A FOLLOW-UP STUDY OF THE GRADUATES OF THE ENGINEERING TECHNOLOGY PROGRAM AT SOUTHWESTERN OKLAHOMA STATE UNIVERSITY

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CHAPTER I

INTRODUCTION

Overview

The purpose of Engineering Technology education at Southwestern Oklahoma State University is to prepare individuals for eventual mid-level employment in various industrial areas. The perceived employment niche is between the engineering and technician levels. This niche has developed as the spread between theoretical and skill-based knowledge widened with technological development. Skill-based knowledge is defined here as the manual implementation knowledge required by technicians. The Canadian Technology Accreditation Board (CTAB) states in part:

> An Engineering Technician (hereinafter referred to as the technician) is an individual who, through academic training and experience in the application of mathematics and engineering or scientific principles, is capable of assuming responsibility and of exercising independent judgment in the specialized portion of the field of engineering or applied science technology in which training has been achieved. By virtue of this training and experience, a technician is prepared to take responsibility of aspects of work within this specialized portion of the field of training.
>
> The academic training for a technician is based upon a core of applied mathematics and engineering/science fundamentals. The technician will use mathematics as a tool in the solution of the technical problems of his/her specialized field. The engineering and science fundamentals provide a firm base along with mathematics for <u>specialized</u> training which normally invokes <u>empirical</u> rather than analytical solutions to technical problems. The academic and theoretical portions of a program of training is suitably reinforced by laboratory and project experience amounting to

approximately one half of the total program.

The technician may carry out a variety of technical work processes in the area of specialization in which certification was granted. Employment or career opportunities exist in many phases of industry, consulting, business, government and public organizations. Typical areas would include design, marketing, sales, estimating, research and development, production control, purchasing, operations and production, testing, quality control, maintenance, customer and field service, supervision of projects and people, instruction and training. Such work is usually in association with other professionals as part of a team.

An Engineering Technologist (hereinafter referred to as the technologist) is a professional who, through academic training and experience in the application of mathematics and engineering or scientific principles, is capable of assuming responsibility and of exercising independent judgment in the field of engineering or applied science technology in which training has been achieved. By virtue of this training and experience, a technologist is prepared to take final responsibility of all aspects of work within this field of training.

The academic training for a technologist is based upon a core of applied mathematics and engineering/science fundamentals. The engineering and science fundamentals provide a firm base along with mathematics for training in the engineering/applied science, applicable to a particular branch or specialty of technology. The academic and theoretical portion of a program of training is suitably reinforced by laboratory and project experience amounting to approximately one-third of the total program.

Employment or career opportunities exist in most phases of industry, consulting, business, governmental and public organizations. Typical areas would include design, marketing, sales, estimating, research and development, production control, purchasing, operations and production, testing, quality management, maintenance, customer and field service, management and supervision of projects and people, instruction and teaching. Such work may be performed independently or in association with other professionals as part of a team (CTAB, 1996).

Occasionally engineering technologists replaced engineers on specific jobs as the need occurred. This left companies free to use engineers for more demanding projects. This replacement also happened at the technician level where engineering technologists specialized in one technical area while still retaining a broad understanding of industry. The coursework for Engineering Technology, in some respects, resembled that of engineering, but had less mathematical rigor and more practical applications. In contrast, the technician education program specialized heavily in one technical skill area with less mathematical rigor. This relationship, as perceived by the author, is shown in Figure 1. This figure shows relative relationships only, not actual values.

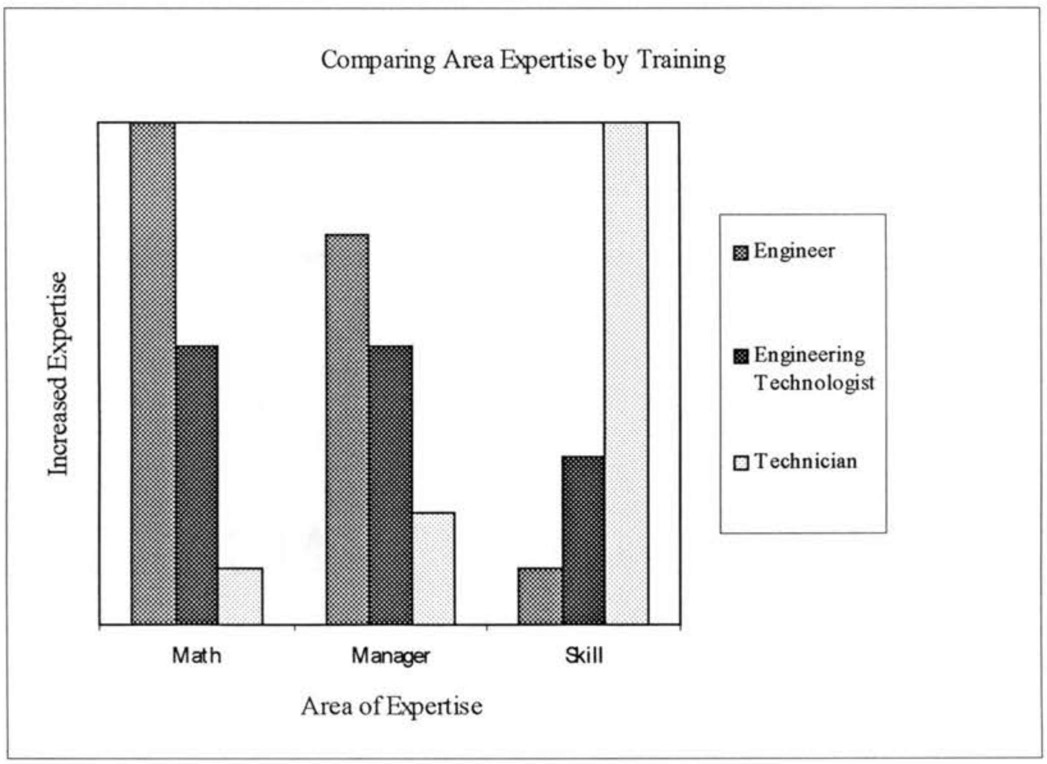

Figure 1 - Math Versus Technical Skills

Degrees Offered in Engineering Technology

A Masters degree in one of the engineering disciplines was generally considered the minimal degree for Engineering Technology teachers. Three or more years of industrial experience were often required to be hired to teach in this area. At present the highest degree awarded in Engineering Technology was the Masters degree in the United States. Southwestern Oklahoma State University offered a Bachelors degree in this discipline as of 1996.

General Reasoning Behind Study

Due, in part, to both the certification requirements of the American Board of Engineering Technology (ABET) and the continuous improvement philosophy of the author, a follow-up study of the graduates of the Engineering Technology program at Southwestern Oklahoma State University was done. ABET required a follow-up study of the employers of students graduating from the program. Since most of the graduates' addresses and employers' names were unknown, this study was the first step for later follow-up studies. It was believed that attaining ABET certification would increase enrollment in the program. A secondary benefit of ABET certification was believed to be improved program quality. Major benefits were also achieved in curriculum planning, alumni-department relations, and record keeping as a result of this study.

Statement of the Problem

There have been relatively few follow-up studies of Engineering Technology students reported in the literature. Certainly none have been made to gather information concerning the characteristics, perceptions, and opinions of the Engineering Technology graduates of Southwestern Oklahoma State University. There was insufficient information about the career development of these graduates and their thoughts and ideas regarding the relevance of their education to their career experiences. What then were the characteristics, perceptions, and opinions of the graduates of the Engineering Technology program in relation to their educational experience? This study will attempt to obtain this information.

Purpose of Study

The purpose of this study was to conduct a follow-up study of Engineering Technology graduates at Southwestern Oklahoma State University, to determine if the then current curriculum offerings met their career needs. This study helped to determine what was needed to improve the curriculum to match those needs.

Specifically, the research was designed to obtain information about course experiences, post-graduate experiences, and an evaluation of the perceived needs for educational experiences. Furthermore, the researcher identified, through analysis of the collated data, items that when studied as group data could lead to meaningful curriculum changes. In addition, the graduates made suggestions on how their educational preparation could have been strengthened.

Significance of the Study

The study focused on the perceived needs of graduates of the Engineering Technology program at Southwestern Oklahoma State University with regard to how well their education prepared them for their work in industry and what changes need to be made to better prepare future students. It also addressed issues outside the curriculum that the graduates perceived as needing attention. University programs should benefit from the experience of their graduates in the field as to what was needed for a successful career. Studies such as this were one way of ascertaining these needs in an organized manner.

Curriculum Planning Benefits

The information from this study aided curriculum planners in meeting the needs of its customers -- the students. The study was also a way for educators to meet future needs in the following ways:

- The implementation of new courses not presently offered.
- The deletion or modification of courses presently offered that do not meet perceived needs.
- The modification of content within presently taught courses to reflect perceived needs.
- The setting of measurement criteria to determine student progress and teacher effectiveness.
- The changing of teaching methods and strategies to reflect perceived needs.

Each of these objectives was also a way to meet the competitive needs of the university. Economic pressures ensure that student enrollment is important to the success of any program. Other universities have used continuous improvement to increase the value of their programs to students by increasing the programs' relevance.

Strategic Planning from an Economic Standpoint

Enrollment had become an issue at Southwestern Oklahoma State University in budget planning during the period studied. With the emphasis on economic concerns in education, strategic planning was considered necessary for increasing enrollment. The information from the study encouraged strategic thinking in the following ways:

- Was the department clear about its mission, the customers it serves, and the results that were needed?

- Were there technological trends that could put the department in a better competitive position with regard to other universities in this area?

- What were the initiatives that could be taken to improve the quality of education?

- What steps did other schools use to improve their competitive advantage and can the department benchmark against them?

It is important that the program did not address each of these issues in a haphazard manner, following trends without measurable goals or effectiveness. This study hoped to provide a starting point for evaluation.

Limitations of the Study

The study's limitations consisted of the usual limitations associated with surveys plus a few associated with specific problems of the study population research (Key, 1995, pp. 105-109). The following limitations were identified:

- The study was limited to graduates of the Engineering Technology program at Southwestern Oklahoma State University over a limited time span and should not be generalized beyond that population and span.
- There was an unknown opportunity for all population members to be included in the study due to the lack of addresses of some of the members.

- There may have been an unknown bias introduced by the exclusion of population members who did not respond.

- The instruments used may not, in spite of efforts to avoid this, have been adequate to have obtained the best response rate and accomplish the objectives of the study.

- The respondents may not have answered honestly.

- The study was generalizable only to the Engineering Technology program at Southwestern Oklahoma State University and should be repeated at regular intervals to note changes.

Other limitations were either not identified or considered of minor importance.

Assumptions

The primary assumptions of this study included the following list in perceived order of importance:

1. The respondents answered honestly.

2. Nonresponse bias did not influence the results.

3. Various instructors teaching the same class had no effect on the study results.

4. Building remodeling and shifting of classrooms had no effect on the outcome.

5. Changing course names and descriptions did not bias the study.

6. The retirement of one teacher did not influence the study

Items three through five occurred during the first two years of the study period.

Thereafter these items ceased to be important and a relatively steady environment ensued.

Objectives

The purpose of this study was to conduct a follow-up study of Engineering Technology graduates at Southwestern Oklahoma State University to determine if current curriculum offerings meet their career needs and what was needed to improve the curriculum. The results were used in modification of the curriculum to better prepare Engineering Technology students for their future careers. To accomplish this purpose the following objectives had to be attained:

- To obtain the geographical location of graduates
- To determine graduate satisfaction with the program
- To determine individual course perceptions and experiences
- To determine perceived needs for educational experiences during school
- To determine post-graduate experiences
- To determine perceived needs for post-graduation education
- To determine suggestions for improvement
- To determine to what extent the graduates were employed in the field in which they received their education
- To determine salary levels of the Engineering Technology graduates
- To determine the graduates' perceived need for content changes in presently offered courses to meet job requirements
- To determine what perceived courses should be offered that were not presently offered
- To determine what perceived courses should be eliminated that were presently being offered

Additional information was, in some cases, volunteered by the graduates. While this information did not specifically address the objectives, it did suggest further items for study.

Definition of Terms

The following terms were used in this study:

- CAD (computer aided drafting) is defined as using a computer program to draw or design objects.
- CAM (computer aided manufacturing) is defined as using a computer program to direct a machine in the transformation of a material.
- Continuing Education is defined as the formal education that occurs after a degree is granted.
- Engineer is defined as a person with extensive training in analytical and empirical math, theoretical and applied physics, design, materials, processes, and other subjects for the purpose of providing or improving goods and services.
- QC (quality control) is defined as monitoring a process to ensure conformance to customer requirements.
- Technician is defined as a specially trained person who performs both problem solving and mechanical manipulations of machines, parts, and other materials in a highly specialized area.
- Technologist is defined as a person, with a wide training base, who performs mid-level analytical, managerial, and mechanical tasks in a variety of areas and acts as a link between engineers, technicians, and other personnel.

CHAPTER II

REVIEW OF LITERATURE

The Need for Evaluation

The prevalent model for education has been the pedagogical model (from the Greek, meaning the art of teaching children). This model presupposed that the teacher was the sole source of knowledge. Information flow in the pedagogical model was from the teacher to the student. In contrast, the andragogy model (from the Greek, meaning the art of helping adults learn), presupposed the active participation of the student in the learning process. Evaluation by the student was an integral part of this process. In the higher education curriculum the andragogy model should have been prevalent and the participation of the student was necessary during and after graduation.

Education is a service process without the tools for self-evaluation (DeYong, 1994, pp. 31-32). It differs, however, from most service industries in several ways. Some of these differences were noted by Seymour and Collett (1991, p. 23) as follows:

- Higher education had multiple customers to satisfy.
- Higher education relied on individuals more than groups.
- Higher education was fragmented into specialized groups that had little idea what occurred in other groups.

Some of the multiple customers that higher education tried to satisfy were: students, parents, governing boards, industry, and society as a whole. Of these customers, the primary number of interactions occurred with the student sector. It was reasonable, then, to assume that students were one of the primary customers to be satisfied. Juran (1991, p. 24) stated that a focus on customer needs and continuous improvement were necessary to any organization interested in quality. It followed that student evaluation of educational offerings was necessary.

Often it had been the practice of educators to devise a curriculum that met the needs of the stereotypical student as perceived by the educators themselves. Seymour and Seymour (1992, pp. 21-23), however, stated that:

> The teacher of today is unlikely to face a class that fits any stereotype. For far too long we have been trying to teach students as if they were all alike. Teachers today are thrown into a classroom that bears no resemblance to the classrooms they have known.

The subjects taught to the educator as appropriate at the time they went to school may no longer be relevant. It is, therefore, more important than ever to know what the actual needs of the students were as opposed to the needs as perceived by educators. An evaluation of the curriculum by working graduates seemed to be a prime source of information in this regard.

Education had often been the object of reform cycles or waves. Frequently these efforts were ill-conceived and short-lived. Brandwein (1981, p. 142) stated that in order to combat the continual pendulum of curriculum change based on polemics the following steps need to be taken.

- A mode of instruction which ... encourages collaboration between teachers and pupils in education.

- A curriculum that ... balances knowledge, skills, and attitudes.

- A balance in the modes of evaluation and assessment.
- A balance based on the future purposes and persons living in an open society.

In examining the above, it was obvious that, as conditions change, curriculums must also change. It was only then that the curriculum will match the needs of its' students with those of society.

Evaluation had been described by educators as the foundation to program improvement and development. Shertzer and England (1968, p. 363) stressed the need for evaluative research when they stated:

> Educators are obligated to conduct follow-up studies of those who enter and leave their preparation programs. Perhaps the demand upon them is even more exacting than upon others who conduct professional preparation programs since counselor educators instruct and urge counselors to conduct follow-up studies of their students and activities. It should be noted that organized student follow-up studies are required of those institutions that expect to meet professional standards.

Evaluating students who had graduated from a program would admirably meet the criteria expressed above.

The American Society for Training and Development (ASTD) noted that evaluation is not a one-time event. They have stated that:

> It's vital for the Technical Training Function (TTF) team to measure and audit the TTF's effectiveness, determine its value or worth, and demonstrate a return on investment to the business units and larger organization on a continual basis. (Kelly, 1995, p. 91)

This statement stressed the continuous nature of evaluation based on standard industry measures of improvement.

