A COMPARISON OF SELECTED OKLAHOMA STATE UNIVERSITY ENGINEERING AND TECHNOLOGY STUDENTS' PERCEPTIONS OF CAREER CHOICE, CURRICULUM, AND EMPLOYMENT OPPORTUNITIES

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CHAPTER I

THE NATURE OF THE PROBLEM

Introduction

In the decade to come, our nation's colleges and universities will experience a severe decline in the numbers of students attending their institutions. In 1978, Noel (25) noted that our institutions of higher education can expect a decrease in potential enrollees as the number of high school students continues to decline. Retaining students will become a most important priority on campuses across the country. Reducing the number of students who drop out may be the quickest and most appropriate way to increase enrollment. Increased retention will result if programs and services for students are improved.

One method that our institutions can use in their efforts to improve services to students is to make certain that the entering student is aware of the specific goals and aims of a particular college or university. Educators must attempt to help the prospective student match his/her educational values, to that of a particular institution. More specifically, current career information distributed to prospective students should be clear and concise in its message. This is especially important when involving two or more academic areas where there is perceived overlap in curricula or in placement upon graduation.

The inability to provide clear and concise career information about such programs as engineering and technology will result in confusion among prospective students. This could lead to a situation where students' needs may go unmet. Today, technical educators appear to be deficient in their efforts to advise students into the most appropriate technical program. To allow this deficiency to continue is to allow students to continue to be confused, disoriented, and more importantly, to drop out due to the possibility of choosing a major that is not compatible with their interests, needs, or abilities.

Statement of the Problem

There has been evidence that many students enter engineering or technology without a clear perception of the differences between engineering and technology curricula and their respective employment opportunities upon graduation. In a study by Maxwell and Ward (19), it was shown that few high schools have the ability to impart to a student exactly what engineering involves. Consequently, many students who have entered engineering or technology at a university have done so without adequately realizing what they will be doing. Additionally, students graduating from engineering and technology may or may not have a clear perception of the differences between the two programs.

Generally stated, the problem was that students who are ignorant of the differences between an engineering and technology education may become students whose needs go unmet. When students' needs are not met, they face a greater likelihood of disenchantment, failure, and dropping out. This result is disastrous to the lives of students and to the colleges where decreasing enrollments are becoming a greater problem annually.

Purpose of the Research

The purpose of this research was to measure the perceptions of representative samples of engineering and technology students concerning career choice, curriculum and employment opportunities. The results of the measurements were used to compare these perceptions between the groups. In addition, comparison was made of the engineering and technology students' perceptions of the characteristics of the engineering and technology programs with the Oklahoma State University (O.S.U.), Division of Engineering, Technology and Architecture (DETA), characterizations of the two programs. Those perceptions of the engineering and technology students that were determined to be incorrect can serve as the focus of more proactive guidance efforts to be administered by student development specialists.

The study resulted in a descriptive profile of the perceptions of the engineering and technology students at O.S.U. which should be useful in the advisement of those students and in the recruitment and career guidance of additional students. The descriptive profile would serve as a baseline against which future perceptual changes may be measured and suggested questions to be answered in future research.

Finally, the study resulted in a model which could be followed by other institutions seeking to determine the perceptions of their engineering and technology students with respect to career choice, curriculum and employment opportunities.

Definitions

1. Engineer - a student who is earning or has earned a Bachelor of Science degree in Engineering will be called an engineer.

2. Engineering - in this study, engineering will be used to denote Bachelor of Science Engineering programs.

3. Technologist - a student who is earning or has earned a Bachelor of Science degree in Engineering Technology will be called a technologist.

4. Technology - in this study, technology will be used to denote Bachelor of Science Engineering Technology programs.

5. DETA - The O.S.U. Division of Engineering, Technology and Architecture.

6. ABET - The Accreditation Board for Engineers and Technology, formerly ECPD.

7. Freshmen - first year students.

8. Seniors - students who have entered their fourth year of college work and have been in either engineering or technology since matriculating.

9. Transfers - students who have transfered from engineering to technology or from technology to engineering.

Research Questions

To achieve the purpose of this study the following research questions were answered:

1. Is there a significant difference in the way selected factors influenced freshmen in engineering and technology, seniors in

engineering and technology, and transfers in engineering and technology, on their choice of academic major?

2. Is there a significant difference in the way the engineering curricula is perceived by freshmen in engineering and technology, seniors in engineering and technology, and transfers in engineering and technology?

3. Is there a significant difference in the way the technology curricula is perceived by freshmen in engineering and technology, seniors in engineering and technology, and transfers in engineering and technology?

4. Is there is a significant difference in the way the employment oportunities for engineers are perceived by freshmen in engineering and technology, seniors in engineering and technology, and transfers in engineering and technology?

5. Is there a significant difference in the way the employment opportunities for technologists are perceived by freshmen in engineering and technology, seniors in engineering and technology, and transfers in engineering and technology?

