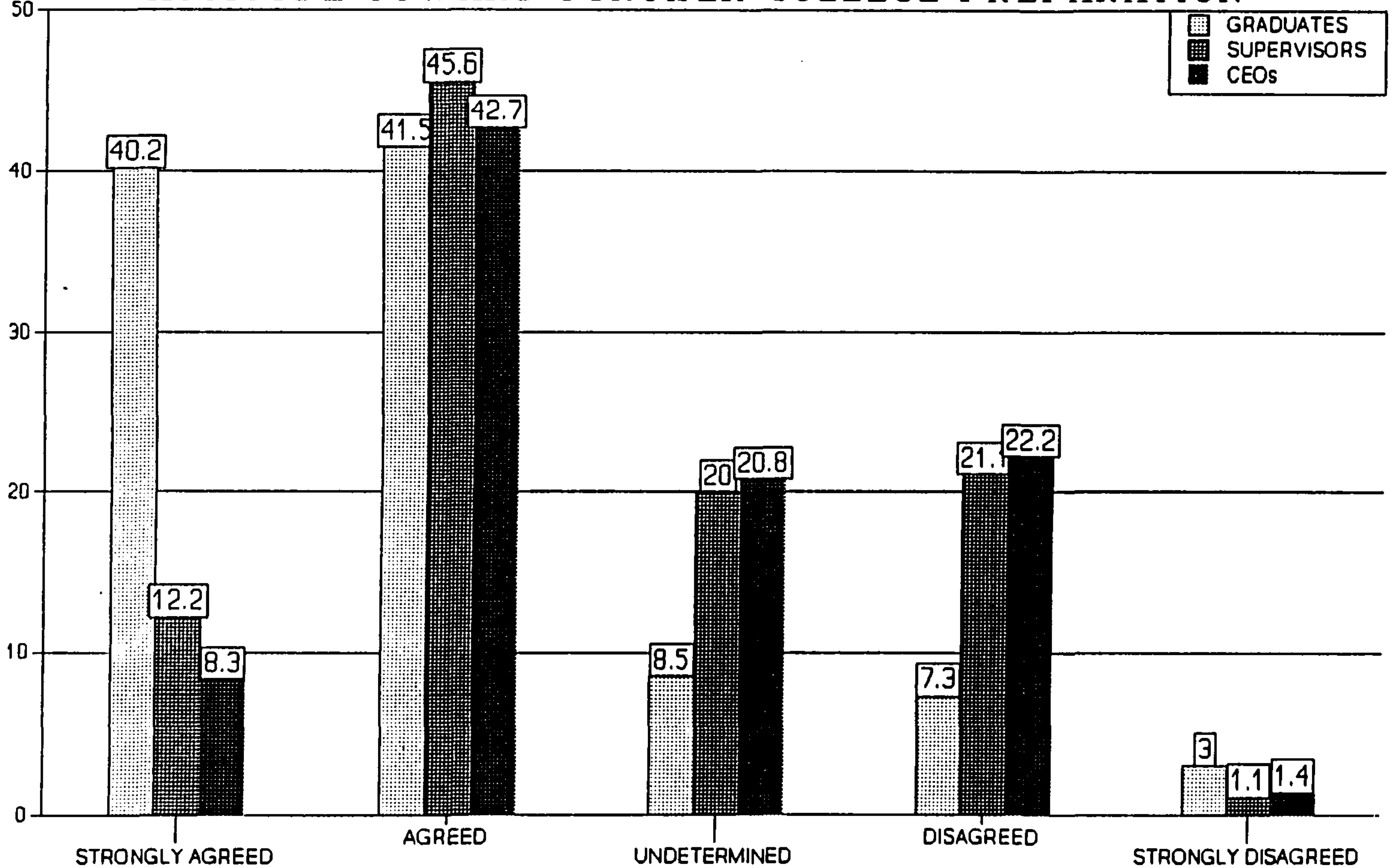
GRADUATES HAD BEEN EMPLOYED BY THE ORGANIZATIONS