There had been few studies conducted to evaluate the quality and utility of Engineering Technology programs in the work experience of graduates. This study provided information that influenced the professional preparation of students. It appeared, in the literature, that while education students were encouraged to do follow-up research in relation to their programs, the educators themselves had been remiss in the evaluation of their own programs. This was true of the Engineering Technology program at Southwestern Oklahoma State University.

The Purpose of Follow-up Studies

The purpose of follow-up studies, while never exactly agreed upon, had certain common points. Good (1973, p. 4) defined the purposes of the follow-up study as:

1. To determine the effectiveness of the guidance process.
2. To obtain a realistic picture of what lies ahead for present students.
3. To help former students reappraise their educational plans.
4. To appraise the school's program.
5. To obtain ideas for improving the program.
6. To obtain information that the school requires to adapt its adult education program to meet more efficiently the needs of its former students and the community.
7. Evaluation of progress of persons in jobs or training to which they have been assigned, on the basis of certain measuring instruments and procedures.

These basic points seemed to reoccur throughout the literature whatever the subject matter under discussion.

Often industrial and educational groups were formed to focus on the educational process. One such group, the Panel on the Economics of Educational Reform (PEER), had stated that:

> Schools must learn systematically from their experience. No matter how successful or unsuccessful current reform programs are, schools will always face the challenge of improving. Yet schools today have no real mechanisms or procedures for managing that continuous process of improvement--for discovering which programs work and which do not, for promoting the good ones and weeding out the bad. (Hanushek and others, 1994, p. xvi)

The PEER group believed that current measures of efficiency, performance, and research were misused in education and needed to be revised to follow current business practices.

According to McKinney and Oglesby (1971), the focus of most evaluation efforts should be on the product or the output of the educational system. This emphasis on the output of the educational system meant that we needed to look at the former students of that system to assist in determining the effects of the educational system on the former students. One of the ways of securing information about former students was to conduct a follow-up study of the former students (McKinney and Oglesby, 1971).

Institutions offering technical education programs had for many years considered graduate follow-up studies an essential part of program evaluation. This technique was employed not only for self evaluation purposes, but the follow-up data was often required by local, state, and federal agencies that support the institutions. These agencies were usually interested in such things as: graduate employment and unemployment, job titles, and salaries (Roberts, 1976).

A 1979 study at Honeywell Corporation found significant correlations between success in work and training (Zemke, 1985). Since this study dealt with management it was particularly applicable to Engineering Technologys' role of training mid-level employees.

In previous research, technical education studies had dealt with job titles, job satisfaction, career patterns, salary analysis, and curriculum development. Whitt (1957) stated that follow-up studies were one of the most important ways to evaluate any educational program.

Holman and Young (1968, p. 4) had stated that "follow-up studies have a tremendous effect on education, for it serves as an opening wedge for continuous faculty and educational improvement".

Barry and Wolf (1963) presented the thought that limited evaluation of training programs can contribute to problems in student education. They also felt that lack of evaluation perpetuated problems already in the system. The lack of systematic study led to armchair philosophy and the best-guess establishment of curriculums. There was little way to tell if the curriculum prepared the students for the intended purpose in these situations.

Hill and Nitzschke (1961) had noted that it was difficult to establish uniform educational objectives without basic research and field investigations. Again the tie between later life experience and previous education was emphasized.

It was significant that legislatures were not interested in waiting years for educators to decide if programs were doing what was claimed for them at the beginning. Either education must evaluate its own programs or outside sources may be brought in to do so (Briggs and Justman, 1963). The California State Department of Education illustrated this need with the following statement:

> Evaluation is an important aspect of the industrial world. Evaluation is equally important in the field of education, and due to rapid industrial and technological developments, evaluation of vocational education programs

> must be a continuous process. The product to be evaluated is the individual not only capable of entry into the labor market but one who is capable of persisting and progressing in the occupation. ("Research Summaries", 1967, p. 14)

It was therefore doubly important that one of the chief tools of educational evaluation, the follow-up study, be used often and well.

Further statements from Grobman, McGee, and Reynolds (1967) reinforced the need for continuous evaluation and improvement:

> Evaluation exists as one means of ascertaining the present status and development of the educational program. The evaluation results permit the educational program to be analyzed so that continuous improvement can be made. It must be flexible and subject to change to be of greatest value. It must stress the essential elements that have the greatest possibility for improved performance and function. The evaluation procedure should stress the forward look, the forward march toward constant improvement and growth quality education. The best evaluation is carried on by the local district as self-evaluation.

Again the same theme appeared in the work of Kempfer (1955) when he stated evaluation stimulates growth and improvement. He further stated that education must be examined from the results end of the spectrum as well as examining the activities that produced those results.

There was some concern that evaluation can get so broadly based that cause-effect relationships were lost. Thatcher (1963, p. 13) had expressed evaluation as:

> An essential and inescapable part of the process of administering an adult program. It is the responsibility of the adult program to train persons for the work life, home life and socio-civic life in which they are to participate. No public school adult education program can remain in an ivory tower feeling secure in its' knowledge of good training methods and organization of instructional material.

It was quite easy to disregard the outside world and assume knowledge of student needs that may or may not be there.

Follow-up Instruments

At this point in the literature review, it was appropriate to incorporate references to follow-up instruments and investigations. Several technical education follow-up studies had been done in Oklahoma. Ballard (1969) conducted a study of the Oklahoma State University Technical Education graduates from 1960-1968. His study concerned salaries, career information, geographic data, and education of graduates. Ballard also analyzed the choice of technical education programs and the involvement within extra professional activities. He reported that the majority of all technical education graduates entered technical education because it was the best post-associate degree educational opportunity. Technical Education graduates pursuing careers in education tended to do more post-graduate study than did Technical Education graduates pursuing careers in industry.

Briggs (1977) conducted a follow-up study of former Arts and Science graduates from Oklahoma State University for the year 1971. Again the instrument employed covered the commonly found subjects of location, salaries, career information, geographic data, areas needing improvement, and the education of graduates.

In a follow-up study by Chaudhry (1981), the purpose was to determine the extent to which graduates employed in different occupations utilized their college education. The respondents expressed their own views on the ways in which their college education contributed to their career development. Conclusions were drawn from responses of two groups of college graduates. This study provided guidelines for the selection of questionnaire items and analysis for the present study. These graduates were asked about job title, numbers of jobs, and employability. The graduates were also asked to recommend courses helpful to their job. The instrument employed covered the commonly found subjects of location, salaries, career information, geographic data, areas needing improvement, and the education of the graduates. Most of the instruments reviewed continually covered these areas.

A similar study was conducted by Rutelonis (1972). His study continued the follow-up study previously conducted by Ballard. Rutelonis' purpose was to update information from Technical Education graduates in 1960-1968 and to obtain pertinent information from graduates during the years of 1969-1972. One result of Rutelonis' study concerned the respondents of Ballard's study who indicated that they intended to pursue an advanced degree. It was found that during the span from 1968 through 1972 only 23.5 percent of the respondents actually pursued an advanced degree. Respondents were asked what additional course work should be included in the curriculum. Most of the respondents preferred more technical courses.

Roberts (1976) conducted a study similar to those of Ballard and Rutelonis. His study collected and analyzed follow-up data on graduates of the Technical Education bachelors and masters' degree programs at Oklahoma State University. The findings of this study again indicated that graduates working in education related fields were found to be more active in seeking advanced degrees. Over half of the graduates in both education and in industry had changed employment. Graduates were asked what additional course or courses would have been beneficial to them. Technical courses were again preferred.

Using and Developing a Follow-up Study

Franchak and Spireer (1978, p. 25) organized the four major steps pertinent in the design and planning of the follow-up study of former students to be as follows:

1. Systematic development of follow-up study objectives. The development of inadequate follow-up study objectives can be considered one of the major obstacles in conducting successful and effective follow-up of former students.

2. Techniques for the development of survey instruments used to collect information from former students and employers. Instrument development involves a series of steps that include:
   a) Determining the questions to be asked.
   b) Developing sex and ethnic equitable language for the instrument.
   c) Increasing the readability of the instrument.
   d) Increasing the reliability and validity of the instrument.
   e) Determining the most appropriate format for the instrument.
   f) Determining how to process the instrument.

3. Techniques for the concerns stemming from the family Education Rights and Privacy Act.

4. Drawing the representative sample.

These steps were used in the preliminary work in developing the present study. Additional help provided by others in the various areas proved to be essential in providing an easily understood questionnaire. The author considers it essential that other viewpoints are used to identify questionnaire problems.

By defining the specific tasks and personnel responsibilities for a follow-up study in the beginning, the chances for a successful effort were greatly increased. McKinney and Oglesby (1971, pp. 28-30) outline, in some detail, a procedure for developing and conducting follow-up studies of former students. Their outline was as follows:

Preparation:

1. Develop objectives for the follow-up study.

2. Determine the group or groups of former students to be involved in the follow-up study.

3. Determine the best method of conducting the follow-up study by mailed questionnaire, personal interview, and phone interview.

4. Design questionnaire in consultation with the administrators, teachers, citizens advisory committee, and student committee and board of education.

5. Obtain authorization for use of signatures from teachers or administrators who will be signing alert cards, cover letters, and reminder cards and letters.

6. Obtain addresses of former students.

7. Prepare master address file.

Data Collection:

1. First mailing - alert cards.

2. End of first week - second mailing - cover letters and questionnaires.

3. First response analysis by beginning running count of returned completed questionnaires, begin search for correct address, and compile address list for third mailing.

4. End of second week - send third mailing reminder cards for non-respondents, questionnaires to corrected address (of instruments returned because of incorrect address), continue search for corrected address, and prepare list for fourth mailing.

5. End of third week - fourth mailing by reminder letter and second copy of questionnaire to non-respondents and continue response analysis.

6. End of the fourth week - fifth and final mailing - reminder card with cut-off date to non-respondents.

Analysis of data:

1. Preparation of follow-up report.

2. Conference with administrators, teachers, citizens, student committee, and board of education.

3. Publication of follow-up report.

Both of the above models had many similarities. Perhaps McKinney and Oglesby's (1971) model was more useful due to its greater detail. The timeline they present seemed very short for the work to be accomplished.

Summary

This chapter addressed the need for evaluation. It was conclusively shown that the literature supports the need for evaluation in order to improve the curriculum. Furthermore, the follow-up study was shown as one of the chief tools used to evaluate educational programs in the section detailing the purpose of follow-up studies. The use of follow-up instruments was discussed in some detail and several studies were used as examples. Finally, the development and use of follow-up studies were addressed with several models given for practical research.

CHAPTER III

METHODOLOGY

Introduction

The purpose of this study was to conduct a follow-up study of Engineering Technology graduates at Southwestern Oklahoma State University to determine if current curriculum offerings meet their career needs and what was needed to improve the curriculum. The results were used to modify the curriculum to better prepare Engineering Technology students for their future careers. The results were also used in the preliminary ABET study of graduates and their employers.

Since there were numerous program and curriculum changes at Southwestern Oklahoma State University in the years 1989 to 1991, it was difficult to separate the fields of Industrial Technology and Engineering Technology that were both offered at this institution during this time period. Consequently, graduates had taken overlapping courses in both curriculums. Due to poor record keeping practices, official university records did not adequately differentiate between the curriculums, or the graduates, of each area during the time mentioned. Considerable effort was used to separate the Engineering Technology graduates from the Industrial Technology graduates. These efforts included:

- Querying registrar records.

- Questioning instructors at the university.
- Examining transcripts.

In spite of the above procedures at least one student was inadvertently omitted from the mailing lists. This student was not included in either the survey or in the statistical analysis of data. Due to chance this student was the only student who, after graduation, worked more than 400 miles from Southwestern Oklahoma State University. This was discovered only after the last mailings were returned. Since this student represented an outlier in terms of present employment location it was particularly unfortunate that he was not given a chance to be represented in the analysis of employment data. It was unlikely that this student would have responded in any case since, at the time of the mailings, his address information was incorrect.

Because of the changing course descriptions and course number problems, special care was taken to develop an instrument that explained the course titles and content. Due to the length (20 pages) of the initial rough-draft questionnaire that resulted from including all the departments' courses, not all of the department's courses were evaluated in the final version. Also, the general education area of the curriculum was not included in the evaluation for the same reason. This may have been a mistake, as several graduates mentioned general education requirements as being a problem in their education. Further work needs to be done in that particular area. Only 1991 to 1995 graduates were polled. The problem of nonresponse was anticipated to be a factor. Perhaps a monetary incentive would have increased the eventual response rate of the graduates as reported by Armstrong (1975). This chapter described the methodology used to meet the objectives of the study.

Follow-up Model Used

The outline of Kampanrana (1983, pp. 15, 16) was used as a rough chronological order for accomplishing the purposes of this study. Slight modifications were made as deemed necessary for the purposes of this study. The actual outline was as follows.

I. Preparation

1. Develop follow-up study objectives.
2. Identify population of graduates to be included in follow-up study.
3. Develop a self-administered mailed questionnaire.
4. Obtain addresses of graduates and prepare master address file.
5. Establish mailing dates and prepare material of mailing.

II. Data Collection

1. First mailing - send letter seeking addresses.
2. Second mailing - send transmittal letter, questionnaire, and address list.
3. Third mailing - follow-up letter with questionnaire to the graduates who do not respond to the original request.
4. Final effort to contact graduates by mail or phone.

III. Data Analysis

1. Analyze personal data by percentage and average.
2. Analyze occupational data by percentage and average.
3. Analyze educational data by percentage and average.

IV. Disseminate Results

1. Send abstract to all concerned individuals, departments, and agencies.

2. Send copy of entire follow-up study to selected parties.

A copy of the questionnaire is presented in Appendix B along with the initial letter (letter1.doc).

Figure 2 graphically shows the time sequence used in the initial planning of this follow-up study as a Gannt chart.

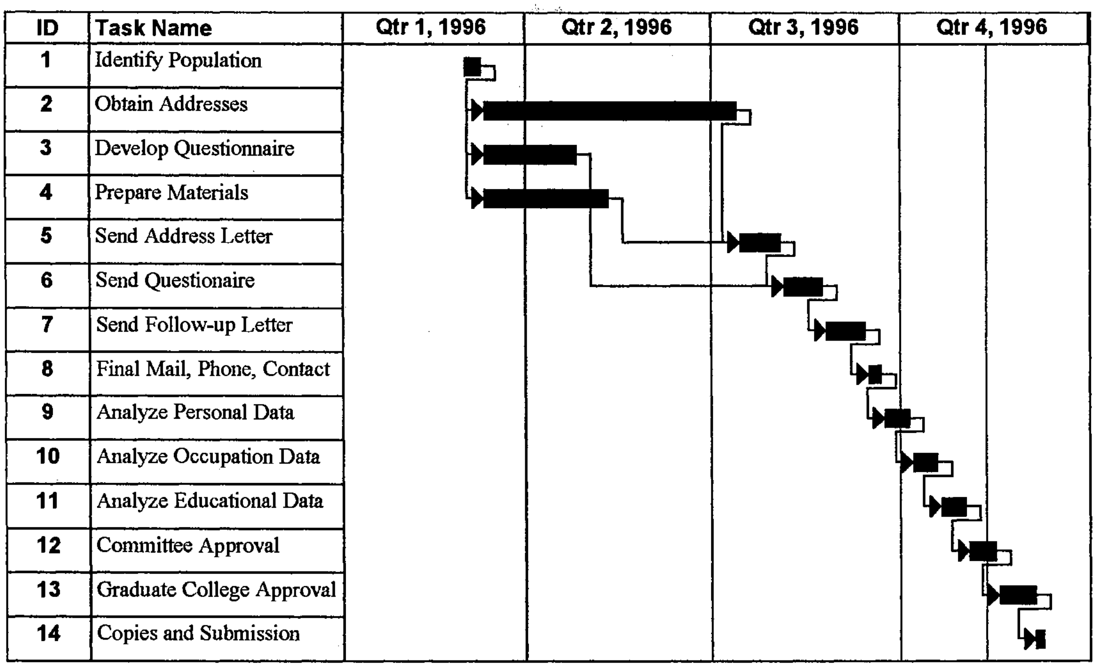

Figure 2. Preliminary Study Timeline

Population

The population of this study consisted of all, except one, Southwestern Oklahoma State University Engineering Technology graduates from 1991 to 1995. This corresponded to a code number of 131 at the Southwestern Oklahoma State University registrar's office. Unfortunately some industrial technology graduates also had this same code number and some intermixing of majors had occurred. These were sorted on a case by case basis.