6. Is there a significant difference in the way the DETA characterizations are perceived by freshmen in engineering and technology, seniors in engineering and technology, and transfers in engineering and technology?

Limitations of the Study

The study was limited to a population of engineering and technology majors at Oklahoma State University. The engineering and technology programs at O.S.U. are administered under the direction of the same dean. Caution was and should be used in generalizing the results to a population found at another campus, and particularly a campus that supports an engineering and technology program administered by separate deans.

CHAPTER II

REVIEW OF LITERATURE

This chapter reviews five areas in order to show a need for the study and a logical approach to the solution of the problem. The areas are: (1) How College Students Choose Their Careers, (2) How Engineering Students Choose Their Careers, (3) Engineering and Technology Curriculum Differences, (4) Employment Opportunities for Engineering and Technology Graduates, and (5) DETA Characterizations of Engineering and Technology.

How College Students Choose Their Career

Career choice is a product of a process called career development. Career development is a long range, gradual process involving the acquisition of self understanding and knowledge of the world of work. Issacson (15, p. 59) states "that recognition that the guidance process requires time, study and adjustment may help in overcoming the impression occasionally met that this is an event, that can be condensed into an afternoon with a counselor."

Career guidance as seen by Ewens, Dobson, and Seals (9) is divided into Three Essential Steps: (1) Awareness, (2) Exploration and personal decision making, and (3) Implement work values.

Super (31) describes the vocational development process of an individual in terms of life states. He identifies these stages as growth, exploration, establishment, maintenance, and decline. When students progress through these stages they are faced with a series of compromises where they must match what they would like against the realities of the situation, and attempt to determine what is attainable.

There are many theoretical conceptions of career development in existence today. What is important is the notion that career development is a process rather than an event. Career education should begin with early childhood and continue throughout an individual's life. That is, career education is developmental. When students reach the doors to our colleges and universities, they should have been exposed to a great deal of world of work values and information, as well as self exploration.

Some college students have been exposed to sound career education opportunities. These students are able to take every advantage of these opportunities and reap the rewards of this behavior. However, in a study by Hillery (13), there is evidence that many individuals enter post secondary institutions with impulsive career choices. They have made educational decisions without an adequate career plan. Impulsive choices seldom sustain people through college programs. Hillery also found that many individuals have participated in some career planning, but their decision making has been greatly influenced by highly romanticized descriptions of occupations. At some point during their career preparation, they decide that the chosen career is not what they had thought it would be and they redirect their efforts. The negative impact of unrealistic career choices on attrition is clear.

Krupka and Vener (17) point out that many college students lack knowledge concerning majors and careers. The deficiency appears to be in the following areas: (1) Career Awareness, (2) Job Specifics, (3) Career Expectations, (4) Curriculum Expecations, and (5) Career Information. Krupka and Vener (17) also cited literature from a large land grant university showing that approximately 75 to 80 percent of entering freshmen have already declared a major. About 75 percent of these students change their major prior to graduation.

Finally, the people who aid students in the career development process have come under some criticism. In a recent study by Goodson (11), some counselors were found to be deficient in their knowledge of the dynamics of career development. Further, career counselors often work with a framework of knowledge that is too general in nature to really help.

In summary, the literature reports that many college bound students enter our universities without adequate career guidance. This often leads to enrolling new students in majors that were hastily chosen. When a student is not afforded adequate career guidance and an opportunity to develop his work values into a career development framework, career choice becomes an event. Many students have made career choices when exploration is still needed.

How Engineering Students Choose Their Career

When the technically inclined, high aptitude high school student looks forward to the selection of a career and its appropriate educational program, it is important that he understand the interrelationship of technical activities, so that he can make his choice with a full understanding of the kinds of work involved. According to Gigliotti (10) it is extremely important that a student understand himself well enough to choose between careers where the end result is abstract and where the end result is physical. One involves gaining satisfaction from knowing that a problem has been solved, versus gaining satisfaction from seeing the finished product.

Contrary to sound career guidance, engineering and technology guidance efforts have been largely uncoordinated and undertaken by a variety of people, agencies and institutions which do not maintain communication with each other. Greenfield (12) concluded that current engineering guidance efforts fail to contact some of the young people who might find success and satisfaction in careers in engineering or technology. Further, current engineering guidance efforts fail to provide adequate information to other students who really should not try to become engineers or technologists.

O'Bryant (26) indicates that students interested in engineering and technology must seek information from school counselors and teachers who have little understanding of the engineering spectrum. Making the high school student aware of these career options is a task that requires effort beyond the ordinary guidance channels.

Many students make career decisions about engineering and technology based on factors other than those that normally develop in the guidance process. Durchholz (5) discovered that many people simply make judgements about engineering not so much by the kind of work it involves by by the kind of people engineers appear to be and the roles they play. One aspect of this is that engineering is often introduced as a career by people telling people what engineering is and what engineers do.