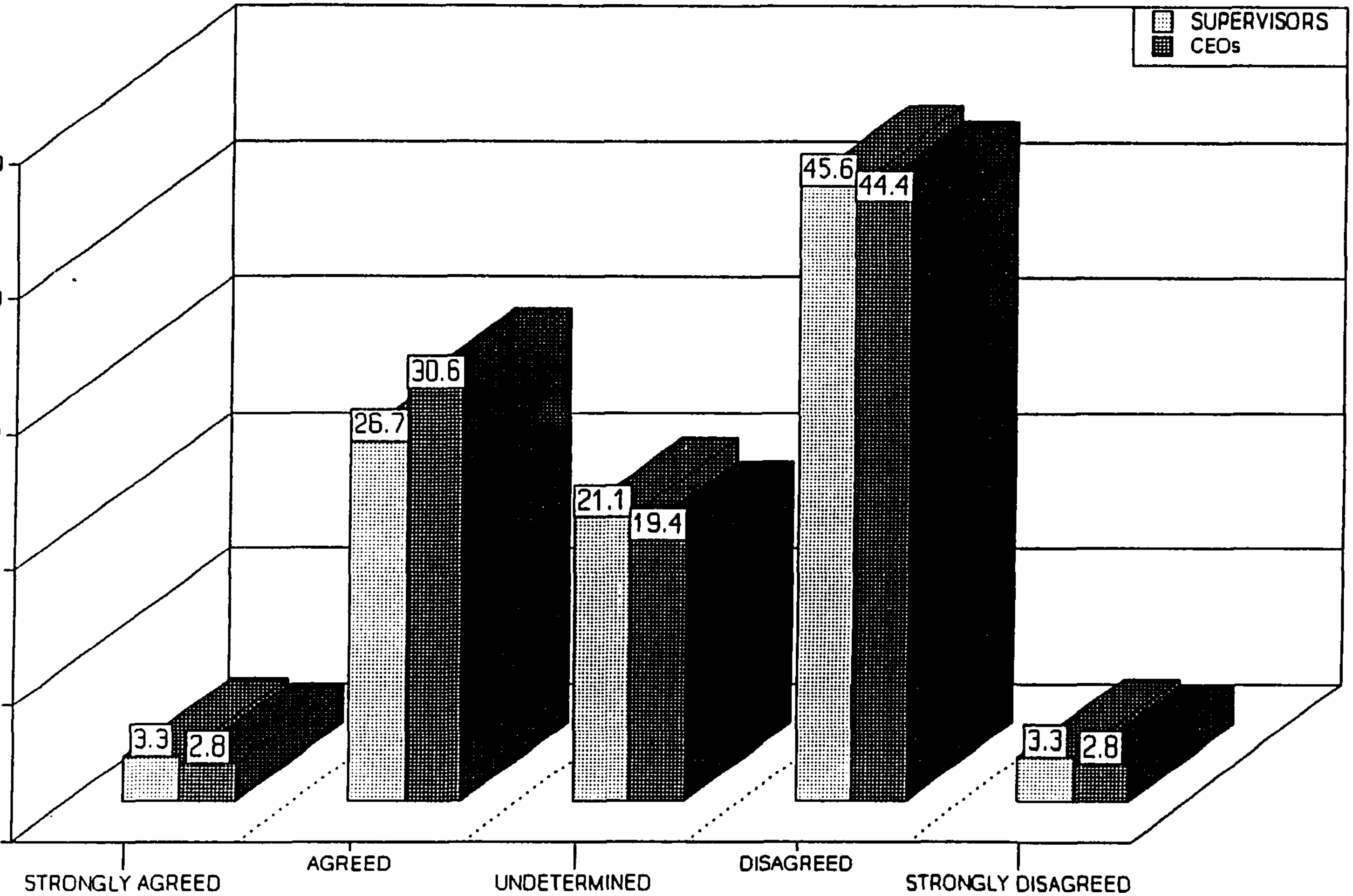
GRADUATES	51.8	40.6	4.9	3	0
SUPERVISORS	58.9	35.6	5.6	0	0
CEOs	59.7	34.7	5.6	0	0