During the initial contact by letter with the graduates, a list of the graduate addresses was included. Graduates were then asked to scan the list for friends and coworkers, correcting their addresses where known. These lists were returned in self-addressed and stamped envelopes and the new address data tabulated. This was then used for later mailings. Addresses and address corrections were sought during each mailing. Phone calls helped to obtain some addresses. A CD ROM database was used to obtain some addresses using the graduates' names and general locations as a sorting mechanism.

The questionnaire was sent to all the graduates' last known address. Additional letters and phone calls were used to seek new addresses for those who had moved. At that time it was assumed that there were 90 graduates based on the university registrar's records. This turned out not to be correct due to a database numbering problem. The correct number turned out to be 67.

Since some questionnaires were returned with all the information except the return address and name of the respondent, it was not known who had responded. All graduates who could not be identified as respondents were sent an additional letter and questionnaire.

Most of the data compilation was done with a spreadsheet and database program (Excel®, version five). Both Excel® and a statistical analysis package (Minitab®, version ten) were used in the statistical analysis of the data. Various sorting methods were used as shown later. In some cases, numbers were substituted for responses in order to statistically analyze the data. This was done to provide a statistical mean and deviation information for determining a picture of the graduates' responses.

Instrumentation

The instrument used in this study was structured to accomplish the goals of the study objectives and purpose. As Warwick and Linninger (1975) pointed out, it is necessary to design a questionnaire to obtain information relevant to the purpose of the study and to maximize the reliability and validity of the information.

The questionnaire items, arrangement, and format were developed in collaboration with the members of the doctoral study committee. Additional help was obtained from nineteen members of a research design group. This group worked to improve the validity of the questionnaire in meeting the stated purpose and objectives of the study. This group consisted mostly of teachers, administrators, and industrial personnel. It was hoped that this would address some of the concerns about content validity as noted by Key (1995). Pilot testing was done using the research design group and several helpful suggestions resulted in changes in the questionnaire. No test and retest, split-halves, or other tests for reliability were done due to the low response rate.

Twenty questionnaires used in previous studies were examined and, where appropriate, adapted for this study. The questionnaire used differed from those examined in having a greater proportion of open-ended questions. This was necessary in order to elicit accurate responses from the graduates and help eliminate questionnaire bias. Due to the changes taking place in the curriculum during the period of the graduates' matriculation, it was necessary to include the presently offered course names and descriptions so that the graduates would have a means of comparison to the courses they actually took.

Because of the number of the courses and the length of the descriptions, smaller type and column formatting were used in that section of the questionnaire. This reduced the apparent length of the questionnaire. This increased the likelihood of getting a response. If a particular graduate was known to have eyesight deficiencies, a larger font was used on their survey to help elicit responses.

A majority of the questionnaire items concerning actual courses required either a circling or crossing out of a course description as a means of indicating approval or disapproval of the course. The next most frequently used questions were of the short answer type. Many open-ended responses were also sought to allow for individualized responses. The questionnaire is included in Appendix B. The graduates frequently enclosed letters with additional comments about the program. These comments were itemized as short statements and included as part of the study. Only comments relating to the curriculum were listed.

Nonresponse is a frequent problem in questionnaire surveys. Anticipating this problem, several methods were used to counter nonresponse as much as possible (Key, 1995). These included:

- Printed, rather than copied, letters and questionnaires.
- Personalized letters for each graduate.
- Professional appearance of mailing.
- Repeated contact with graduates.
- Involved graduates in the process by requesting the addresses of other graduates.
- Returned a corrected address list of all graduates where requested.
- Kept the questionnaire as short as possible.

It was thought that the generally friendly environment of Southwestern Oklahoma State would also increase the response rate.

Data Analysis

According to Merriam (1988, p. 127), data analysis is the process of making sense out of one's data and in deciding what things fit together. This fit in with Lincoln and Guba's (1985) assertion that the units of information gathered will serve as the basis for defining categories. The structuring of the questionnaire also influenced the resulting categories.

While the data forms categories as a result of the questionnaire's structuring and as a result of the data gathered, the interpretation of the data was the major area of disagreement among researchers (Kerlinger, 1986, p.142). In a descriptive study, such as this, the interpretation is likely to be piecemeal in practice as each instructor will either use, or not use, the data according to their own mind set. Questions of research design, methodology, or measurement can always be raised to justify what one believes.

The defined population of the Engineering Technology graduates numbered 67 in total; according to Krejcie & Morgan (1970) the returned sample size needed was 56 responses from a total population of 67. Another method for estimating population proportions uses $p^\wedge = x/n$ and the approximation of confidence interval as equal to $p^\wedge \pm 1.96*((p^\wedge q^\wedge)/n)$ for a 95% confidence interval (McClave & Benson, 1994, p. 326). The proportion confidence interval turned out to be $0.358 \pm .114$ for 95% confidence that the samples would enclose p, the population mean. Many attempts, including multiple mailings and phone calls, were made to increase this proportion to increase the validity of the data obtained. It was not anticipated that this would be attained for several reasons. These reasons included inaccurate address information and lack of interest in filling out the questionnaire.

Since the information gathered represented mostly nonparametric data, both ordinal and nominal statistical tests were appropriate, as well as some simple descriptive measures.

Data from the questionnaires was handled on a line by line basis by means of a computer database (Excel®, version 5). The data was tabulated, entered into the database, and sorted as needed. Graphs and tables were generated in Excel® and cut and pasted, by the Windows® program, into a word processor (Word®, version 6) for the final copy. Data from the questionnaire were divided into six sections. These were:

- Address information
- Employment

- Academic preparation
- Further education
- Course ratings
- Salary

Frequencies and percentages were computed, as needed, for the necessary questionnaire items. Where necessary, numbers were substituted for responses as needed for computation purposes. Where items were left blank, the computations were not performed.

Additional, unsolicited, comments were often received along with the returned questionnaires. These comments were only included in the study if they related to the graduates' educational experience. Comments that related to housing, financial, or personal matters were ignored if they exceeded department control.

CHAPTER IV

DATA ANALYSIS

Introduction

The purpose of this study was to conduct a follow-up study of Engineering Technology graduates at Southwestern Oklahoma State University to determine if the then current and present curriculum offerings met their career needs. Specifically, the research was designed to obtain information about employment, courses presently offered, courses that need to be offered, and post-graduate experiences in education. In addition, the graduates made suggestions on how their educational preparation could have been strengthened.

The following objectives were used to accomplish the purpose of the study.

- To determine to what extent the graduates were employed in fields related to their education.
- To determine the name and kind of industry where the graduates were employed.
- To determine the geographical location graduates were employed at.
- To determine salary levels of the Engineering Technology graduates.
- To determine if job descriptions influenced perceived course needs.
- To determine the graduates' overall attitudes toward the current curriculum in terms of courses and content.

To determine the graduates' perceived need for content changes in previously offered courses to meet job requirements.

- To determine what perceived courses should be offered that were not previously offered.
- To determine what perceived courses should be eliminated that were previously being offered.
- To solicit additional information that the graduates felt to be pertinent.

Questionnaire items were developed to accomplish the above objectives. In a few cases the courses evaluated in the survey were either no longer part of the curriculum or were not part of the curriculum at the time of the graduates' matriculation. This was deliberately done to evaluate the wisdom of eliminating or adding these courses to the curriculum. The results were discussed in the same order as they appeared in the questionnaire for ease of matching items between the questionnaire and the information presented in this chapter.

Statistically speaking, the use of the simple random sampling technique in mailed questionnaires requires the return of all the questionnaires to maintain randomness. A lack of randomness in sampling makes the data suspect in terms of bias and confidence. The sampled population of the Engineering Technology graduates numbered sixty-six out of sixty-seven total. Many attempts were made to increase the sample proportion. In general, larger population sizes need fewer responses in proportion to small population sizes (Krejcie & Morgan, 1970, p. 71). It is, however, commonly accepted, in research of this type, that high confidence levels, with low associated error rates, are rarely achieved (Key, 1995, p. 77). In point of fact, the statistical significance of mailed survey research was usually low compared to laboratory research. However, there is no method that can replace it at reasonable cost (McClave & Benson, 1994, p. 1092).

The population for the study consisted of sixty-seven graduates in total. Of these, one graduate was inadvertently not given a chance to respond due to a clerical error on the author's part. Since the address of this graduate was later found to be incorrect, it was believed, by the author, that it was unlikely that a response would have been obtained. Of the sixty-six graduates actually surveyed, twenty-four questionnaires (36%) were received, over a three-month period, that were useful to the study. The majority of nonrespondents were also those for whom no forwarding address could be obtained. The author firmly believes that the response would have significantly increased with better mailing address information. Some replies to the initial contact letter (letter1.doc, Appendix A) were received as letters or e-mail which did not answer questionnaire items. Comments from these were included in the suggested improvement section of the questionnaire only if they were phrased as suggestions. Items which personally attacked individuals by name were not included.

It was interesting to note that if the graduates did fill out the questionnaire they tended to fill it out completely, as twenty-two (92%) of them were. Two (8%) respondents left questions unanswered. Six (25%) graduates sent letters along with, or preceding, the returned questionnaires. These letters often enhanced the information in the questionnaire related to:

- Job titles and duties
- Company names and locations
- Salary information

- Suggestions for improvement

Where the letter matched the correct questionnaire item and had greater information detail (e.g. Web Quality Inspector vs. Inspector for job title) the more complete information was used. Care was taken to not use items that were unrelated, or only peripherally related, to the questionnaire.

Employment Location Data

One of the first questions asked in this study was the location of the graduates at the present time. All of the graduates live in the area where they work. Thus job locations and home addresses were within 25 miles (straight-line distance) of each other in all cases as near as could be determined. These distances were scaled from map locations as given by the graduates. Some inaccuracy can be expected due to mechanical errors in scaling distances during the process. Since further information as to exact distance from work was deemed immaterial to the purposes of the study, no further work was done in this area. Instead, it was assumed that job and work locations were sufficiently close to each other as to be considered equivalent for the purpose of determining where Southwestern Oklahoma State University Engineering Technology graduates are employed. The base point for mapping purposes was Weatherford, Oklahoma.

It was found that 28% of the graduates work within a 62 mile radius of Southwestern Oklahoma State University in Weatherford, Oklahoma. The highest percentage of the graduates, 36%, lived in a zone between 62 and 124 miles in radial distance from Weatherford, Oklahoma. Approximately 16% of the graduates lived in a zone between 124 and 350 miles from Weatherford, Oklahoma.. Approximately 20% of the graduates lived outside the 350 mile radius from Weatherford, Oklahoma. One graduate, indicated by an arrow on the map, lives in Georgia and was not shown on the map. It may be inferred that most (~62 %) of the graduates do not leave the state for employment.

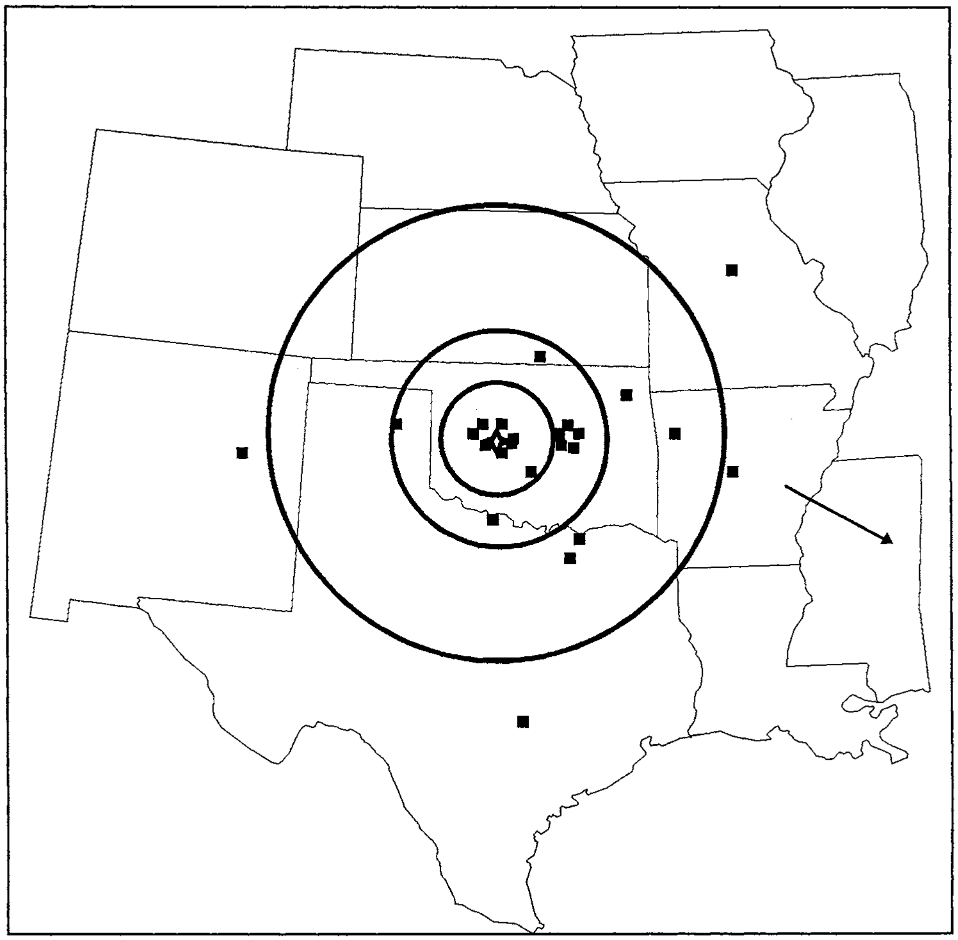

Figure 3. Geographical Location of Graduates (approximate locations)

It was suggested that this map may violate the anonymity features guaranteed in the questionnaire. It should be noted that the locations were approximations.

First Professional Job Data

The next area of interest was the first professional job obtained by the graduates upon graduation. In this area it was important to remember that Engineering Technology students were trained for eventual mid-level management positions. Thus it seemed wise to consider that technician jobs, which were usually handled by technical schools, should not be considered as appropriate placement unless management considerations were involved. The information in Table I shows the distribution of positions obtained by graduates.

The graduates should have been queried about job descriptions in addition to job titles. It was felt that some of the titles containing the word "engineer" were, in fact, technician positions with no management duties. This was inferred from some of the letters that accompanied the questionnaires. Conversely, it was possible some of the maintenance positions were, in fact, managerial in nature. However, since no determination was possible in most instances, the engineer title was assumed to have some managerial and technologist significance while the maintenance position was not. This was supported, at least somewhat, later in the study by the course evaluations and by the further educational work and desires of the graduates. Many engineering technologists indicated that management courses were high priority items while the maintenance designates indicated that electronics courses were high priority items.

TABLE I

POSITION TITLES AND JOB PLACEMENT

Number	Title	Engineering Technologist Position	Technician Position	Non-technical Position
1	Service Technician		1	
2	Maintenance Craftperson		1	
3	Customer Service		1	
4	Process Engineer	1		
5	Process Engineer	1		
6	Service Technician		1	
7	Industrial Engineer	1		
8	Instructor			1
9	Process Engineer	1		
10	Support Engineer	1		
11	Manufacturing Engineer	1		
12	Maintenance Technician		1	
13	Maintenance Craftsperson		1	
14	Service Technician		1	
15	Maintenance Engineer		1	
16	Line Engineer	1		
17	Process Engineer	1		
18	Craftperson		1	
19	Manufacturing Engineer	1		
20	Service Technician		1	
21	Customer Service		1	
22	Support Engineer	1		
23	Manufacturing Engineer	1		
24	Maintenance Technician		1	
Totals		11	12	1

The results show that eleven (46%) of the respondents obtained their first position as an engineering technologist. It was further shown that twelve (50%) obtained their first position in the related technician area. Only one person (4%), of those responding, obtained an initial position not related to either area by job title.

First and Present Job Title Comparison Data

The next area investigated was the present job held by the graduates. Table II illustrates both the previous and present job titles held by the graduates.