A study reported by the Engineering Manpower Commission of The Engineers Joint Council, entitled "What's Different About Engineering Students?", was based on data collected from high school seniors, class of 1972, in the state of Indiana by the Purdue University Office of Manpower Students (1). The survey obtained 51,600 responses of which 2,000 gave engineering as their vocational choice and 1,200 indicated a plan to become technicians. One observation reported in this study was students desiring to become high school teachers seem to have a much clearer focus on the relationship between their high school curriculum and their college aspirations. One statistic from this study suggest that some students choosing engineering and technology may not know, or at least are confused, as to the difference between the work of engineers and technologists.

This report, called the Alden Study (1), reported a profile of the students choosing engineering and technology as follows:

A. Grade Point: Students planning on going into engineering had a high school grade point centered between B and C while those students choosing technology were C students.

B. Choice of School: The students choosing engineering and technology were most likely to choose the school they were going to attend on the basis of the type of academic program the school had.

C. Career Decision: Those students choosing engineering tend to become interested in engineering over a wide range of ages while those choosing technology tend to become interested near the end of high school. Also reported by the study was the fact that no factors other than family influence stands out strongly affecting the career choice of those students who reported to be going on to pursue an engineering or technology degree.

D. Important Reasons for Choosing a Career: Engineers and technicians were somewhat similar in their reasons for choosing one career field over the other. In rank order, for the engineering students were (1) activities on the job, (2) money, (3) outdoor work and (4) prestige.

To summarize, many career guidance efforts in engineering and technology programs around the country have been no more than half hearted attempts at helping the student choose a program that fits their needs, interests and abilities. Most high school personnel have little real understanding of what it means to be an engineer or technologist. Many college level recruiters are ill equipped to properly aid the student in career guidance. Many of these people are from the ranks of the engineering and technology faculty rather than from counseling or student personnel backgrounds. Too often, faculty have vested interests or are simply not totally aware themselves of the various options open to students.

Engineering and Technology Curriculum Differences

The Accreditation Board for Engineers and Technology (ABET), publication The Engineering Team, gives the following definitions of engineering and technology:

> Engineering is the profession in which a knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgement to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind.

> Engineering Technology is that part of the technological field which requires the application of scientific and engineering knowledge and methods combined with technical skills in support of engineering activities; it lies in the occupational spectrum between the craftsman and the engineer at the end of the spectrum closest to the engineer (7, p. 56).

The educational objective for an engineering education was defined by Hollister (18) in 1950. The objective of an engineering technology program was defined in 1972 in the American Society for Engineering Education (ASEE) Engineering Technology Education Study (6). These objectives are shown below:

Engineering	Engineering Technology
. . . nevertheless it is believed that in its full import, ability to design is the professional hallmark of the engineer (6, p. 8).	. . . engineering technology education develops capacity to achieve a practical result based upon an engineering concept or design (6, p. 8).

The Engineering Team an ABET manual, expresses the fact that the educational emphasis of the technologist's program is less theoretical, and less mathematical than that of the engineering counterpart but is more hardware and process oriented (7).

According to the Institute for Electronic and Electrical Engineers (IEEE) Educational Activities Board (14), despite the differences in the two kinds of programs, the statements defining and pointing out curricular differences do not adequately reveal the differences that exist between these educational programs. Only upon close examination of the content, depth and level of each curriculum are the differences between the two curricula apparent.

The IEEE Educational Activities Board (14), explains that during the first two years of study, the engineering student is much more occupied with liberal studies while obtaining the appropriate math and science background whereas the technology student is proceeding directly into technical courses at a lower level of mathematical ability. Technology students normally terminate their mathematics preparation with a six semester hour applied calculus sequence. Engineering students add two or more additional math courses to a ten hour calculus sequence. In addition, the engineering student has a calculus based physics sequence and a comprehensive sequence in general chemistry, while the typical technology student has an algebra based physics sequence and a single course in applied chemistry.

Carlson (4) indicates that because of the applied nature of the technology program, laboratory experience plays a major role in the education process. Laboratory courses are an integral part of theory courses because this experience ties in with the concept that the engineering technologist is a doer.

The engineering curriculum is much less likely to contain laboratory work until the latter stages of the student's education. The emphasis on theory and analytics is to insure the design capability of the engineering graduates. Those courses in engineering that contain laboratories show a strong orientation toward experimentation or research. Technology education places laboratory emphasis on practical applications.

A 1972 ASEE Engineering Technology Education Study states in part

> . . . there must be considerable overlap between each engineering technology curriculum and the related engineering curriculum. The engineering technology mathematics requirement need not be as advanced as engineering mathematics but it must provide

an adequate base for a realistic study of physics and chemistry (6, p. 351).

According to ABET, the first professional degree from an accredited engineering program will contain the following:

> (a) one half year of mathematics beginning with differential and integral calculus, (b) basic physical sciences, (c) engineering sciences, and (d) interrelate engineering principles with economic, social political, aesthetic, ethical, legal, environmental, etc., issues (7, p. 57).