ATTITUDE TOWARD FURTHER COLLEGE PREPARATION



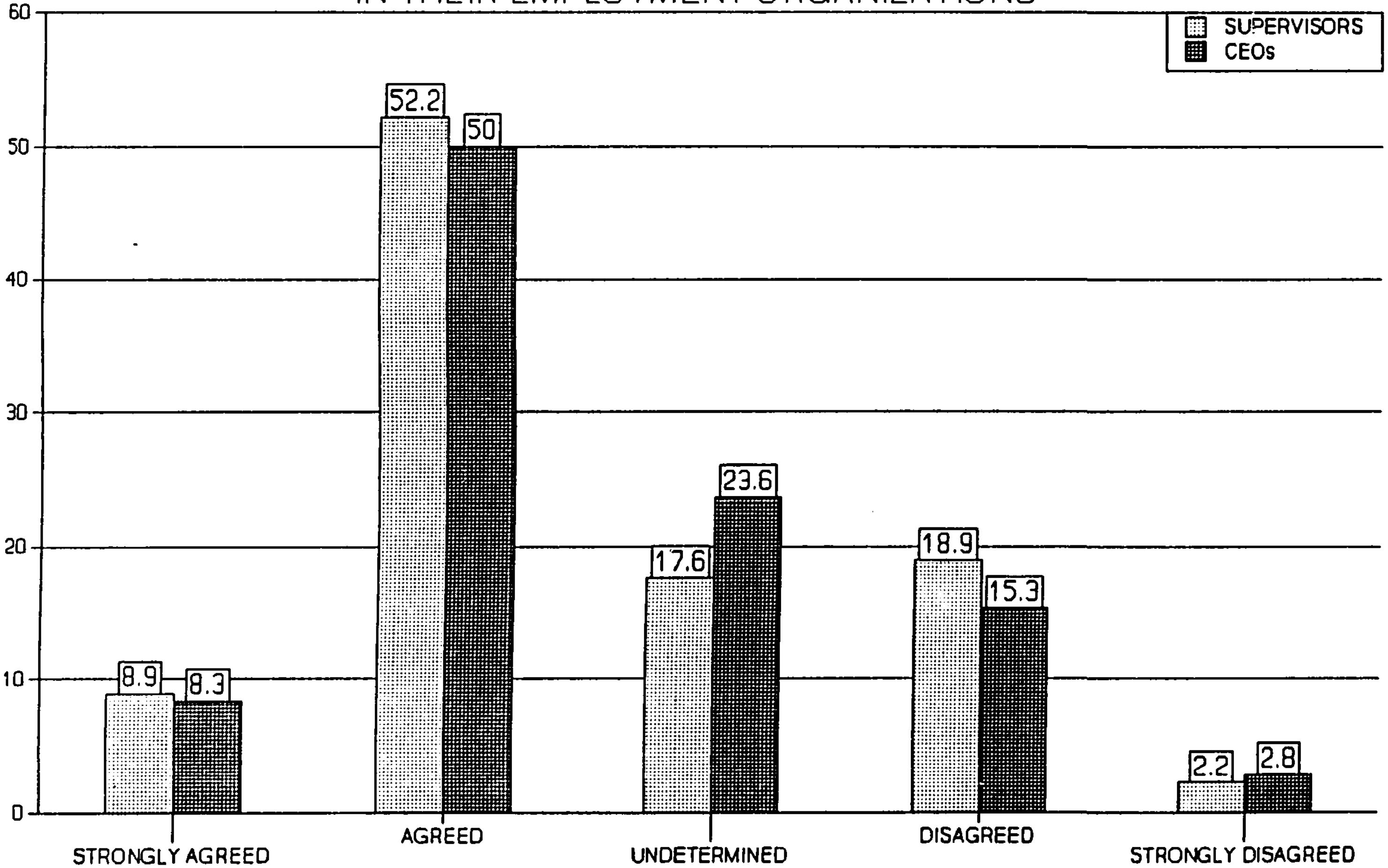
GRADUATES	40.2	41.5	8.5	7.3	3
SUPERVISORS	12.2	45.6	20	21.1	1.1
CEOs	8.3	42.7	20.8	22.2	1.4