TABLE II

COMPARISON OF POSITION TITLES AND JOB PLACEMENT

Number	Previous Title	New Title	Engineering Technologist Position (New)	Technician Position
1	Service Technician	Production Planner	1	
2	Maintenance Craftperson	No Change		1
3	Customer Service	No Change		1
4	Process Engineer	Process Leader	1	
5	Process Engineer	No Change	1	
6	Service Technician	Manufacturing Engineer	1	
7	Industrial Engineer	Owner	1	
8	Instructor	Service Engineer	1	
9	Process Engineer	No Change	1	
10	Support Engineer	No Change	1	
11	Manufacturing Engineer	No Change	1	
12	Maintenance Technician	Engineering Supervisor	1	
13	Maintenance Craftsperson	No Change		1

TABLE II (Continued)

14	Service Technician	Service Manager	1	
15	Maintenance Engineer	Maintenance Manager	1	
16	Line Engineer	No Change	1	
17	Process Engineer	Process Engineer II	1	
18	Craftperson	No Change		1
19	Manufacturing Engineer	Manufacturing Engineer II	1	
20	Service Technician	Service Representative		1
21	Customer Service	Customer Sales		1
22	Support Engineer	No Change	1	
23	Manufacturing Engineer	No Change	1	
24	Maintenance Technician	Maintenance Foreman	1	
Totals			18	6

The reader may observe there is a shift away from the technician level and towards the technologist level position. The number of technologist positions had increased from 11 (45%) to 18 (75%) with the move to a new job title. Correspondingly, the number of technician positions had decreased by 6 (25%). One graduate had moved from a somewhat unrelated area into a technologist position. The area involved in this case was teaching at a Vo-Tech. While technically oriented, this was not the programs' focus for its' graduates. These changes are shown graphically in Figure 4.

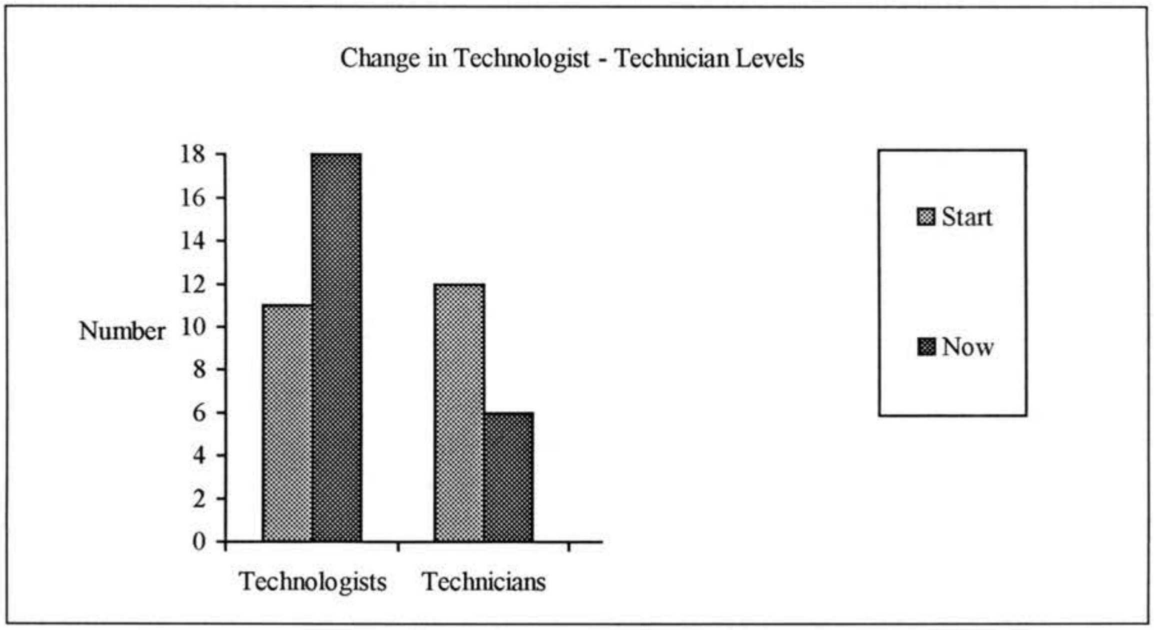

Figure 4. Change in Technologist - Technician Levels with Position Change

The relative length of time spent in each position is shown in Figure 5. It appears that if a job change was sought, it was sought early. Of the 13 people who changed jobs, 8 did so in the first year. It appears that 11 graduates were content with their present job, but three of the 11 were still in the first year of their position. If the previous trend noted continued, 62% of the three would change jobs at the end of this year (1 to 2 positions). Three graduates expressed interest in changing jobs.

A statistical analysis of the time on the first and present job for the respondents revealed, as was shown in Table III, that graduates tended to leave their first position rather quickly (1.6 years) on the average. The present position obtained was evidently more satisfactory as the graduates spent an average of 2.7 years in it.

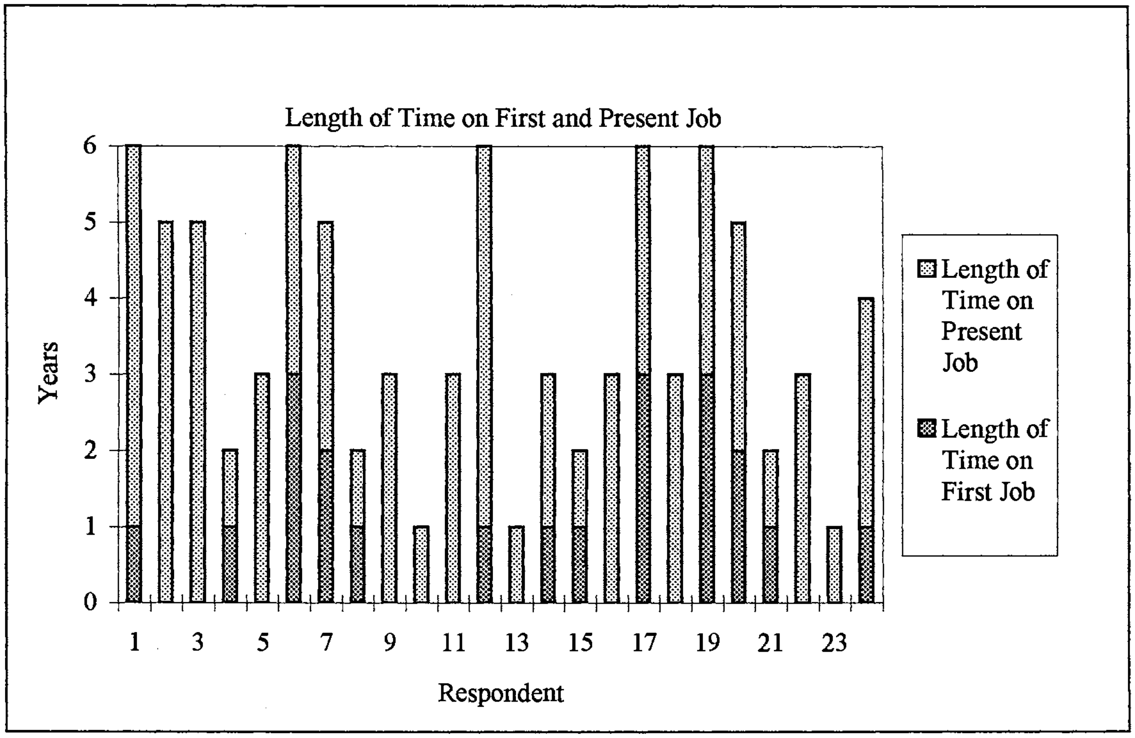

Figure 5. Length of Time on First and Present Job

TABLE III

TIME ON FIRST AND PRESENT JOB

Length of Time on First Job (years)		Length of Time on Present Job (years)	
Mean	1.615	Mean	2.708
Standard Error	0.241	Standard Error	0.279
Median	1.000	Median	3.000
Mode	1.000	Mode	3.000
Standard Deviation	0.870	Standard Deviation	1.367
Range	2.000	Range	4.000
Minimum	1.000	Minimum	1.000
Maximum	3.000	Maximum	5.000
Count	13.000	Count	24.000
95% Confidence Level for μ	± 0.473	95% Confidence Level for μ	± 0.547

One weakness of the study was that it did not obtain the total number of job positions held, just the first and present position. Because of a stratified answering system (i.e. 0-1 years, etc.) it was possible that short-term jobs could have been missed. Some respondents indicated more precise time periods, and these were used when given. Another weakness in the questionnaire occurred when the graduates were asked to describe their first "professional" job after leaving school. It was possible that some other non-professional positions were held for short periods of time before obtaining a professional position. An analysis of the times in Figure 5 makes this unlikely but not impossible.

Employment Salary Data

The salary data indicated growth with time in almost all cases. Respondents' three and four, as shown in Figure 6, indicate a lower salary in their present position. The highest salary reported was $47,000 and the lowest was $15,000. The average increase in salary between the beginning and present position was $8,935. The $47,000 salary is markedly different from the other values reported. This turned out to correspond to a fairly high managerial position. The lowest value reported corresponded to a trainee level technician's position. No further detail can be given due to the anonymity features of the study.

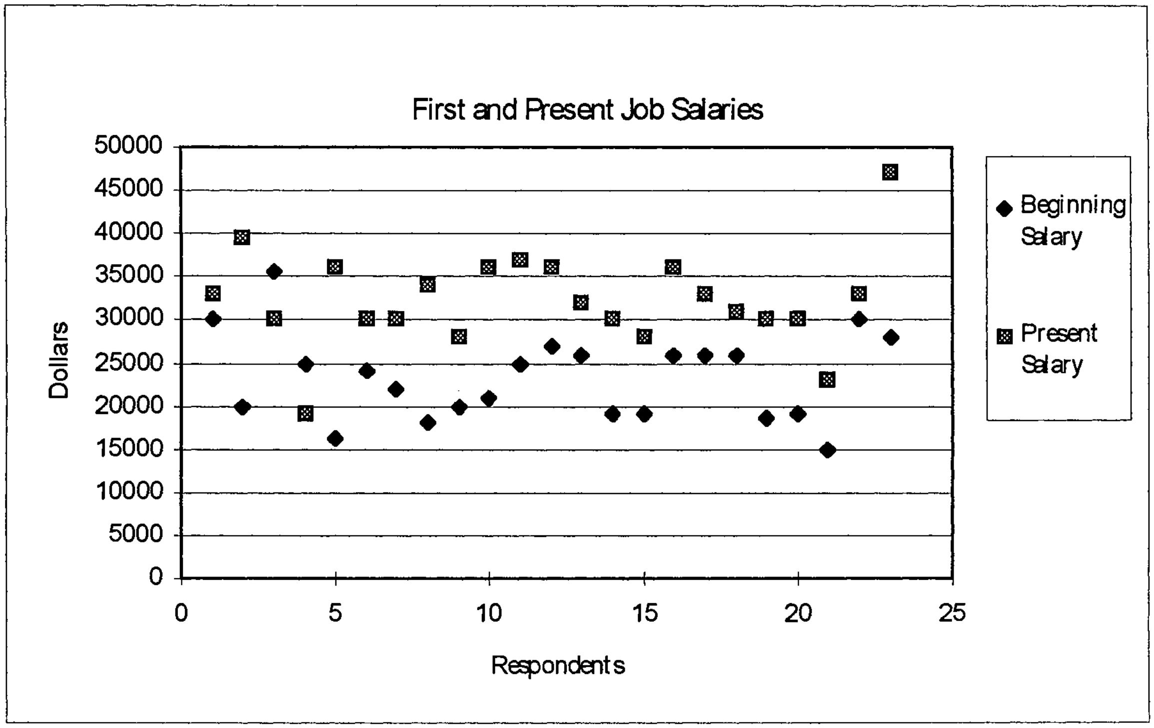

Figure 6 - First and Present Salary

Table IV presents the statistical differences between the beginning and present salary of the respondents. The beginning mean may have been influenced by several factors. One factor was the desire by some of the graduates to work near their home. This led to some of the students being "underemployed" based on their scholastic record in the author's opinion. Another factor was the immediate need for a job expressed by one graduate. This led to his taking the first one available.

The present salary reported mean was considered to be quite good considering that the students have been employed for six years maximum. Since the confidence level was high we can be 95% confident that the means were within \$2,075 and \$2,271, respectively, of the actual means of those responding. The difference in median values of \$8,000 and the difference in modes of \$4,000 also indicated increasing salary levels as length of employment, whether in first or newer positions, continued. Range values of $20,500 in the first position and $27,800 in the present position indicate increasing salary gaps between graduates as time goes by. The reason for only twenty-three responses being used was that one response included all associated benefits in his salary value and was, therefore, not used.

TABLE IV

BEGINNING AND PRESENT SALARY

Beginning Salary		Present Salary	
Mean	$23,317	Mean	$32,252
Standard Error	$1,058	Standard Error	$1,159
Median	$24,000	Median	$32,000
Mode	$26,000	Mode	$30,000
Standard Deviation	$5,076	Standard Deviation	$5,556
Range	$20,600	Range	$27,800
Minimum	$15,000	Minimum	$19,200
Maximum	$35,600	Maximum	$47,000
Count	23	Count	23
95% Confidence Level for μ	±$2,075	95% Confidence Level for μ	±$2,271

Perceived Adequacy of Preparation for Employment

Question eight of the questionnaire dealt with whether the graduates felt that they were adequately prepared for their employment. Eighteen of the twenty-four respondents (75%) indicated that they had received adequate preparation. Six respondents (25%) felt that they had not received adequate preparation. Most of these respondents felt that both computer and analytical instruction could have been improved, but these perceptions were shared by others outside this group. Nearly all the respondents indicated in a later section of the questionnaire several suggestions for improvement. Figure 7 shows the two responses of the graduates.

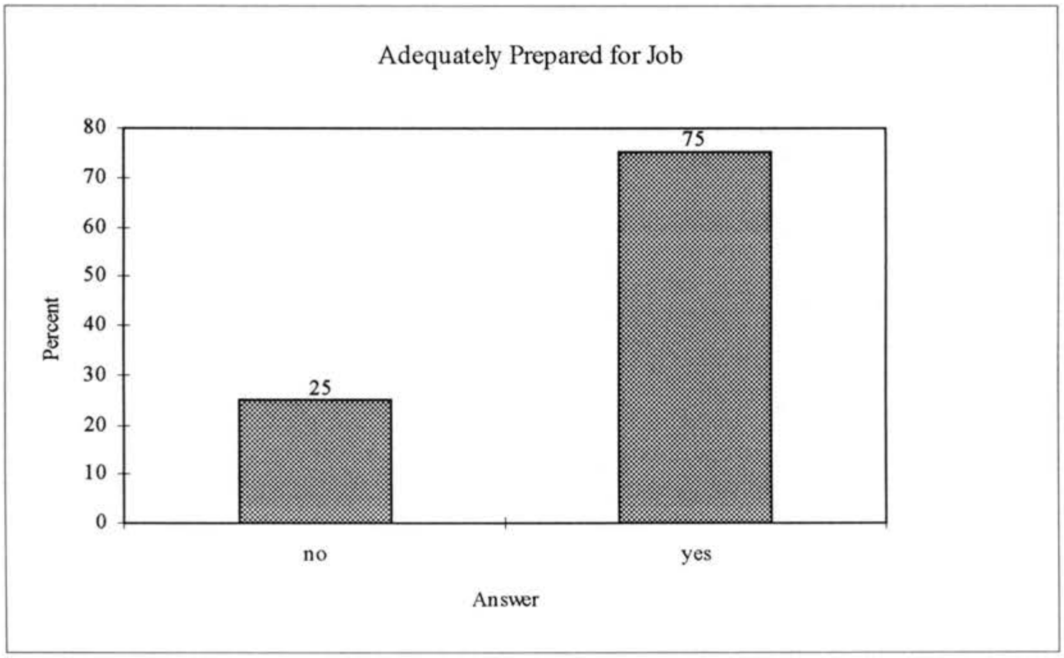

Figure 7. Adequately Prepared for Job

It was interesting to note that all of the graduates who made a "no" response (six), later mentioned lack of one or more computer skills as a suggestion for improvement. As little as six years ago the departments' students used computers only in one CAD class. The computers in that class were turned both on and off by the instructor. Any other use of computers was on a very limited basis, if any. Now at least one teacher both instructs in and requires student use of computers in every class. The author had noticed a gradual increase in student knowledge in this area during the last three years of the study period while teaching in the department. Indeed, some students are now more computer literate than the department faculty average in the author's opinion.