According to ABET, a four year accredited engineering technology program will contain the following:

> (a) applied science and mathematics (through concepts and applications of calculus), (b) technical sciences and specialty areas, (c) field orientation, and (d) apply technological methods and knowledge, with technical skills, to support engineering activities (7, p. 57).

The following represents the curricular requirements for an ABET accredited degree in Engineering in the Division of Engineering, Technology and Architecture (DETA) at Oklahoma State University:

a. Sixteen semester hours of mathematics. This sequence begins with differential and integral calculus and ends with courses in differential equations and linear algebra or statistics and probability.

b. Sixteen semester hours of basic physical sciences. This involves two calculus based general physics courses, a course in general chemistry and an additional basic science course.

c. Eighteen semester hours in the engineering sciences. This includes one course in electrical science, one course in dynamics, one course each in thermodynamics and statics and strengths of materials, and one course each in fluid mechanics and materials science.

d. Four semester hours in engineering. This includes an introduction to engineering, engineering graphics, and fortran computer programming.

e. Ten semester hours of humanities and social science.

f. Six semester hours of english composition.

g. Six semester hours consisting of U.S. History and American Government.

h. The balance of the degree is made up of departmental requirements for the particular engineering specialty (27, p. EN 1).

The engineering curricula at Oklahoma State University is predominately theoretical in nature while containing some laboratory work throughout the program.

The first two years of the engineering program contains sixty semester hours of the 76 hours considered "common" to all engineering disciplines. The common course work is intended to provide all engineering students with a common base from which to build with the departmental curricula.

Students pursuing the Bachelor of Science degree in Engineering must earn at least a 2.3 grade point average on a 4.0 scale in the common course areas in order to be accepted into the Professional School of Engineering.

The Professional School curricula is generally taken during the last two years of study for the Bachelor of Science degree. The requirements consist of all courses required in the particular engineering specialty.

The following represents the curricular requirements for an (ABET) accredited degree in Engineering Technology in DETA at Oklahoma State University:

a. Eleven semester hours in mathematics. This includes college algebra and trigonometry, plus two courses in applied calculus.

b. Eleven semester hours in physical sciences. This includes one course in physics, a course in chemistry, and one course as a physical science elective.

c. Twenty-nine semester hours of technician specialty courses. These are departmental specialty courses at the freshman-sophomore level.

d. Sixteen semester hours of related specialty course work. This involves taking classes that are related to the students' specialty area.

e. Eight semester hours of humanities and social sciences.

f. Nine semester hours of english composition and communications.

g. Six semester hours of technologist specialty course work. These are departmental specialty courses at the junior-senior level (27, p. EN 16).

The technology curricula at Oklahoma State University is application oriented as most theory courses contain laboratories. Some design work is found in the curricular offerings. Technology students begin their specialty course work in their first semester of the freshman year and continue in the specialty throughout the program. Students pursuing the Bachelor of Science degree in Engineering Technology must complete approximately 64 semester hours, and earn an Associate degree before being permitted to continue toward the Bachelor of Science degree (27).

In summary, in a report by the curricula work group of a recent DETA Engineering-Technology Interface Workshop at Oklahoma State University, the group concluded that the primary differences between Engineering and Technology Bachelor of Science degree programs at Oklahoma State University are: (1) the significantly greater use of mathematics and computer methods in engineering, and (2) the significantly greater "hands on" laboratory activity in technology (20).

A problem that technical educators face today is that most high school counselors, students and the general public, are not able to easily determine the differences between the engineering and technology curriculum. At present, technical educators are just beginning to have the expertise to determine the sometimes subtle differences. The next step is to be able to provide the proper information to incoming students and those who seek career guidance in the engineering spectrum.

Employment Opportunities for Engineering and Technology Graduates

According to the IEEE (14), engineering programs are intended to prepare graduates for the practice of engineering closest to the research, development and design functions. Their analytical training equips them to handle quantitative decision making in the managerial areas as well. The preparation for the function of development and design guides most engineering academic programs.

Technology programs prepare graduates for those careers requiring some knowledge of mathematics, basic science and technical science but not at the same level as that required for design; in addition, they require thorough knowledge of the equipment and applications in a particular field. Technology education programs are intended to provide the best possible preparation for careers in applications, operations and engineering support rather than development and design.

Researchers for the Educational Activities Board of IEEE (14) report that upon graduation, the technologist is prepared for rapid integration into industry and is ready to handle today's practical problems while the engineer is prepared to assimilate current practice quickly and to go beyond this in becoming involved in the complex areas of engineering design and practice.

DETA research has shown that upon graduation, an engineer typically requires a period of training by his employer, since the engineering program stresses the development of a capacity for professional development and continuing self education. Further, upon graduation, a technologist is usually ready to begin contributing immediately, since he has been trained in relatively current procedures; as new technological advancements occur, the technologist will retrain to keep current.