PREPARATION FOR INITIAL EMPLOYMENT OF GRADUATES



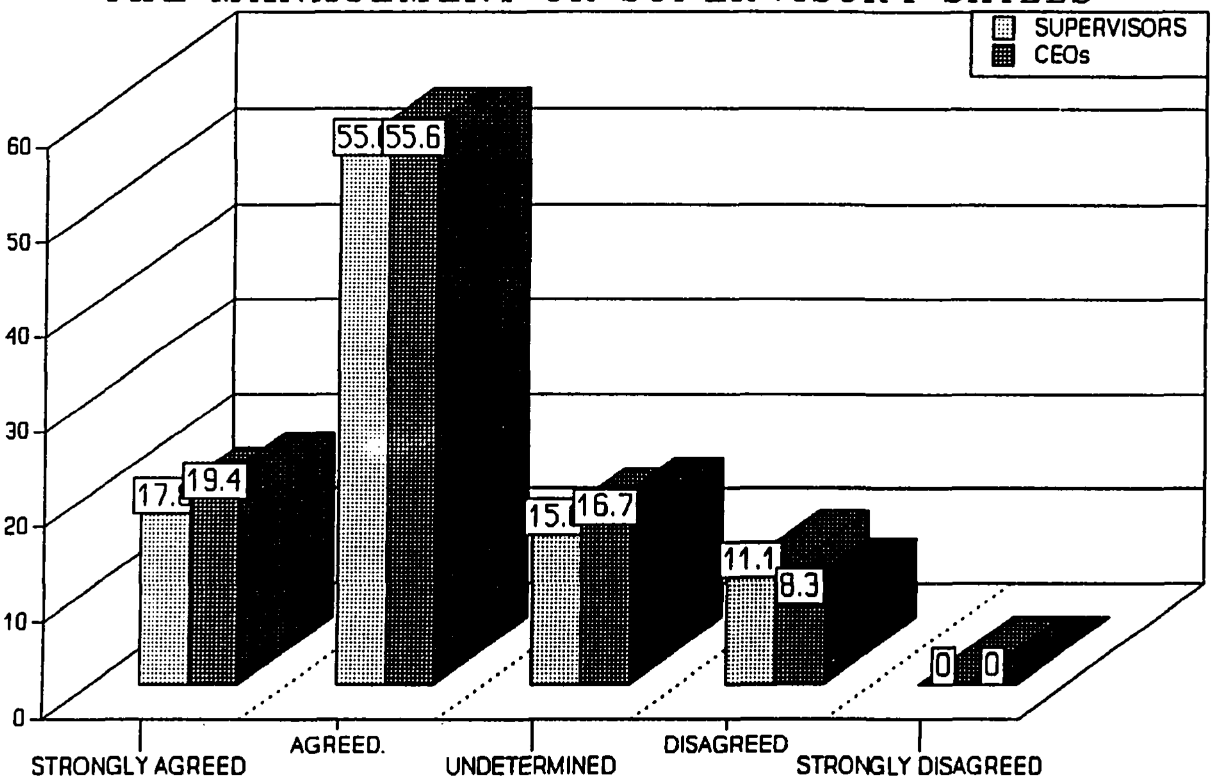
SUPERVISORS	3.3	26.7	21.1	45.6	3.3
CEOs	2.8	30.6	19.4	44.4	2.8