The computer literacy issue led the author to consider whether a time and "no" response correlation might exist. A statistical analysis of the data led to an "r" value of -0.94. This seems to indicate that computer literacy was declining as an issue as time went by. The small sample size (six) makes this, at best, an indicator of a possible trend. The trend is shown in Figure 8. Further data is needed in this area, however it was apparent to the author that significant improvement had occurred. The department's need for more powerful computers each year was an indication of increasing use of sophisticated software.

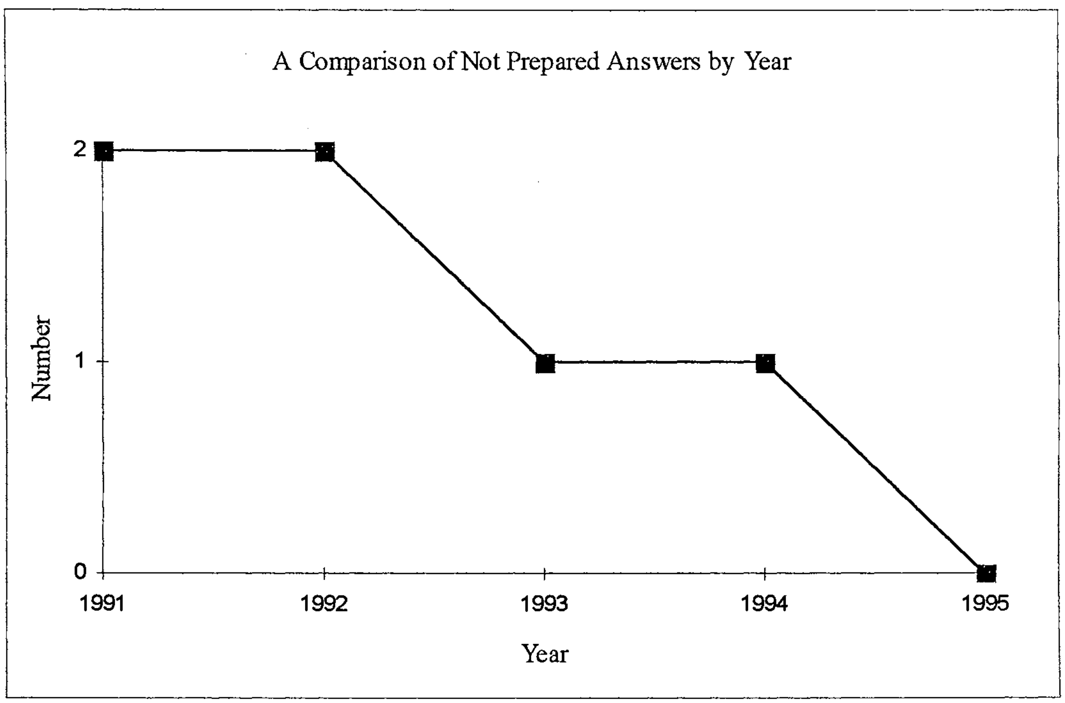

Figure 8. A Comparison of "Not Prepared" Answers by Year

Most Useful Courses or Programs

Questionnaire item numbers nine, ten, and eleven dealt with how useful the courses or programs within the department were perceived by the respondents. It was felt that the best way to handle these questions was to group the data and use a database program (Excel®, version five) to sort the resulting data based on percentages answering in each of the categories; most, average, or least useful. The database program was used to sort based on the following criteria:

1. Eight per-cent or more answered "most useful" for this course with some dissent.
2. Eight per-cent or more answered "most useful" for this course with no dissent.
3. Eight per-cent or more answered "least useful" for this course with some dissent.
4. Eight per-cent or more answered "least useful" for this course with no dissent.

Using these criteria Tables V through VIII, respectively, were generated showing all responses in these four categories. The eight per-cent figure was pre-selected to assure that at least some differentiation would take place among courses.

After examining the information in these tables and comparing it with the "suggested improvements" section of the questionnaire there appeared to be some conflict. As was previously mentioned graduates holding maintenance related positions tended to request more electronics courses as high priority items; yet the tables seem to indicate otherwise. Possible reasons for this include, but were not limited to the following:

- Graduates in managerial positions outnumbering the maintenance graduates.

- No strong feeling by the maintenance graduates as to rating these courses higher and thus giving them an average rating.

- Errors in completing the questionnaire. Some graduates tended to fill out items in "blocks" rather than individually. Lack of detail due the length of the questionnaire was evident in several responses.

- The electronics courses indicated were all exactly at the low 8% response criteria level. This response rate was arbitrarily picked before the data were sorted.

The unexpected inclusion in the "least useful" category was the Society of Manufacturing Engineers (SME) course results. Fully 17% found it not useful to their present position with no dissenters. The department had considered this course essential to the students' success. This area needs further study to differentiate between courses related to SME and certification by SME. This is because the department uses the SME Manufacturing Engineering Technologist Certification test as an exit exam to satisfy administrative requirements of Southwestern Oklahoma State University.

TABLE V

COURSES WITH 8% OR MORE "MOST USEFUL" RESPONSES WITH DISSENT

Courses	Most Useful #	Most Useful %	Average Usefulness #	Average Usefulness %	Not Useful #	Not Useful %
1203 ENGINEERING DRAFTING	2	8%	22	92%	0	0%
1813 BASIC ELECTRONICS I	4	17%	19	79%	1	4%
2813 BASIC ELECTRONICS II	3	13%	20	83%	1	4%
3113 INDUSTRIAL SAFETY	3	13%	21	88%	0	0%
3143 TECHNICAL PRESENTATIONS	3	13%	21	88%	0	0%
3183 STATICS AND STRENGTHS	2	8%	22	92%	0	0%
3203 COMPUTER AIDED DRAFTING I	9	38%	15	63%	0	0%
3263 MACHINE DRAFTING I	2	8%	22	92%	0	0%
3413 MANUFACTURING PROCESSES	5	21%	19	79%	0	0%
3463 MANUFACTURING OPERATIONS I	4	17%	20	83%	0	0%
3813 ELECTRO/MECHANICAL CONTROLS	2	8%	22	92%	0	0%
3863 ELECTRONIC TROUBLE SHOOTING	4	17%	20	83%	0	0%
4243 COMPUTER AIDED DRAFTING II (CAD)	4	17%	20	83%	0	0%
4253 MACHINE DRAFTING II	2	8%	22	92%	0	0%
4433 QUALITY CONTROL	9	38%	15	63%	0	0%
4453 COMPUTER AIDED MANUFACTURING	3	13%	20	83%	1	4%
4493 MANUFACTURING OPERATIONS II	5	21%	19	79%	0	0%
4514 MACHINE TOOL PROCESSES	2	8%	22	92%	0	0%
4823 DIGITAL ELECTRONICS	2	8%	20	83%	2	8%
4833 MICROCOMPUTER ELECTRONICS	2	8%	18	75%	4	17%
4843 PROGRAMMABLE CONTROLLERS	6	25%	18	75%	0	0%

TABLE VI

COURSES DEEMED "MOST USEFUL" BY 8% OR MORE WITHOUT DISSENT

Courses	Most Useful #	Most Useful %	Average Usefulness #	Average Usefulness %	Not Useful #	Not Useful %
1203 ENGINEERING DRAFTING	2	8%	22	92%	0	0%
3113 INDUSTRIAL SAFETY	3	13%	21	88%	0	0%
3143 TECHNICAL PRESENTATIONS	3	13%	21	88%	0	0%
3183 STATICS AND STRENGTHS	2	8%	22	92%	0	0%
3203 COMPUTER AIDED DRAFTING I	9	38%	15	63%	0	0%
3263 MACHINE DRAFTING I	2	8%	22	92%	0	0%
3413 MANUFACTURING PROCESSES	5	21%	19	79%	0	0%
3463 MANUFACTURING OPERATIONS I	4	17%	20	83%	0	0%
3813 ELECTRO/MECHANICAL CONTROLS	2	8%	22	92%	0	0%
3863 ELECTRONIC TROUBLE SHOOTING	4	17%	20	83%	0	0%
4243 COMPUTER AIDED DRAFTING II (CAD)	4	17%	20	83%	0	0%
4253 MACHINE DRAFTING II	2	8%	22	92%	0	0%
4433 QUALITY CONTROL	9	38%	15	63%	0	0%
4493 MANUFACTURING OPERATIONS II	5	21%	19	79%	0	0%
4514 MACHINE TOOL PROCESSES	2	8%	22	92%	0	0%
4843 PROGRAMMABLE CONTROLLERS	6	25%	18	75%	0	0%

TABLE VII

COURSES WITH 8% OR MORE "LEAST USEFUL" RESPONSES WITH DISSENT

Courses	Most Useful #	Most Useful %	Average Usefulness #	Average Usefulness %	Not Useful #	Not Useful %
1101 INTRODUCTION TO TECHNOLOGY	0	0%	11	46%	13	54%
1313 WOOD MATERIALS AND PROCESSES	0	0%	14	58%	10	42%
2543 WELDING PROCESSES AND METALLURGY	1	4%	11	46%	12	50%
3163 CALCULUS FOR TECHNOLOGY	0	0%	22	92%	2	8%
3323 MACHINE WOODWORK	0	0%	17	71%	7	29%
3433 AUTOMATION/ROBOTICS	1	4%	17	71%	6	25%
3453 INDUSTRIAL PLASTICS	0	0%	18	75%	6	25%
3843 ELECTRONICS AMPLIFIERS	0	0%	22	92%	2	8%
3853 ELECTRONIC INSTRUMENTATION	0	0%	22	92%	2	8%
3873 ELECTRONIC DEVICES	0	0%	22	92%	2	8%
4161 SOCIETY OF MANUFACTURING ENGINEERS (SME)	0	0%	20	83%	4	17%
4194 INDUSTRIAL INTERNSHIP	1	4%	20	83%	3	13%
4823 DIGITAL ELECTRONICS	2	8%	20	83%	2	8%
4833 MICROCOMPUTER ELECTRONICS	2	8%	18	75%	4	17%

TABLE VIII

COURSES CONSIDERED "LEAST USEFUL" BY 8% OR MORE WITHOUT DISSENT

Courses	Most Useful #	Most Useful %	Average Usefulness #	Average Usefulness %	Not Useful #	Not Useful %
1101 INTRODUCTION TO TECHNOLOGY	0	0%	11	46%	13	54%
1313 WOOD MATERIALS AND PROCESSES	0	0%	14	58%	10	42%
3163 CALCULUS FOR TECHNOLOGY	0	0%	22	92%	2	8%
3323 MACHINE WOODWORK	0	0%	17	71%	7	29%
3453 INDUSTRIAL PLASTICS	0	0%	18	75%	6	25%
3843 ELECTRONICS AMPLIFIERS	0	0%	22	92%	2	8%
3853 ELECTRONIC INSTRUMENTATION	0	0%	22	92%	2	8%
3873 ELECTRONIC DEVICES	0	0%	22	92%	2	8%
4161 SOCIETY OF MANUFACTURING ENGINEERS (SME)	0	0%	20	83%	4	17%

Questions 11 and 12 both dealt with continuing education in both the past and present states while "on the job". It was noted that 37.5% (9) of the respondents had not taken any further courses or participated in any continuing educational programs at the time of the survey as shown by the information in Figure 9.

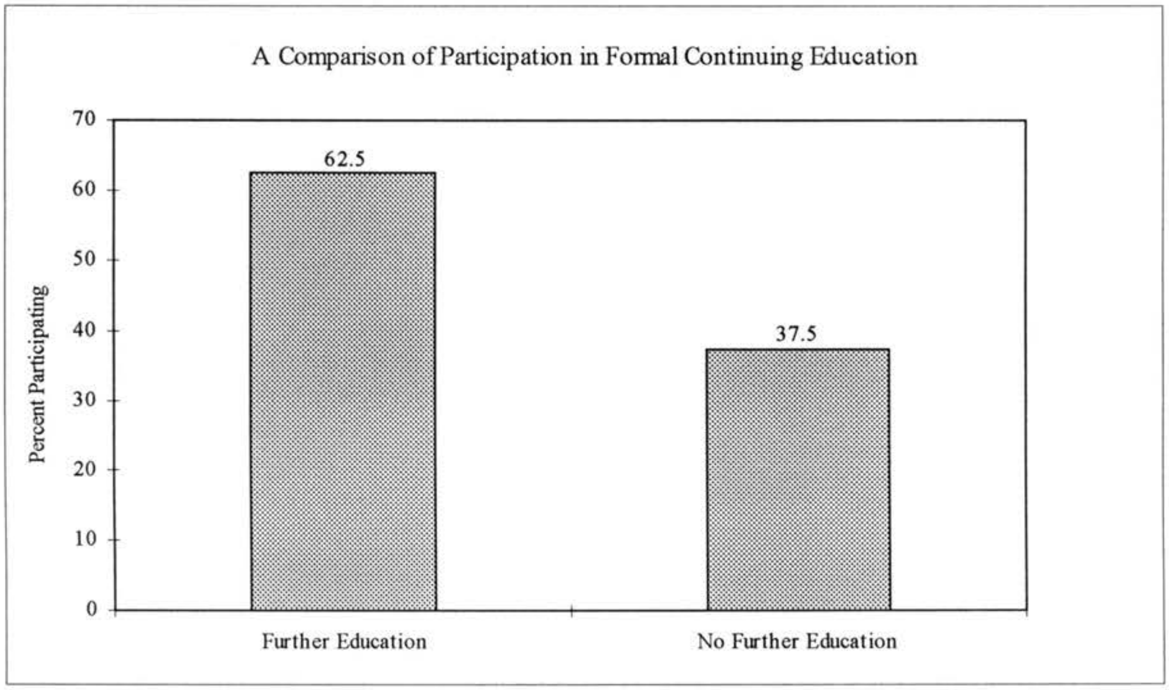

Figure 9. Participation in Formal Continuing Education

Of the remaining 62.5% (15) of the respondents, the programs and courses they took varied. Three respondents took management classes since graduating, three more took quality control classes, another three took CAD classes after graduation, and two took Calculus classes The following six classes were each attended by one graduate: Unix (computer operating system) , logistics, environment, computers, copier repair, and MOST (time and motion study technique). These results are shown in Figure 10.

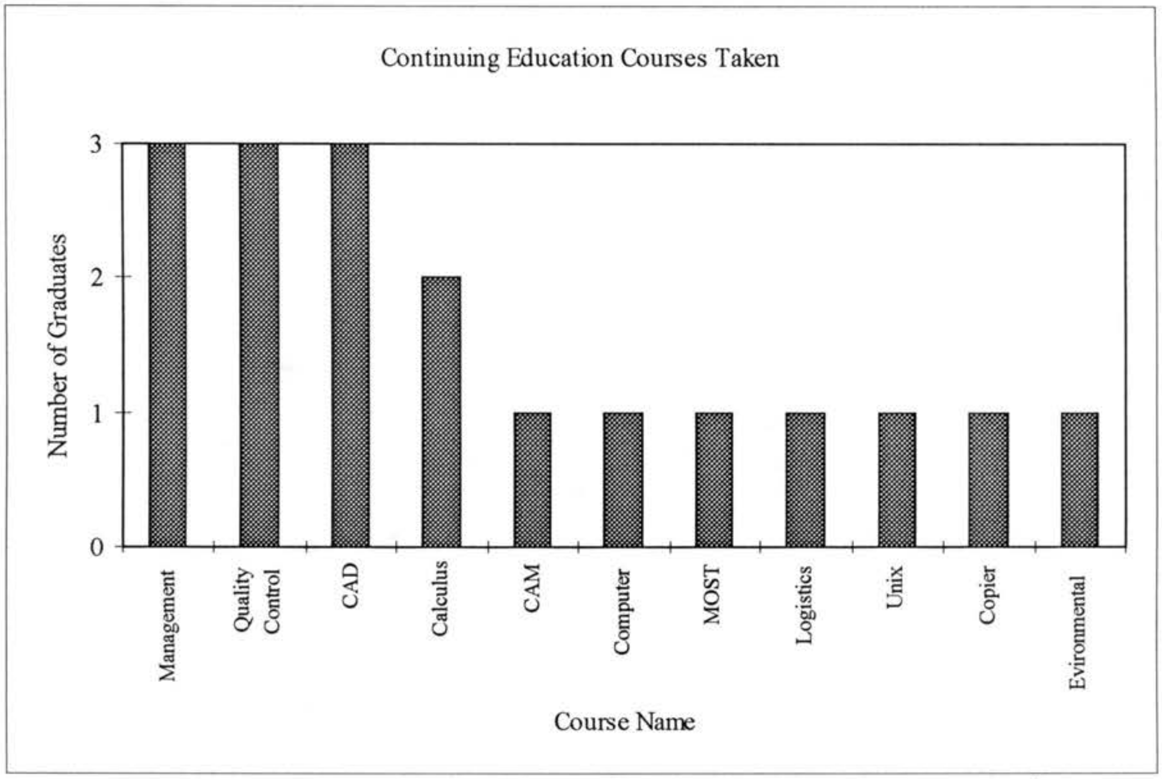

Figure 10. Continuing Education Courses Taken

Despite the fact that one-third had not formally continued their education, all of the respondents stated they plan to do so in the future. Question 12 attempted to address this issue with limited success. Respondents ranked some, all, or just one of the possibilities given. In some cases, the respondents specified courses in the space provided without ranking. Consequently, this section did not generate as much data as was anticipated. It is recommended that this question should be handled differently in future questionnaires so that more useful data can be generated. A longer list of choices with ranking required may work better. For the purpose of the present study, Table IX was generated listing course names and ranking by first through fifth choice.