In a 1977 study, Byers (3) reported that industry may need as little as ten percent of its total technical force operating as professional engineers. Konon (16) found that engineering technology programs have responded to industrial needs by providing application oriented programs. These produced graduates who were ready for productive work, not in graduate school, but in industry. Engineering graduates are generally prepared for graduate study or for a period of training by an employer prior to initiating industrial production.

ABET offers the information presented in Table I as typical of engineering and technology student career goals and job descriptors (7).

TABLE I

CAREER GOALS

Engineering	Technology
Research	Hardware Design and Development
Conceptual Design	Product Analysis and Development
System Synthesis Development	System Operation
Product Innovation	Technical Sales and Services
Job Descriptors	
Conceptualizer	Operator of Systems
Innovator	Translator of Concepts into Hardware and Systems
Designer	Director of Technicians and Draftsmen
Producer of Standards	Implementor and Producer

According to McCollom (21), some typical engineering occupations are:

1. Research scientist in industry.

2. Research at a government laboratory.

3. University professor.

Further, typical occupations of the technologist are:

1. Technical Supervisor

2. Technical Sales

3. Industrial Production

4. Construction Supervisor

Industry appears to need both the engineer and the technologist. In a study by Ross (29), Stanley Anderson of Commonwealth Edison, the giant Chicago based utility remarked that:

> The technologist is better than an engineer in solving a practical technical problem. He is not as good as an engineer if a problem is theoretical or analytical. He is not as good in some research activities, or in design or in planning. Thus, an operating company staffed by both technologists and engineers, both of whom are appropriately assigned, is better than one staffed by engineers alone (p. 32).

A survey by Moore (22), studying graduates from a bachelors degree program in engineering technology, found that the technology graduates job assignments in many instances were very similar to those of B.S. graduates in engineering.

In a study at Virginia Polytechnic Institute, Moore (24) found that 57 percent of the technology graduates had attempted the Engineer in Training Exam (EIT), but 80 percent of these had passed it. (The E.I.T. is the first step toward becoming a Registered Professional Engineer.)

Over 90 percent of the graduates have assignments and responsibilities about the same as those of B.S. engineers in their firms, and over 95 percent state that they are accepted as professionals or professional equals by engineers who supervise their work. Moore (24) concluded that the technology graduates are being employed by industry and most are receiving job assignments comparable to those given engineering graduates.

It is beyond the scope of this research to determine whether or not industry as a whole is utilizing the engineer and the technologist in a manner which is consistant with their different but sometimes overlapping curricula. The literature has research to support the fact that engineering and technology graduates are entering industry in positions befitting their training and education. The literature also cites research that indicates that many B.S. degree level engineers and technologists start their careers in very similar, if not the same, types of positions. It appears that there is some confusion in industry concerning the place of the technologist and the engineer in todays industrial world. There may be some insight into this problem by looking at research by Carlson (4, p. 32), who stated that "in less technically demanding jobs, engineering technology and engineering graduates may perform the same functions". Again, additional research into this area needs to be done.

The bachelor of engineering technology graduate has faced and faces still a problem of recognition within the engineering community. The term technologist has not been widely accepted in industry. This graduate is not a technician, but, on the other hand, many engineering educators have made it clear that he or she should not be called an engineer. Acceptance of the technologist is an ever spreading phenomena as industry learns where and how this unique graduate fits in with the traditional engineering graduate.

Some people who are critical of the technology education movement have speculated that these graduates probably would find technical employment, but that after very few years they would reach a plateau in pay and job advancement. In a survey of technology graduates, Moore (23) found only 4 in 51 responding that they were not pleased with their upward mobility and only two thought they had reached a plateau in advancement.

Recent graduates in engineering and technology from O.S.U. have found positions in industry similar to those reported in the literature. Listed on the following page are some descriptions of job opportunities being offered to engineering and technology graduates at O.S.U.. The examples in Table II were extracted from actual letters written to the graduates with specific job offers.

In summary, the job opportunities of the O.S.U. engineering and technology graduates appear to be following their respective educational backgrounds fairly closely. Most of the employment opportunities offered O.S.U. graduates in engineering were along the lines of the analytical, design and research function for which these students prepared. The technology graduate usually finds employment in an applications area of the engineering spectrum. The work of the technologist does seem to be in the support role to engineering design efforts.

Many technology graduates job titles are engineer. This may be due in part to industries' lack of acknowledgement of the term technologist. The term technologist is just beginning to emerge to signify the difference in education and in job duties.

Both groups appear to be in heavy demand by industry as evidenced by a 100% placement rate in both engineering and technology. There is some evidence to indicate that the overlap in curriculum sometimes

TABLE II

JOB OFFERS

Engineering		Technology	
Title	Function	Title	Function
Associate Engineer in the Research and Engineering Department	Not Given	Engineering Associate	Analysis of state of the art electronics equipment. Translate test requirements into hardware.
Associate Manufacturing Systems Research Engr.	Not Given	Propulsion Engineer	Engine cycle analysis - Engine operation analysis.
Development Engineer	Not Given	Engineering Associate	Laboratory Assignment, testing, and development, application of known engineering theory.
Engineering Development Program	Not Given	Engineering Technologist	Not Given

shows up in overlapping job responsibilities. There are students graduating in engineering who begin their industrial careers in positions that a technologist might normally fill. There are also some technology graduates who are filling industries' needs in a research and design area. These cases seem to be in the minority.