PREPARATION FOR ADVANCEMENT OF GRADUATES
IN THEIR EMPLOYMENT ORGANIZATIONS



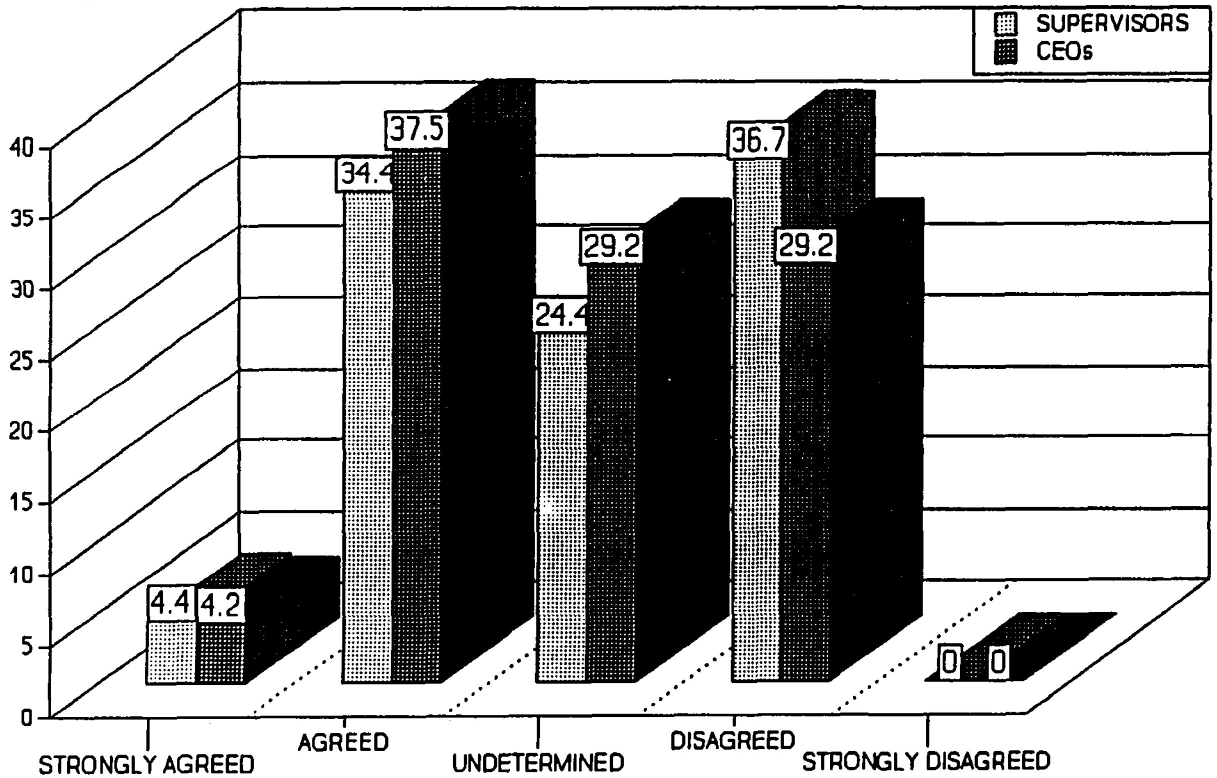
SUPERVISORS	8.9	52.2	17.6	18.9	2.2
CEOs	8.3	50	23.6	15.3	2.8

THE MANAGEMENT OR SUPERVISORY SKILLS



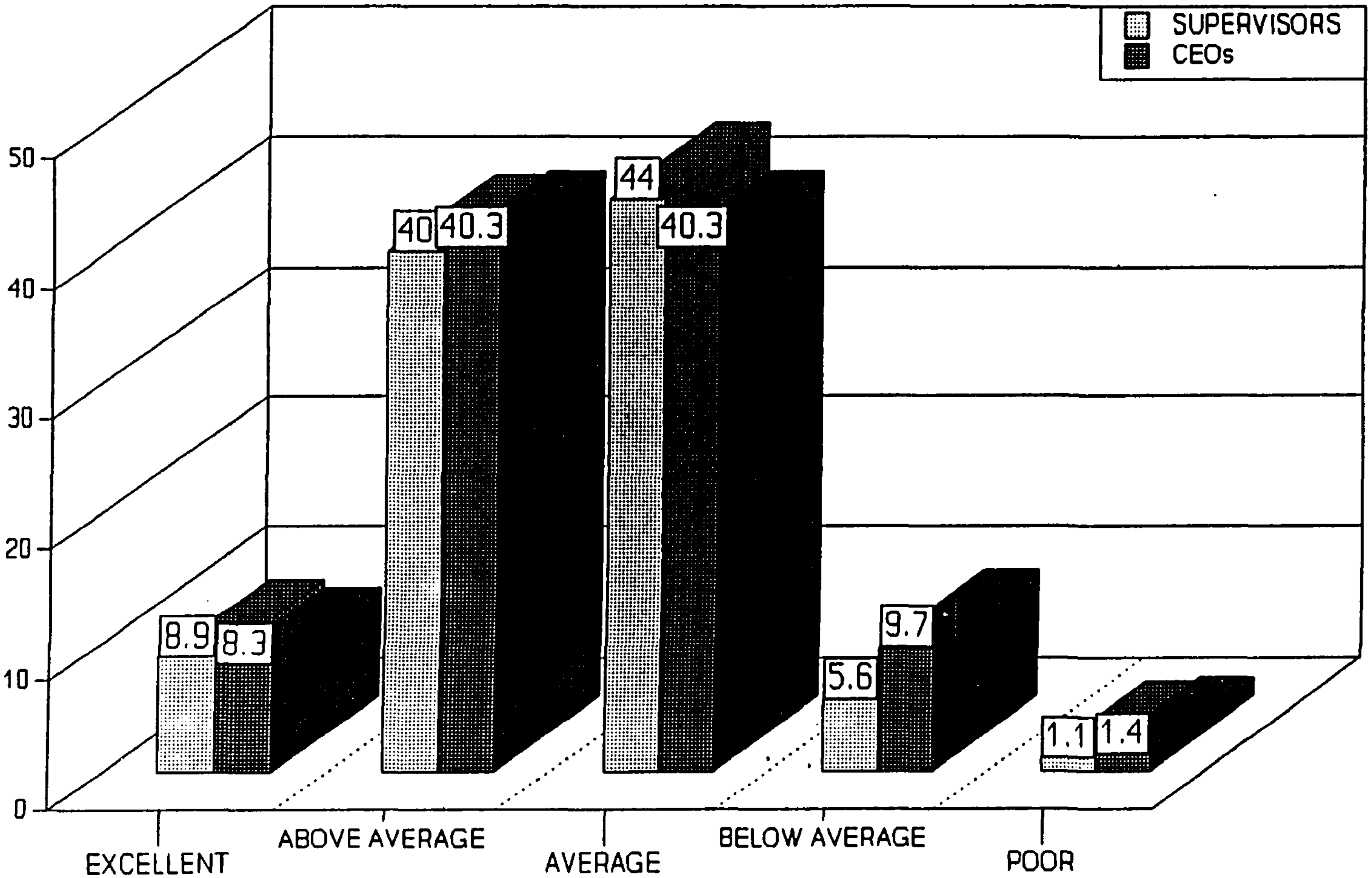
SUPERVISOR	17.8	55.6	15.6	11.1	0
CEOs	19.4	55.6	16.7	8.3	0