TABLE IX

A RANKING OF FUTURE EDUCATION DESIRED

Ranked	First	Second	Third	Fourth	Fifth
Course Name					
Operation Management	11	3	2	0	0
Computer	4	3	1	0	0
Communication	3	3	1	1	1
Math & Science	1	3	1	0	0
MBA	2	0	0	0	0
Technical Specialty Course	1	6	3	1	0
Quality Control	1	7	1	1	0

To generate some relative ranking of the courses all first-ranked course responses were multiplied by five, second-ranked by four, third-ranked by three, fourth-ranked by two, and fifth-ranked by one to provide a single list. Table X shows the relative importance, as perceived by the graduates, of the future training they desire. Further work should be done to determine where the graduates are likely to obtain this training (college, vo-tech, industry, etc.).

TABLE X

RELATIVE SCORE OF DESIRED FUTURE AREAS OF STUDY

Course Area	Score
Operations / Management	73
TSC (Technical Specialty Course)	40
Quality Control	38
Computer	35
Communication	33
Math & Science	20
MBA (Master of Business Administration)	10

The management course area had a large degree of interest. The pay scale was evidently a major incentive to move into this area. It was shown previously that the job title tended to change with time to a more management oriented position. This evidently generated a perceived need for management training. The rapid pace of technical development in industry may also tend to accelerate this trend.

The technical specialty course (TSC) area also had a large degree of interest. The extremely rapid pace of technical development may have fueled this interest. It was recommended that further work be done to obtain data in this area.

Question 13 dealt with the reasons behind the graduates choosing the educational areas listed above. Significantly, 15 of the 24 (62.5%) respondents wished to advance themselves in their present position. The second greatest group of six respondents (25%) wished to improve their general knowledge or education. Only four (17%) of the respondents wished to train for a different position. Figure 11 shows the relative frequency and reasons for the respondents continuing their education. Only two of the respondents (8%) indicated that they were pursuing degree programs.

Question 14 asked for suggestions for improving the Engineering Technology program at Southwestern Oklahoma State University. This section generated varying degrees of interest. Some graduates had many ideas and some only a few. The suggestions were divided into individual statements even if they were grouped together by the graduate. An exception to this is the general studies area responses. These comments are listed below in frequency order. Comments that attacked individuals without an associated suggestion for improvement were not included.

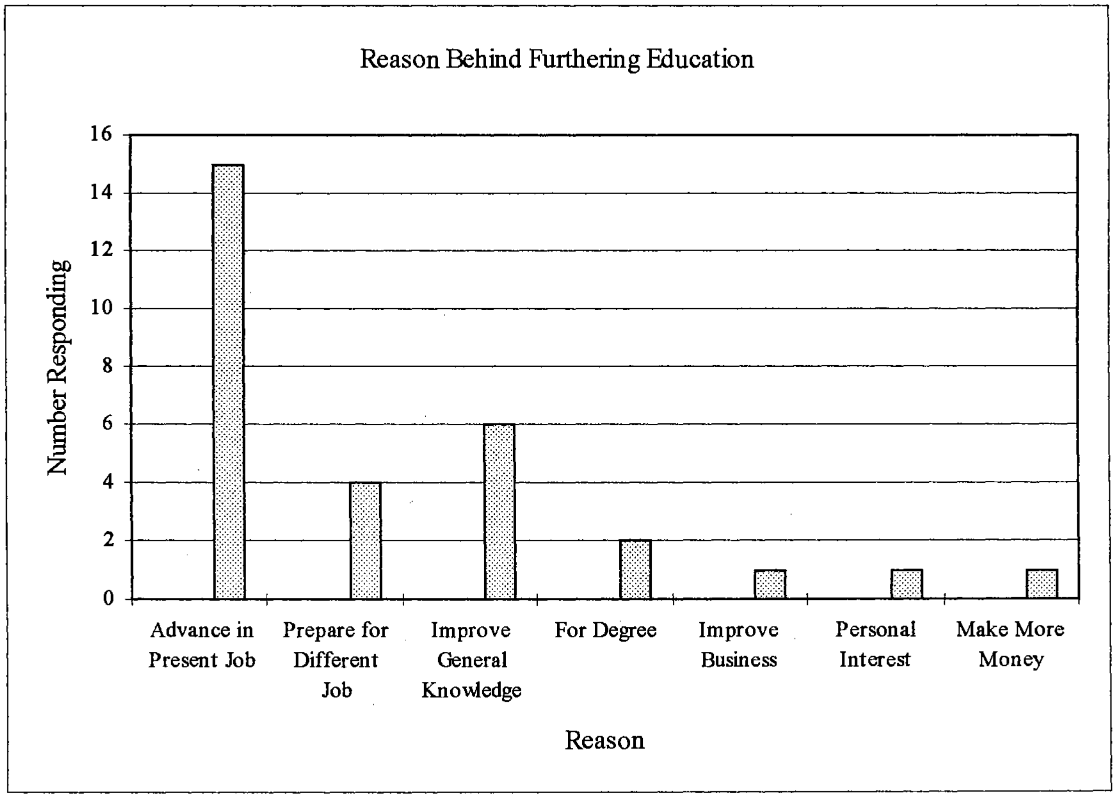

Figure 11. Reasons for Furthering Education

Some of the suggestions came from letters included with the questionnaire. Comments that only implied a needed improvement without actually stating the needed action were also included for completeness. A weakness of the study in this section was that no comments were solicited about what the graduates' perceptions were about what the program was doing well. This should be rectified in further surveys. The comments were:

- The general education classes are too much and many of them are so poor that they are a waste anyway. My employer didn't care or even check if I had social science classes. They looked for technical classes. (Five unsolicited responses in this area of which this response is a composite)

- More math and physics needs to be taught in the classes as practical subjects. Computer spreadsheet and database use could be done in many of the classes but is not. We use these programs every day and all day.

- I would like to see more practical CAD use. You need more architectural work for facility planning. We do not use drawing boards where I work and haven't for a long time. Why not use CAD to teach drafting?

- The school really needs computer spreadsheet, simulation, MRP, communication, and CAD use. My buddies from other schools are much better at using computers than I am. Plus they have been exposed to many industry packages that SWOSU doesn't use (have).

- When I graduated I knew very little about computers. After a few months on the job my boss told me to get training or I wouldn't be there long. I bought a computer and trained myself at home. I feel that SWOSU should have done this.

- The projects in some of the classes are old. In one class we were doing the exact same projects that my uncle did years ago. Why can't we use creativity to substitute our own project for the required ones? We are not stupid, you know. It seems to me that this is just a way to make teaching the class easier.

- Some of the teachers in the department don't really care. They are just putting in their time. You can tell they have not kept up.

- Only you () and Mr. () seem to really care about the students.

- Many of the classes there (SWOSU) are taught at a lower level than here (college attending now). When I moved, my grades dropped way down. I think the level of teaching needs to be raised.

- Some classes were taught at the moron level and others were too hard. In general I thought yours were too hard at the time.

- I found that the rosy job picture I was given was not true. You need to give out the right information better.

- My advisor told me that I could make $70,000 a year and have a choice of jobs. This wasn't true. Not even close.

- The labs were locked up too much, individual student projects (Capstone?) should be done with open labs.

- I am in maintenance and I found that the Vo Tech guys were much better trained at fixing problems than I was. The courses need to be more practical.

- I got a job at a much higher pay scale than I expected. I did not like the class

(Technical Presentation) at the time, but now I think you should do more in this area.

- The metals' lab was too old, overcrowded, and dangerous. Why have a class on safety since the school doesn't practice it? There was a big empty room in the brick building for two years. Why couldn't it be used?

- I liked the safety class a lot. I am now in a Master's program in safety. SWOSU needs more safety classes.

- I complained about the way one class was taught and got my grades trashed. When I talked to the department chair nothing was done. This wasn't just me in this situation. I don't recommend the department to anyone now. That is why this form is not completed. Nothing against you, Mr. ().

- Can't someone else sign forms when he is gone? There is always someone in charge where I work.

- Some of the classes were taught with a great deal of unnecessary sarcasm and a know-it-all attitude.

- I didn't like it that some teachers seem spend a lot of time in the Union or talking and then act like it is a big deal if you bother them..

- ABET certification is needed. The guys from OU and OSU are getting the jobs.

The suggestions covered such a wide area that they were presented without further development or analysis in this chapter. For reasons of tact, several suggestions were not included in the above list. The results may be biased due to this action on the author's part. It was felt that the libelous character of some of the statements would not add anything constructive to the survey and so they were excluded.

Section three of the questionnaire dealt with rating specific courses in the curriculum based on perceived usefulness. The graduates were asked to read the course list and descriptions and cross out the courses that they believed were not useful to an engineering technologist. They were then asked to circle the courses they believed useful.

The graduates were instructed to not mark courses of average usefulness. A simple count was made of each response to each course and the results tabulated in Table 11 as both count and percentage data. It must be remembered that the graduates were rating the courses based on their present experience. Thus the position they hold will influence the ratings given the course. Ideally the ratings were a measure of course usefulness.

TABLE XI

COURSE RATING LIST

Courses	Most Useful #	Most Useful %	Average Usefulness #	Average Usefulness %	Not Useful #	Not Useful %
1101 INTRODUCTION TO TECHNOLOGY	0	0%	11	46%	13	54%
1203 ENGINEERING DRAFTING	2	8%	22	92%	0	0%
1313 WOOD MAT AND PROCESSES	0	0%	14	58%	10	42%
1813 BASIC ELECTRONICS I	4	17%	19	79%	1	4%
2513 FABRICATION PROCESSES I	1	4%	23	96%	0	0%
2543 WELDING PROCESSES AND METALLURGY	1	4%	11	46%	12	50%
2813 BASIC ELECTRONICS II	3	13%	20	83%	1	4%
3113 INDUSTRIAL SAFETY	3	13%	21	88%	0	0%
3143 TECHNICAL PRESENTATIONS	3	13%	21	88%	0	0%
3163 CALCULUS FOR TECHNOLOGY	0	0%	22	92%	2	8%
3183 STATICS AND STRENGTHS	2	8%	22	92%	0	0%
3203 COMPUTER AIDED DRAFTING I	9	38%	15	63%	0	0%

TABLE XI (Continued)

3263 MACHINE DRAFTING I	2	8%	22	92%	0	0%
3323 MACHINE WOODWORK	0	0%	17	71%	7	29%
3413 MANUFACTURING PROCESSES	5	21%	19	79%	0	0%
3433 AUTOMATION /ROBOTICS	1	4%	17	71%	6	25%
3453 INDUSTRIAL PLASTICS	0	0%	18	75%	6	25%
3463 MANUFACTURING OPERATIONS I	4	17%	20	83%	0	0%
3513 MATERIALS TESTING	0	0%	23	96%	1	4%
3523 FABRICATION PROCESSES II	0	0%	24	100%	0	0%
3623 FLUID POWER	1	4%	23	96%	0	0%
3813 ELECTRO/MECH CONTROLS	2	8%	22	92%	0	0%
3823 INDUSTRIAL ELECTRONICS	0	0%	24	100%	0	0%
3843 ELECTRONICS AMPLIFIERS	0	0%	22	92%	2	8%
3853 ELECTRONIC INSTRUMENTATION	0	0%	22	92%	2	8%
3863 ELECTRONIC TROUBLE SHOOTING	4	17%	20	83%	0	0%
3873 ELECTRONIC DEVICES	0	0%	22	92%	2	8%
4010 ORIENT TO INDUST INTERNSHIP	0	0%	23	96%	1	4%
4161 SOC. OF MFT. ENGINEERS (SME)	0	0%	20	83%	4	17%
4194 INDUSTRIAL INTERNSHIP	1	4%	20	83%	3	13%
4223 ELECTRICAL CIRCUIT DESIGN	0	0%	24	100%	0	0%
4243 COMPUTER AIDED DRAFTING II (CAD)	4	17%	20	83%	0	0%
4253 MACHINE DRAFTING II	2	8%	22	92%	0	0%

TABLE XI (Continued)

4293 MACHINE DESIGN	1	4%	23	96%	0	0%
4433 QUALITY CONTROL	9	38%	15	63%	0	0%
4443 MAT. HANDLING AND FAC. PLANNING	1	4%	23	96%	0	0%
4453 COMPUTER AIDED MANF. (CAM)	3	13%	20	83%	1	4%
4493 MANUFACTURING OPERATIONS II	5	21%	19	79%	0	0%
4514 MACHINE TOOL PROCESSES	2	8%	22	92%	0	0%
4583 METROLOGY AND METALLURGY	0	0%	24	100%	0	0%
4823 DIGITAL ELECTRONICS	2	8%	20	83%	2	8%
4833 MICROCOMPUTER ELECTRONICS	2	8%	18	75%	4	17%
4843 PROGRAMMABLE CONTROLLERS	6	25%	18	75%	0	0%

Due to questionnaire length limitations, some minor courses were omitted from the course description list in the questionnaire. Obviously these courses do not appear in the rankings. A few courses were included in the list that were not part of the required curriculum to see if they should have been included.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Purpose

The purpose of this study was to conduct a follow-up study of Engineering Technology graduates at Southwestern Oklahoma State University to determine if the then current curriculum offerings met their career needs. This helped to determine needed curriculum improvements to match those needs.

Specifically, the research was designed to obtain information about:

- Geographical location of graduates
- General employment data about the graduates
- Graduate satisfaction with the program
- Individual perceptions and experiences with courses
- Perceived need for educational experiences during school
- Post-graduate educational experiences
- Perceived needs for post-graduation education
- Suggestions for improvement

The researcher identified, through analysis of the collated data, items that when studied as group data, could lead to meaningful curriculum changes.

Limitations

The study's limitations consisted of the usual limitations associated with survey research plus a few associated with specific problems of the study. The following limitations were identified either before or during the study period:

- The study was limited to graduates of the Engineering Technology program at Southwestern Oklahoma State University over a limited time span and should not be generalized beyond that population and span.
- There was an unknown opportunity for all population members to be included in the study due to the lack of addresses of some of the members.
- There was an unknown bias introduced from the exclusion of population members who did not respond.
- The instruments used may not have been adequate to have obtained the best response rate and accomplish the objectives of the study.
- The respondents may not have answered honestly.
- The study was generalizable only to the Engineering Technology program at Southwestern Oklahoma State University and had no earlier follow-up data for comparison purposes. Furthermore, the limited response rate lowered the statistical significance of the study.

Data Collection

The method of data collection used in this study was the mailed questionnaire. This questionnaire was developed with the help of the author's graduate committee, an in-depth literature search, and a pilot-study using a research design group. After development, both an initial contact letter and a questionnaire were sent to all identified population members. A follow-up letter was used for non-respondents. Additional efforts to locate population members were made by phone. The six page questionnaire was sent to 66 of the graduates' last known mailing addresses. Eventually 26 were returned with 2 of the 26 being unusable for various reasons. This resulted in a response rate of 36%.