DETA Characterizations of Engineering and Technology

In assisting students to understand the various options available to them, some descriptive materials that differentiate technology from engineering is essential. Table III shows characterizations of engineering and technology that have been prepared at Oklahoma State University to help clarify to students the distinctions between these programs (21).

Summary

As discussed in Chapter I, many students enter engineering or technology without a clear perception of the differences between engineering and technology curricula and their respective employment opportunities upon graduation. Students who are deficient in their knowledge of these programs may become students whose needs go unmet. When this happens, failure may result. This can be disastrous to the student and to the college.

The purpose of this chapter has been to select from the literature those writings and research studies which would provide insight into the following areas: (1) How College Students Choose Their Careers,

TABLE III

DETA CHARACTERIZATIONS OF ENGINEERING AND TECHNOLOGY

Engineering	Technology
1. Emphasis on higher analytical development and education.	1. Emphasis on training and education.
2. Develops conceptual abilities.	2. Develops specific skills.
3. General design principles are developed, applicable to a wide variety of problem situations.	3. Current design approaches are used, applicable to problem situations similar to those used in course work examples.
4. "Engineering core" provides common language and a fundamental base for all engineers.	4. Technology disciplines are relatively unique and specialized.
5. Engineering graduate is relatively broad; has an analytical, creative mind challenged by unsolved problems.	5. Technology graduate is relatively specialized; prefers routine, standardized job environment.
6. Engineer uses fundamental and basic knowledge of materials, forces, energy, physical and chemical behavior.	6. Technologist applies this knowledge to operations, equipment components, maintenance procedures.
7. Engineer develops new procedures for use in future.	7. Technologist follows established procedures on current day to day problems.
8. Engineering courses stress underlying theory of subject matter.	8. Technology courses stress physical demonstrations in laboratories and practical applications.
9. Engineers translate basic knowledge of science and mathematics into products, processes, machine structures, systems, and material for use by mankind.	9. Technology generally serves a support role to the engineering profession through state of the art design procedures to produce engineering drawings, machine placement, maintenance procedures, safety practices, etc.

TABLE III (Continued)

9. Engineers translate basic knowledge of science and mathematics into products, processes, machine structures, systems, and material for use by mankind.	9. Technology generally serves a support role to the engineering profession through state of the art design procedures to produce engineering drawings, machine placement, maintenance procedures, safety practices, etc.
10. Engineers may be come Registered Professional Engineers, whose testimony is admissible as "expert evidence" in courts of law.	10. Technologists may become certified as possessing specific skills in certain specific areas, such as safety inspection, tool designer, etc.
11. Upon graduation, an engineer typically requires a period of "training" by his employer, since the engineering program stresses the development of a capacity for professional development and continuing self education.	11. Upon graduation a technologist is typically ready to begin contributing immediately, since he has been trained in relatively current procedures; as new technological advancements occur, the technologist will retrain to keep current.
12. Many engineers move into management positions.	12. The technologist can move into supervisory positions in the plant, since his training emphasized current, production oriented practices.
13. The engineering student can transfer to a technology program from an engineering curriculum with some loss of time.	13. It is more difficult to transfer to an engineering curriculum from a technology program.
14. Graduate study for those having a B.S. in an engineering discipline is available for qualified students.	14. Graduate study in technology is not available at O.S.U. and transfer to engineering programs is difficult. Advanced degrees in technical education and business are possible.

(2) How Engineering Students Choose Their Careers, (3) Engineering and Technology Curriculum Differences, (4) Employment Opportunities for Engineering and Technology Graduates, (5) DETA Characterizations of Engineering and Technology.

This review has indicated that many college bound students enter universities without adequate career guidance. This leads to hastily chosen majors when exploration is still needed. Further, career guidance efforts concerning engineering and technology programs have been inadequate. High school personnel don't know the differences between these two paths and college recruiters have generally come from the ranks of faculty who may have vested interests to protect.

The primary difference between engineering and technology programs is that the engineer makes significantly greater use of mathematics and computer science, while the technologist makes significantly greater use of "hands on" or laboratory activity. The literature further points out that the differences between engineering and technology are sometimes subtle.

Although there is some evidence to the contrary, the recent literature reports that job opportunities tend to follow the curricular training of each program rather closely. Engineering graduates usually work more in analytical, design and research areas. Technology graduates generally work in an applications area of the engineering spectrum and usually in support of an engineer.

In Chapter I, the purposes of the study were defined. The next step was to measure these perceptions and compare the results to the information found in the literature and to the O.S.U. DETA characterizations of the engineering and technology programs.