THE NEED OF GRADUATES IN NEXT FIVE YEARS



SUPERVISOR	4.4	34.4	24.4	36.7	0
CEOs	4.2	37.5	29.2	29.2	0

GRADUATES PERFORMANCE EVALUATION



SUPERVISOR	8.9	40	44	5.6	1.1
CEOs	8.3	40.3	40.3	9.7	1.4

Appendix F

Tables of Employment Characteristics

Table 26

Summary of Graduates' Occupational Categories

Occupational Category	Number	Percent
Engineering	54	32.7%
Management/Supervision	7	4.2%
Marketing/Sales	13	7.9%
Product Design	15	9.1%
Production	22	13.3%
Quality Control	17	10.3%
Inventory Control	4	2.4%
Research and Development	6	3.6%
Servicing and Repair	19	11.5%
Others	8	4.8%

Table 27

Number of Years Graduates Had Been Employed by The Organizations

Number of years	Number	Percent
Less than one year	58	35.2%
Between 1 to 2 years	69	41.8%
Between 2 to 3 years	26	15.8%
Between 3 to 4 years	8	4.8%
Between 4 to 5 years	4	2.4%

Table 28

The Number of Job Changes From One Organization to Another Since Graduation of Graduates

Number of Job Change	Number	Percent
Not changed	82	49.7%
One time	65	39.4%
Two times	13	7.9%
Three times	5	3%

Table 29

Starting Salaries of Graduates

Salaries	Graduates	Supervisors	CEOs
NT$ 15,000 to NT$ 18,000	9 or 5.5%	23 or 25.3%	20 or 27.8%
NT$ 18,000 to NT$ 21,000	48 or 29.1%	47 or 51.6%	40 or 55.6%
NT$ 21,000 to NT$ 24,000	80 or 48.5%	18 or 19.8%	11 or 15.3%
NT$ 24,000 to NT$ 27,000	19 or 11.5%	2 or 2.2%	1 or 1.4%
More than NT$ 27,000	9 or 5.5%	-	-