Due to the type of study results obtained, descriptive statistical measures were used to quantify the data.

Recommendation Overview

Due to the curriculum changes taking place both before and during the study, several obvious change recommendations were made redundant in actual practice, but will still be reported. Some courses covered by the study were eliminated from the curriculum or changed before the study took place. In these cases, the study acted as check on the validity of the actions that caused these changes. In other instances, course content and requirements had changed since the respondents took the course. These changes will lessen the validity of some of the recommendations. A visit by an ABET accreditation team near the end of the study brought forth several recommendations by that group that reinforce the studies' findings in many instances. In some cases, however, the ABET recommendations will supersede the studies' recommendations as a means of curriculum change. This means that changes were taking place that will require further evaluation almost immediately.

The list of recommendations concentrates on items of special concern as indicated by the responses given by the graduates. These recommendations were divided by areas as follows:

- Customer (student) relations

- Advisement
- Courses considered least useful without dissent
- Computer related concerns
- Equipment and facilities
- Courses considered most useful without dissent
- Suggested articulation, content, prerequisites, and sequences for courses

The Pareto phenomenon suggests that the most prevalent concerns be addressed first. Because this research was devoted to determining needs, courses rated as of average usefulness will not be discussed as thoroughly as those rated either “most useful” or “least useful”. Average courses were of less interest because they had generated little interest either way with the graduates. They were thus less likely to need to be expanded, reduced, or changed. Because of the nature of the courses and divisions in workload, it will ultimately have to be the responsibility of the Southwestern Oklahoma State University Engineering Technology Department as individuals and as a group to effectively determine and implement the changes needed to meet the perceived needs of the graduates. In some cases administration, faculty, industry, or budget considerations will supersede the perceived needs of the respondents. This should be done very carefully for the reason that educational decisions have often been shown to be short sighted (Hanushek, 1994). Customer requirements have been shown to be important in industry and this should hold true for education as well. The many customers education serves confuses the issue.

Customer Relations

The ability of an organization to satisfy its customers may be crucial to the success of the organization. Customer dissatisfaction expresses itself in various ways. Probably the most noticeable way was the lack of customers as they leave to go elsewhere. In education there was much discussion about the multiple customers that need to satisfied. These customers include, but were not limited to:

- Employers
- Society
- Regents
- Administration
- Various government organizations
- Parents
- Students

Of these, the primary customer should be, in the author's opinion, the student. For this reason, student needs were critical indicators of organizational success in this study.

Several items were mentioned as areas of concern as far as customer relations with the student. One area delineated as an area of concern was the lack of availability of the department personnel at various times. It had been repeatedly brought to the author's attention that this department was better than others on campus at meeting this particular need. This reasoning was circular and unproductive as far as the students were concerned. The fact that some departments may be worse had little bearing on students' expectations for that department or for the Technology Department. This was particularly crucial for a commuter campus such as Southwestern Oklahoma State University. Often the students drove long distances with little free time on campus.

It is recommended that all personnel post their destination when leaving their office for a period of time and give an expected time of return, especially during their posted office hours. Essential tasks should be delegated by absent personnel to others until their return. This is particularly true for phone calls and required signatures near deadlines. It is further recommended that any informal meeting be interrupted as soon as convenient when a student indicates a need to communicate with one of the members of that meeting. In addition, formal meeting times need to be prominently posted ahead of time for student information. Nonproductive time should be kept to a minimum, especially when students are needing advisement, as a public relations measure.

Advisement

Two suggestions by students fell into the advisement field and related to the lack of factual or correct information. Particularly noted were errors in salary and employment expectations. Accordingly, it was recommended that the data from this document be the sole source of employment and salary information given to students until further data is gathered. It was also recommended that advisement be directed towards student career needs rather than perceived university, department, or faculty needs. It seemed reasonable to suggest an advisement procedure that all advisors would follow. Another possibility was the use of one person as the sole advisor for the Engineering Technology area. This had been done at other universities with some success as it insures accountability and uniformity in the advisement process.

Courses Considered Least Useful Without Dissent

This section was of primary concern to the study. It was of great interest that the curriculum reflects the needs in technical areas. Any courses deemed not useful were scrutinized carefully for either improvement or elimination. Table XII lists courses deemed not useful by the criteria of the study. These criteria required that a minimum of eight percent of the responses indicate dissatisfaction with the usefulness with no responses indicating "most useful". The criteria used were not adequate to designate the courses as not needed, but they certainly encouraged critical examination of the courses. Again, the author would stress that the concerns stressed by the students had already been met it many cases. These are designated in the list below.

As noted earlier, the upper level electronics courses were deemed very useful by graduates with maintenance positions, but were not deemed useful by the larger managerial group. A better advisement system may suffice to eliminate this problem if maintenance and managerial students were identified early.

The chief surprise in this area was the Society of Manufacturing Engineers (SME) course not being considered useful. It was unknown whether this applied only to the course or if it also applied to other related areas. Further work needs to be done to examine the other areas of certification, SME membership, SME activities and meetings to determine their usefulness. It was recommended that the SME course be either changed or eliminated on the basis of this survey.

TABLE XII

COURSES CONSIDERED "LEAST USEFUL" WITHOUT DISSENT

Courses	Concern Already Addressed
1101 INTRODUCTION TO TECHNOLOGY	Yes, course changed
1313 WOOD MATERIALS AND PROCESSES	Yes, not used
3163 CALCULUS FOR TECHNOLOGY	Yes, Applied Calculus used
3323 MACHINE WOODWORK	Yes, not used
3453 INDUSTRIAL PLASTICS	Yes, not used
3843 ELECTRONICS AMPLIFIERS	
3853 ELECTRONIC INSTRUMENTATION	
3873 ELECTRONIC DEVICES	
4161 SOCIETY OF MANUFACTURING ENGINEERS	

The area of industrial plastics needs to studied further. This area is so important to modern industry that it really needs to be addressed. It was recommended that the Industrial Plastics course be changed to better meet student needs.

Computer Related Concerns

Perhaps the primary area of student concern was the lack of computer related training. This area had been addressed to some degree over the term of the study period. It was anticipated that the addition of several computer rooms to the campus would partially address the equipment needs for some years.

However, the Engineering Technology students were still lacking software that was currently standard in industry. This included:

- Factory simulation packages
- AutoCAD r13, Microstation, Cadam or other industry standards
- Project management scheduling packages

- Symbolic math packages
- Fortran, Basic, or C programming languages
- Machine animation packages
- MRP II factory control software

It was also important to note that some courses implemented limited computer use in the department during the latter period of the study. The fact remains that the faculty were poorly trained in CAD, word processor, spreadsheet, database, simulation, and other computer software use. This situation resulted in the faculty not training the students in the use of the packages described, but still requiring students to use some of these packages. It was, unfortunately, true that the basic computer use courses offered on campus did not provide the analytical skills needed by the students in the department. This has changed in recent years as noted earlier. It was recommended that the software needs enumerated above be purchased in the order of which are most useful to the greatest number of students. It was further recommended that the department be trained in the use of this software as needed.

It will be necessary to work closely with the Computer Science department to address programming courses and needs for technical students. Some minimum computer competency needs to be addressed before the students progress to other courses. A number of the concerns, noted above, must be addressed by the College of Arts and Science or the administration for effective articulation. The following recommendations address the concerns noted:

- Implement campus-wide, articulated, computer training appropriate to the future career needs of the students. This would involve at least two tracks, one for business, technical, and scientific careers and one for artistic, social science, and education careers. These concerns had been partially met in the latter part of the study period.

- Purchase core software for technical needs. This would include CAD, factory simulation, and management software in quantities that the students could actually use. Many of these packages are useful in other departmental areas. The areas of technology, math, business, physics, and computer science could benefit from increased communication at the instructional level for course articulation. This had not been done at higher levels due to the lack of technical literacy at that level.

- Train departments in core areas of communication such as CAD, word processing, and spreadsheet use. Provide further training in analytical tools such as project management, computer languages, databases, and additional training according to specialty needs of the individual instructors. Particular training needs to be done in the area of 3-D CAD to CAM conversions. Much of the training could be accomplished on campus.

- Integrate computer use, where possible, within courses in the department with recognizable and measurable objectives being set and evaluated by outside evaluators.

- Standardize graphical, programmable, calculators for new students for the purpose of teaching programming, math (particularly calculus), statistics, and exchanging data. The associated cables, software, and projection stands would be purchased by the department for instructional purposes. Department wide training in the use of these calculators would be done. This would help solve math concerns noted by some graduates.

- Have departmental labs open during the workday for student use.

- Require CAD use in drafting courses as well as more use of CAD in other classes for the purpose of student design of projects.

- Implement a capstone experience blending the use of problem-solving, planning, organizing, implementing, and control of an integrated solution to a designated and difficult problem. All of this should be computer integrated using the various tools taught in different courses. A complete report should be generated with physical evidence of a solution to the designed problem.

These recommendations were coincidentally supported by the ABET recommendations of "one or more programming languages" and "using programming skills in other technical courses" (ABET, 1996). These minimal recommendations need to be addressed for progress in the computer literacy of Engineering Technology students.

Equipment and Facilities

Equipment and facilities were noted as areas of concern by some respondents. Particularly mentioned were the crowded and unsafe conditions in the metals' area and the age of some of the machines. It was recommended that the entire entry, bathroom, and classroom area of this floor of the facility be converted to working space. The cost of a liability suit could far exceed the remodeling cost. The campus had an excess of classroom capacity, and bathrooms were easily accessible on the next floor.

Perceived equipment needs were extensive. Much of the equipment was over thirty years old and some much older. A partial listing of major equipment needs, directly replacing very old and substandard equipment, would be:

- Four metal lathes, including a turret lathe
- One industrial CNC metal lathe
- One surface grinder
- One TIG welder
- One MIG welder
- One plasma arc torch
- One temperature controlled heat treating furnace
- One CIM cell (this could be developed with present equipment)
- One granite surface plate with associated measuring equipment

However, it should be noted that the increase of floor space is a preliminary requirement to purchase of the above equipment.

Courses Considered Most Useful Without Dissent

The recommendations for the courses considered most useful were somewhat self-evident. They are noted in Table XIII.

TABLE XIII

COURSES CONSIDERED "MOST USEFUL" WITHOUT DISSENT

Course	Concern / Recommendation
1203 ENGINEERING DRAFTING	CAD use encouraged
1813 BASIC ELECTRONICS I	
2813 BASIC ELECTRONICS II	More practical
3113 INDUSTRIAL SAFETY	More courses
3143 TECHNICAL PRESENTATIONS	More of same
3183 STATICS AND STRENGTHS	More of same
3203 COMPUTER AIDED DRAFTING I	More use, more architectural
3263 MACHINE DRAFTING I	CAD use encouraged
3413 MANUFACTURING PROCESSES	
3463 MANUFACTURING OPERATIONS I	More of same
3813 ELECTRO/MECHANICAL CONTROLS	More practical
3863 ELECTRONIC TROUBLE SHOOTING	More practical
4243 COMPUTER AIDED DRAFTING II (CAD)	Integrate with CAM
4253 MACHINE DRAFTING II	CAD use encouraged
4433 QUALITY CONTROL	More of same
4453 COMPUTER AIDED MANUFACTURING	Integrate with CAD
4493 MANUFACTURING OPERATIONS II	
4514 MACHINE TOOL PROCESSES	Upgrade equipment
4823 DIGITAL ELECTRONICS	
4833 MICROCOMPUTER ELECTRONICS	
4843 PROGRAMMABLE CONTROLLERS	More of same

Here too, changes had been occurring during the period studied that had addressed some of the concerns expressed by the graduates. In general, the courses considered most useful had been improved in content. It was recommended that the courses, listed in

Table XIII, be continued or expanded subject to the concerns noted.

Suggested Course Articulation, Prerequisites, and Sequence

The final recommendations related to the overall curriculum. Perhaps some of the graduates' concerns about the lack of analytical tool use in the classes could be traced to lack of student readiness to use those tools. This was primarily a prerequisite, articulation and subject competency problem in the author's opinion. Often students were placed into classes without the required prerequisites. The primary curriculum focus was on the Engineering Technology department courses at Southwestern Oklahoma State University. While the general education courses were the focus of many graduates' comments, very little could be done about the general education requirements from within the department. However, it was recommended that, based on the survey findings, the general education curriculum be reduced in both the number of courses required and the credit-hours associated with those courses. It was frequently pointed out by the graduates that the liberal arts portion of their curriculum was ignored by their employers. Table XIV shows a recommended list of course sequences, prerequisites, and articulation for future use in curriculum planning. The then current general education requirements were included even though some of these courses should be replaced with math, computer science, science, or engineering technology courses to meet student employment needs. Further work needs to be done in this area.

TABLE XIV

SUGGESTED COURSE SEQUENCE AND PREREQUISITES

ID #	Class / Semester	Course #	Prerequisite ID #
1	Freshman 1		
2	CIA	1022	
3	Intro. to Tech.	1101	
4	Eng. Comp. I	1113	
5	Eng. Drafting.	1203	
6	Speech	1312	
7	Col. Algebra	1613	
8	Freshman 2		1
9	Biological Con.	1004	
10	Eng. Comp. II	1213	4
11	Trig.	1633	7
12	B. Elect. I	1813	3
13	CAD I	3203	5, 2
14	Sophomore 1		8
15	Bas. Physics	1044	
16	US History	1063	
17	Wellness	1133	
18	B. Elect. II	2813	12
19	App. Calculus	2823	11, 7
20	Sophomore II		14
21	Amer. Gov.	1103	
22	W. History	1103	
23	Economics	1113	7
24	Chemistry. & Soc.	1614	
25	Visual Basic	1433	2
26	Junior I		20
27	CAD II / CAM	4243	13
28	Fabrication Proc. I	2513	
29	Technical Presentations.	3143	10, 6
30	Manufacturing Proc.	3413	
31	Materials Test.	3513	19
32	Junior II		26
33	Statics	3183	19
34	Mach Drafting	3263	5

TABLE XIV (Continued)

35	Fabrication Proc. II	3523	28
36	Intern	4010	29
37	Senior I		32
38	Safety	3113	29
39	Manufacturing Op. I	3463	29, 30
40	Materials Hand.	4443	30
41	Statistics	3413	7
42	CAM	4453	35
43	Senior II		37
44	Q. C.	4433	41
45	Manufacturing Op. II	4493	39
46	Machine Tool	4514	35
47	Capstone	4951	13, 35, 46, 44, 45, 42

Summary

Considering the respondents' replies to this survey, the following general recommendations are stated:

- Departmental personnel need to be focused on their customers, the students.
- Advisement needs to be standardized.
- Equipment and facilities need to be improved in the metals' area.
- Courses rated "most useful" by the graduates need to be retained or expanded.
- Courses rated "least useful" by the graduates may need to be improved, deleted, or not required. This will require additional research into why they were considered "least useful".
- Computer use must be greatly expanded within the department.
- Several software packages should be purchased to match industrial needs.
- Computer programming should be required and used by faculty and students.

- More use of advanced mathematics needs to be implemented in all courses.
- The general education requirements should, perhaps, be changed to better reflect student employment needs, not administrative or faculty perceptions.
- Better contact with graduates needs to be maintained and expanded.
- Continuing research on employer and student perceptions needs to be done to increase curriculum validity.

This chapter had presented a summary of the research recommendations and results. The research was the first time a study of this type was performed at Southwestern Oklahoma State University. The interest it generated in the graduates was an indication of their need to communicate what they perceived about their educational experience. Further research is needed to increase the significance of the results obtained in this study.

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APPENDIXES

APPENDIX A. LETTERS

Letter1.doc

April 6, 1996

«FIRST_NAME» «LAST_NAME»
«PERMADDR»
«CITY», «ST» «ZIP»

Dear «FIRST_NAME»:

We need your help! As you know by now, social networking is important in your life. Sometimes knowing someone can even get you a job. We at Southwestern Oklahoma State University would like to keep up with our graduates and we would like our graduates to keep up with each other.

You will find a very incomplete list of addresses, and phone numbers of our graduates enclosed. Please take the time to check this for former classmates and friends. We would like current addresses and phone numbers for everyone. If you can help, please fill in any new addresses and phone numbers you know.

If you can help us do this, I will be glad to send you an updated list when it is available. In addition if, in the future, you need to find someone on the list we will do the best we can to connect you with them.