CHAPTER III

RESEARCH DESIGN

Introduction

The purpose of this research was to measure the perceptions of representative samples of engineering and technology students concerning career choice, curriculum, and employment opportunities. The results of the measurements were used to compare these perceptions between the groups. In addition, comparison was made of the engineering and technology students' perceptions of the characteristics of the engineering and technology programs with the O.S.U. DETA characterizations of the two programs. To accomplish this purpose it was necessary to select the respondents, design and develop the questionnaire, collect the data and analyze the results.

This chapter will explain the procedure for gathering and evaluating the data necessary to determine the perceptions of the groups being studied. The resulting information will aid in providing a profile of the perceptions of engineering and technology students at O.S.U.. The profile should be useful in the advisement and recruitment of current and prospective students.

The Population

The population consisted of a random sample of students from selected groups of students enrolled in engineering and technology at O.S.U. during the fall semester, 1980-81. Students enrolled in engineering were divided into three groups: first semester freshmen, transfers from technology, and seniors who have never transferred from an O.S.U. technology program. Students enrolled in technology were divided into three groups: first semester freshmen, transfers from engineering, and seniors who have never transferred from an O.S.U. engineering program.

The questionnaire was distributed to a random sample of 50 students from each of the six groups. The only exception to this was in the group of students who had transferred to engineering from technology. This group had a total population of only twenty students. The questionnaire was mailed to all 20 students. A second questionnaire was mailed to those students in any group who failed to return the first questionnaire.

A random sample of 30 questionnaires was drawn from the returned questionnaires in five of the six groups. All useable returns were used in the one group that had only 20 students in the total population.

Instrumentation

The Engineering and Technology Survey, shown in the Appendix, was developed as a part of this research. Its purpose was to measure the perceptions needed and provide answers to the research questions asked in Chapter I.

The questionnaire was designed during the review of literature and relied on the questionnaires of several studies to develop the final form. One significant questionnaire that influenced the design of the Engineering and Technology Survey was designed by Willison (33) in 1978. Another study whose questionnaire influenced the design of the present questionnaire should be specifically cited: The American Freshman: National Norms for Fall, 1975 (2). The survey instrument used by the American Freshman study was called the Student Information Form (SIF). The SIF provided initial input information on students entering college as first-time, full-time freshmen. The form has been revised annually since it was initiated in 1966. The format of the SIF was adapted for this study.

The questionnaire includes a section pertaining to the DETA characterizations of engineering and technology. These characterizations of engineering and technology are a set of definitions and guidelines which were developed at a joint engineering and technology faculty retreat at Roman Nose State Park, Watonga, Oklahoma, in 1980.

The questionnaire was reviewed by several faculty in DETA including the Associate Dean, as to its content and structure. This DETA team was utilized to give validity to the questionnaire and to relate an official DETA position statement regarding those questions where the literature reflects conflicting data.

Statistical Procedures

Equal samples were used for each group which allowed for more convient comparisons and statistical manipulation. One group was smaller than the others and, therefore, all useable returns were utilized.

The data were statistically summarized by use of the Statistical Analysis System (SAS) provided by the University Computer Center, Oklahoma State University, Stillwater, Oklahoma.

Frequency analysis and percentage distribution were used to report the descriptive section of the questionnaire. A Chi-square test was used for comparison of the multiple-choice items on the questionnaire. The .05 level was chosen as the minimum level at which the results would be considered significant. The Chi-square test, according to Runyon and Haber (30, p. 247), "may be used to test the null hypothesis that two variables are independent (non-related) in a single sample. The Chi-square is usually applied to nominal data."

A "t" test was used for the numerical rating scaled questions on the questionnaire. The .05 level was again chosen as the minimum level at which the results would be considered significant. The "t" test, according to Van Dalen (32, p. 82) "is the difference between two sample means, measured in terms of the standard error of those means."

Summary

This chapter has considered the design and methodology used in the completion of this research study. Mention was made of the population, instrumentation, and statistical treatment of the data.

Chapter IV will present, analyze, and discuss the data obtained in this investigation in relationship to the research questions developed in Chapter I.

CHAPTER IV

PRESENTATION AND ANALYSIS OF THE DATA

This chapter is devoted to presenting and analyzing the data collected in this study as it applies to the purpose of the study as stated in Chapter I. This chapter is divided into three sections. The first section deals with the questionnaire and the return rate of the groups surveyed. The second section considers the appropriate data needed to answer the first five research questions. The third section is devoted to the last research question which dealt with the DETA characterizations of engineering and technology.

Return Rate of the Questionnaires

The questionnaire was administered by mail and in classrooms to a total of 270 engineering and technology students at Oklahoma State University during the Fall, 1980 semester. The return rates for each group are presented in Table IV. The total return rate was 77 percent for delivered questionnaires. The high return rate was achieved by a follow up letter and questionnaire to those not returning the first questionnaire.