Table 30

Present Salary Range of Graduates

Salaries	Graduates	Supervisors	CEOs
NT$ 15,000 to NT$ 20,000	1 or 0.6%	3 or 3.3%	2 or 2.8%
NT$ 20,000 to NT$ 25,000	57 or 34.5%	47 or 52.2%	35 or 48.6%
NT$ 25,000 to NT$ 30,000	73 or 44.2%	34 or 37.8%	31 or 43.1%
NT$ 30,000 to NT$ 35,000	28 or 17%	4 or 4.4%	3 or 4.2%
More than NT$ 35,000	6 or 3.6%	2 or 2.2%	1 or 1.4%

Table 31

Number of Promotions of Graduates

Number of Promotions	Graduates	Supervisors	CEOs
None	85 or 51.1%	47 or 52.2%	35 or 48.6%
One Time	54 or 32.7%	34 or 37.8%	29 or 40.3%
Two Time	17 or 10.3%	7 or 7.8%	6 or 8.3%
Three Time	8 or 4.8%	1 or 1.1%	1 or 1.4%
Four Time	1 or 0.6%	1 or 1.1%	1 or 1.4%

Table 32

Work Satisfaction of Graduates

Work Satisfaction	Graduates
Strongly agreed	25 or 15.2%
Agreed	87 or 52.7%
Undetermined	23 or 13.9%
Disagreed	25 or 15.2%
Strongly disagreed	5 or 3%

Table 33

Attitude Toward Further College Preparation For Graduates

Attitude	Graduates	Supervisors	CEOs
Strongly agreed	66 or 40,2%	11 or 12.2%	6 or 8.3%
Agreed	68 or 41.5%	41 or 45.6%	34 or 42.7%
Undetermined	14 or 8.5%	18 or 20%	15 or 20.8%
Disagreed	12 or 7.3%	19 or 21.1%	16 or 22.2%
Strongly disagreed	5 or 3%	1 or 1.1%	1 or 1.4%

Table 34

Supervisor Work of Graduates

Statements	Graduates	Supervisors	CEOs
Statement: If Graduates Held a Supervisory Position?			
Answer: Yes	66 or 40%	28 or 31.1%	25 or 34.7%
Answer: No	99 or 60%	62 or 68.9%	47 or 65.3%
Statement: Technical background was essential for the supervisory position			
Strongly agree	37 or 56.1%	17 or 60.7%	15 or 60%
Agreed	19 or 28.8%	9 or 32.1%	8 or 32%
Undetermined	3 or 4.5%	1 or 3.6%	1 or 4%
Disagreed	7 or 10.6%	1 or 3.6%	1 or 4%
Statement: The graduates desire to hold a supervisory position.			
Strongly agreed	62 or 62%	30 or 48.8%	22 or 46.8%
Agreed	33 or 33%	25 or 27.5%	19 or 40.4%
Undetermined	3 or 3%	5 or 8.1%	4 or 8.5%
Disagreed	-	1 or 1.6%	1 or 2.1%
Strongly Disagreed	-	1 or 1.6%	1 or 2.1%

Table 35

The Need of The Graduates in Next Five Years

The Need Will Increase Substantially	Supervisors	CEOs
Strongly agreed	4 or 4.4%	3 or 4.2%
Agreed	31 or 34.4%	27 or 37.5%
Undetermined	22 or 24.4%	21 or 29.2%
Disagreed	33 or 36.7%	21 or 29.2%

Table 36

The Management or Supervisory Skills For The Graduates

The Management or Supervisory Skills Are Important	Supervisors	CEOs
Strongly agreed	16 or 17.8%	14 or 19.4%
Agreed	50 or 55.6%	40 or 55.6%
Undetermined	14 or 15.6%	12 or 16.7%
Disagreed	10 or 11.1%	6 or 8.3%

Table 37

The Number of Promotion of Graduates

Number of Promotion	Graduates	Supervisors	CEOs
None	85 or 51.5%	47 or 52.2%	35 or 48.6%
One time	54 or 32.7%	34 or 37.8%	29 or 40.3%
Two times	17 or 1.3%	7 or 7.8%	6 or 8.3%
Three times	8 or 4.8%	1 or 1.1%	1 or 1.4%
Four time	1 or 0.6%	1 or 1.1%	1 or 1.4%

Table 38

The Year Graduates Graduated from School

The Year	Numbers	Percentage
1987	8	4.8%
1988	10	6.1%
1989	31	18.8%
1990	67	40.6%
1991	49	29.7%