Would you please take just a few minutes to complete and return any information you have on the list in the enclosed self-addressed stamped envelope. We will sincerely appreciate the quick return, and we thank you in advance for your cooperation. Be sure to tell us if you would like an updated list.

Sincerely,

Gary Frey
CMT, CME
Technology Department
100 Campus Dr.
Southwestern Oklahoma State University
Weatherford, OK 73096

Letter2.doc

June 6, 1996

«FIRST_NAME» «LAST_NAME»
«PERMADDR»
«CITY», «ST» «ZIP»

Dear «FIRST_NAME»:

I want to thank all of our graduates who were able to supply addresses for our database of Engineering Technology students. We still are looking for many of our graduates and if you can help us out we would appreciate it. Some of the information needed might include: name, address, Email, and fax #. An updated list will be sent to those who request it. «Comments»

We need your help! We at Southwestern Oklahoma State University are involved in a study of engineering technology graduates and we are pleased to state that you have been selected to participate in the study. The information you can provide us will be very helpful in improving the curriculum here at Southwestern.

Would you please take just a few minutes to complete and return the questionnaire in the enclosed self-addressed, stamped envelope. The confidentiality of your material will be maintained during the study and all materials will be destroyed at the conclusion of the study.

We will sincerely appreciate the quick return, and we thank you in advance for your cooperation.

Sincerely,

Gary Frey
CME
Technology Department
Southwestern Oklahoma State University
Weatherford, OK 73096

Letter3.doc

July 28,1996

«FIRST_NAME» «LAST_NAME»
«PERMADDR»
«CITY», «ST» «ZIP»

Dear SWOSU Graduate:

We still need your help! A short time ago you received a questionnaire about the courses you took at Southwestern Oklahoma State University. The information you can provide us will be very helpful in improving the curriculum here at Southwestern. We need enough of a return to make the results statistically significant or no change will take place. This is **YOUR chance to make a difference** to those students who will follow you.

Would you please take just a few minutes to complete and return the questionnaire in the self-addressed, stamped envelope provided with the questionnaire. If you have misplaced the questionnaire, please call the number below for another. The anonymity of your material will be maintained during the study and all materials will be destroyed at the conclusion of the study

We appreciate your time, and we thank you in advance for your cooperation.

Sincerely,

Gary Frey, CME
Technology Department
Southwestern Oklahoma State University
Weatherford, OK 73096
(405) 774-3711
Email freyg@host1.swosu.edu

APPENDIX B. QUESTIONNAIRE

CONFIDENTIAL GRADUATE QUESTIONNAIRE

Section 1 - (Optional, if you want complete anonymity) This section deals with personal information and is not strictly necessary to the study. It will enable us to exclude you from further annoying letters (like this one). It will also provide the department data to answer frequently asked questions from new, or prospective, students. Your name will not be used. In any case, the only person who will see this form is myself and all forms will be destroyed, after data tabulation, at the end of the study. <u>It is important that you answer honestly if you do answer</u>. <u>So if you feel absolute confidentiality is needed to answer honestly, you can leave your name and address information blank</u>.

1. Name
   First ____________ Middle ____________ Last _____________________

2. Present mailing address
   Number and Street ___________________________________
   City ________________State _______________ Zip Code _____________

3. Present telephone number _____-______-____________

4. Permanent telephone number _____-______-____________

5. Address of someone who will always know where you are located.
   Number and Street ___________________________________
   City ________________State _______________ Zip Code _____________

6. First professional job after leaving school.
   First job title ___________________________________
   Name of first employer _______________________________________
   Address of first employer _____________________________________
   Number and Street ___________________________________
   Number and Street ___________________________________
   City ________________State _______________ Zip Code _____________
   Telephone number of first employer _____-______-____________
   Length of time on first job
   0-1 years 2-3 years 4-5 years >5 years

7. Present job (if same as number 6 above, leave blank)
   Job title ____
   Employer's name ___________________________________
   Employer's address _________________________________
   Number and Street ___________________________________
   City ________________State _______________ Zip Code _____________
   Telephone number _____-______-____________

Length of time with present employer

0-1 years   2-3 years   4-5 years   >5 years

Section 2 - This section deals with the engineering technology program. It is important that you honestly answer this section as completely as possible. A current list of engineering technology course offerings and their descriptions is included in your survey at the end.

8. Do you feel that the program of study adequately prepared you for employment upon graduation? (Circle one)
   Yes   No

9. What course(s) and/or activities in your program were the most useful to your present job?
   ____
   ____
   ____
   ____
   ____

10. What course(s) and/or activities in your program were the least useful in your present job?
   ____
   ____
   ____
   ____

11. Since graduation have you attended formal educational courses or programs?
   Yes   No
   If yes, name courses or programs
   ____
   ____
   ____
   ____
   ____

12. What type of courses or programs are you now interested in pursuing? Please rank, number one, two, etc. with most important first..
   _____ Technical Specialty Courses
   _____ Operations Management Courses
   _____ Mathematics and Science Courses
   _____ Communication Courses
   _____ Quality Control, SPC, TQM
   _____ Other course(s), please specify
   ____

_____ Other program(s), please specify

____

13. If you are interested in pursuing additional courses or programs, what are your major reasons for being interested in these? (Please check as many as apply)
_____ To advance in my present job field
_____ To prepare for a different occupation
_____ To improve my general knowledge or education
_____ To get credit toward a degree
_____ Other (please specify)

____

14. Please give suggestions for improving our technical program based upon your educational and work experiences. Use the back of the page for additional space.

____
____
____
____
____
____
____
____

Section 3 - This section deals with specific courses in our curriculum. Again, honest answers are needed. Please read the following course descriptions of our present curriculum and CROSS OUT the courses that you believe are not useful to an engineering technologist. Please CIRCLE the courses you believe are useful. Thus courses you believe useful will be CIRCLED, and courses you believe not useful will be CROSSED OUT, and courses of average usefulness will be ignored. You should evaluate all the courses, even if you have not been in that particular course.

1101 INTRODUCTION TO TECHNOLOGY
An orientation course for technology and undecided students to help prepare the student to successfully accomplish their college career goals. Laboratory activities are included.

1203 ENGINEERING DRAFTING
A beginning class in drafting which includes lettering, geometric construction, orthographic projection, sketching, and pictorial drawing. Concepts of computer aided drafting are introduced.

1313 WOOD MATERIALS AND PROCESSES
A survey and application of the materials, processes, tools and equipment relating to wood materials in the construction and manufacturing industries.

1813 BASIC ELECTRONICS I
A study of the fundamentals of A.C. and D.C. electricity and magnetism, emphasizing their applications in the home and industry. Basic circuits and measurements will comprise a major part of the course. **Prerequisite: MATH 1613.**

2513 FABRICATION PROCESSES I
A study of common industrial metals, layout tools and procedures, welding and brazing processes, precision measuring instruments, fasteners, and assembly processes.

2543 WELDING PROCESSES AND METALLURGY
Theory and laboratory experiences in the operation of oxyacetylene electric, T.I.G. and M.I.G., and resistance welding with attention given to the change in mechanical properties of ferrous metals through controlled cooling and principles of heat transfer.

2813 BASIC ELECTRONICS II
A thorough use of Ohm's Law as applied to A.C. and D.C. circuits composed of active and passive components. Solid state theory will be integrated with circuit design and measurements. A brief introduction to integrated circuits will be included. **Prerequisite: 1813.**

3113 INDUSTRIAL SAFETY
Course emphasizes the recognition and prevention of unsafe working conditions. OSHA regulations are emphasized.

3143 TECHNICAL PRESENTATIONS
Extensive practical exercises in research, reading and writing of technical descriptions, explanations of processes, instructions, service manuals, progress reports and industrial proposals.

3163 CALCULUS FOR TECHNOLOGY
Applied calculus using analytic processes, functions, limits, derivatives, and integrals. **Prerequisites: MATH 1613 and MATH 1633 or 1625.**

3183 STATICS AND STRENGTHS
The study of force systems in two dimensions, equilibrium, moments, bending, stress, and strain. **Prerequisites: MATH 1633 and MATH 1613; or MATH 1625.**

3203 COMPUTER AIDED DRAFTING I
A study of computer applications for drafting, including software selection, drawing commands, and plotting. MS-DOS computers will be used to produce orthographic, pictorial, and chart drawings.

3263 MACHINE DRAFTING I
Drawing machine parts with emphasis on auxiliary views, sections and dimensioning. Computers will be used for producing drawings. **Prerequisites: 1203 and 3203.**

3323 MACHINE WOODWORK
The application of the safe and economic use of power equipment, tools, jigs, and fixtures in the manufacture of wood products. **Prerequisite: 1313.**

3413 MANUFACTURING PROCESSES
The study of industrial materials and processes from an engineering viewpoint. **Prerequisite: 2513.**

3433 AUTOMATION/ROBOTICS
A survey of automated manufacturing and related activities.

3453 INDUSTRIAL PLASTICS
A general overview of industrial plastic materials and processes including vacuum and pressure forming, molding and lay-up of selected media such as fiberglass, expandable polystyrene epoxy resins, and sheet materials.

3463 MANUFACTURING OPERATIONS I
The study of management, productivity, quality, design, and work measurement in industry.

3513 MATERIALS TESTING AND ANALYSIS
Testing materials for compression, tension and shear, using modern testing and measuring equipment. **Prerequisites: 1613 and 3523.**

3523 FABRICATION PROCESSES II
Application of precision measuring instruments, foundry practices, ferrous metal heat treating, traditional industrial machine tools and a study of powder metallurgy. **Prerequisite: 2513.**

3623 FLUID POWER
An in-depth study of hydraulics, pneumatics, and mechanical systems.

3813 ELECTRO/MECHANICAL CONTROLS
The study of devices used to control A.C. and D.C. motors and their applications in industry. Control devices for study include relays, timers, switches, overloads, and motor controllers. **Prerequisite: 2813.**

3823 INDUSTRIAL ELECTRONICS
A study of the different types of A.C. and D.C. motors and controls. Generator principles and A.C. rectification will be a part of the course along with single phase and three phase electricity as it applies to motors and generators. **Prerequisite: 1813.**

3843 ELECTRONICS AMPLIFIERS
An advanced study of semiconductor biasing, feedback, amplification, comparison, and filtering. Such devices as bipolar transistors, diodes, JFET's, MOSFET's, Darlington Pairs, differential amplifiers, and operations amplifiers will be used in lab experiments. **Prerequisite: 3873.**

3853 ELECTRONIC INSTRUMENTATION
A study of various pieces of equipment used to measure current, voltage, and resistance of electronic circuits. **Prerequisite: 3813.**

3863 ELECTRONIC TROUBLE SHOOTING
Use of test equipment to find defects in typical electronic industrial circuits. **Prerequisite: 3813.**

3873 ELECTRONIC DEVICES
A study of semiconductor biasing, feedback, amplification, comparison and filtering. Such devices as bipolar transistors, diodes, JFET's, MOSFET's, Darlington Pairs, differential amplifiers, and operational amplifiers will be examined in lab experiments. **Prerequisite: 3813.**

4010 ORIENTATION TO INDUSTRIAL INTERNSHIP
Non-credit course to be completed before internship. Students will develop: personal resume, letter of application, cover letter, and formulate positive interviewing techniques to be used in obtaining an internship.

4161 SOCIETY OF MANUFACTURING ENGINEERS (SME)
Student will gain membership and become actively involved in the Society of Manufacturing Engineers Student Chapter #181.

4194 INDUSTRIAL INTERNSHIP
Student must complete a minimum of 320 clock hours of employment with an approved industry, submit a formal report of experience and a supervisor's evaluation. Students with documented industrial experience may select approved elective courses in lieu of internship. **Prerequisite: 4010.**

4223 ELECTRICAL CIRCUIT DESIGN
A study of electrical symbolism and the designing of schematic layouts of electrical circuits and systems. Conventional drafting practices and techniques related to electronic drafting are included.

4243 COMPUTER AIDED DRAFTING II (CAD)
An advanced course in computer applications which includes symbol libraries, architectural applications, and chart drawings. A variety of graphic software packages will be used. **Prerequisite: 3203.**

4253 MACHINE DRAFTING II
Preparation of detail and assembly drawings using computer-aided drafting systems. **Prerequisite: 3263.**

4293 MACHINE DESIGN
A class in the design, analysis, and development of industrial products with emphasis on machine components and mechanisms. Design teams will manufacture a prototype product. **Prerequisite: 3263.**

4433 QUALITY CONTROL
The study of statistical process control and quality management techniques. **Prerequisite: 3523.**

4443 MATERIALS HANDLING AND FACILITY PLANNING
A study of the factors influencing location, layout, and planning of industrial facilities.

4453 COMPUTER AIDED MANUFACTURING (CAM)
Applications, operations, and evaluation of computer-integrated manufacturing and design systems. **Prerequisite: 4514.**

4493 MANUFACTURING OPERATIONS II
Economic aspects of industry and manufactured processes. Work measurement, TQM, productivity, and effectiveness **Prerequisite: 3463.**

4514 MACHINE TOOL PROCESSES
Provides advanced activities related to industrial processes. **Prerequisite: 3523.**

4583 METROLOGY AND METALLURGY
A combined study of the various types, uses and calibration of precision measuring instruments, and the effects of various heat treating processes on ferrous and non-ferrous materials. **Prerequisites: 3523 .**

4823 DIGITAL ELECTRONICS
A study of digital principles as they apply to computers, microprocessors, communications, and instrumentation. Such areas as binary octal and hexa-decimal number systems, codes, Boolean Algebra, Karnaugh Maps, DeMorgan's Theorem, AND, NAND, NOR gates and combinational logic will be included. **Prerequisite: 3813.**

4833 MICROCOMPUTER ELECTRONICS
A thorough examination of bus-oriented systems, input/out devices, flowcharts, high-level language programming and telecommunications. **Prerequisite: 4823.**

4843 PROGRAMMABLE CONTROLLERS
The study of interfacing microcomputers with electronic devices used in industry. The microcomputer is connected to typical input and output devices. **Prerequisite: 3813.**

Section 4 - This section is one that people are often sensitive about. It is, for that reason, optional. However perhaps the most asked question by new students is about salary ranges of graduates. Plus graduating students want to know what industries pay well. If you can provide us with this information, it will be appreciated. Your name will not be linked to the salary in any way.

15. Beginning annual salary. Please state either a range or an actual value below if you can.

    ____

16. Present annual salary. Please state either a range or an actual value below if you can.

    ____

2

VITA

Gary Frey

Candidate for the Degree of

Doctor of Education

Thesis: A FOLLOW-UP STUDY OF THE GRADUATES OF THE ENGINEERING TECHNOLOGY PROGRAM AT SOUTHWESTERN OKLAHOMA STATE UNIVERSITY

Major Field: Applied Educational Studies

Biographical:

Education: Graduated from 71st High School, Fayetteville, North Carolina in May of 1966; received Bachelor of Science degree in Zoology from the University of Missouri, Columbia, Missouri in May of 1971; and a Bachelor of Science degree in Industrial Education from Montana State University, Bozeman, Montana in May of 1979. Completed the requirements for the Master of Science degree in Industrial Education from Montana State University in May of 1981. Fulfilled the requirements for the Doctor of Education degree in Applied Educational Studies, at Oklahoma State University in December, 1996.

Experience: Employed as research participant in biochemistry lab at the University of Missouri. Employed as researcher in environmental impact of proposed coal mine at Montana State University. Employed as educator at various junior and senior high schools, and three universities.

Professional Memberships: Society of Manufacturing Engineers, Project Management Institute.

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
HUMAN SUBJECTS REVIEW

Date: 04-26-96 **IRB#:** ED-96-120

Proposal Title: A FOLLOW-UP STUDY OF ENGINEERING TECHNOLOGY GRADUATE OF SOUTHWESTERN OKLAHOMA STATE UNIVERSITY

Principal Investigator(s): Cecil Dugger, Gary Frey

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

ALL APPROVALS MAY BE SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW BOARD AT NEXT MEETING.
APPROVAL STATUS PERIOD VALID FOR ONE CALENDAR YEAR AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD APPROVAL.
ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

Comments, Modifications/Conditions for Approval or Reasons for Deferral or Disapproval are as follows:

Signature: John H. Wychoff

Chair of Institutional Review Board

Date: April 30, 1996