Demographic Data

To achieve part of the total purpose of the study, it was important to collect certain demographic data. Questions one through

TABLE IV

RETURN RATE OF QUESTIONNAIRES ADMINISTERED

Group Number	N mailed	N return	%
1. Technology Freshmen	50	37	74
2. Engineering Freshmen	50	41	82
3. Technology Seniors	50	41	82
4. Engineering Seniors	50	36	72
5. Transfers From Engineering to Technology	50	35	70
6. Transfers From Technology to Engineering	20	18	90
Total	270	208	77

five dealt with the identification of the groups involved in the study. The tabled data from these questions are presented in Tables V thru IX. Presented in Table V are data showing the randomly drawn samples from the returned questionnaires. Chapter III discussed the fact that equal sample sizes were drawn from the returned questionnaires where possible. This procedure allowed for easier comparisons and statistical manipulation.

TABLE V

SAMPLE SIZES USED FOR STATISTICAL EVALUATION

Groups	N	%
1. Technology Freshmen	30	17.86
2. Engineering Freshmen	30	17.86
3. Technology Seniors	30	17.86
4. Engineering Seniors	30	17.86
5. Transfers to Technology	30	17.86
6. Transfers to Engineering	18	10.71
Total	168	100.00

Thirty questionnaires were selected at random from the returns of each group. Group six totalled 18 useable returns from the 20 which were distributed. Further, the sample population resulted in the total use of 78 questionnaires from engineering students and 90 questionnaires from technology students.

Presented in Table VI are data showing the college classification of the students in the study. The seniors sampled were students who had been enrolled in engineering or technology since matriculating. A total of twelve senior respondents answered that they were juniors. These respondents are simply students who began their programs with the remaining seniors but had not progressed to senior status when the questionnaires were returned.

TABLE VI

COLLEGE CLASSIFICATION (QUESTIONS 1 AND 2)

Groups	Freshmen	Sophomore	Junior	Senior
1. Technology Freshmen	30	0	0	0
2. Engineering Freshmen	30	0	0	0
3. Technology Seniors	0	0	3	27
4. Engineering Seniors	0	0	9	21
5. Transfers to Technology	0	6	11	13
6. Transfers to Engineering	1	5	9	3
Total	61	11	32	64
%	36.31	6.55	19.05	38.10

Data presented in Table VII concerns the ethnic origin of the students studied. The study was limited to American respondents.

TABLE VII

ETHNIC ORIGIN (QUESTION 3)

Groups	Oriental	American Indian	Black	Spanish American	All Other
1. Technology Freshmen	0	3	1	1	25
2. Engineering Freshmen	0	0	0	0	30
3. Technology Seniors	0	1	0	0	29
4. Engineering Seniors	0	0	2	0	28
5. Transfers to Technology	0	0	3	0	27
6. Transfers to Engineering	0	1	0	0	17

Presented in Table VIII are the respondents who were from Oklahoma versus out of state.

Every effort was made in this study to insure that the sample composition were new freshmen in engineering and technology, seniors who had never transferred from either program, or transfers from one program to the other. Presented in Table IX are the data concerning the enrollment status of the respondents.

TABLE VIII

RESIDENT STATUS (QUESTION 4)

Groups	Okla. Resident	Out of State
1. Technology Freshmen	30	0
2. Engineering Freshmen	26	4
3. Technology Seniors	26	4
4. Engineering Seniors	30	0
5. Transfers to Technology	29	1
6. Transfers to Engineering	18	0

TABLE IX

ENROLLMENT STATUS (QUESTION 5)

Groups	Transfer EN to Tech.	Transfer Tech. to EN	Been in EN since matriculating	Been in Tech. since matriculating
1. Technology Freshmen	0	0	0	30
2. Engineering Freshmen	0	0	30	0
3. Technology Seniors	0	0	0	30
4. Engineering Seniors	0	0	30	0
5. Transfers to Technology	30	0	0	0
6. Transfers to Engineering	0	18	0	0

Analysis of the Research Questions

This study sought to determine the perceptions of representative samples of engineering and technology students concerning career choice, curriculum and employment opportunities. The results of the measurements were used to compare these perceptions between the groups. In addition, comparison was made of the engineering and technology students' perceptions of the characterisitics of the engineering and technology programs with the O.S.U. D.E.T.A. characterizations of the two programs.

To achieve this goal, it was necessary to answer a set of six research questions. Question one dealt with the factors that influenced students to enter either engineering or technology at O.S.U. Question one is stated below:

1. Is there a significant difference in the way selected factors influenced freshmen in engineering and technology, seniors in engineering and technology, and transfers in engineering and technology on their choice of academic major?

The data for the first research question are presented in Tables X thru XII. These tables represent questions 13 thru 25.

Freshmen

Presented in Table X are data showing the factors that influenced engineering and technology freshmen with their choice of academic major. There were no significant differences in responses of the groups with regard to all but two of the factors shown. "Parental influence" and "influence by a technologist" were both significant at

TABLE X

FACTORS THAT INFLUENCED ENGINEERING AND TECHNOLOGY FRESHMEN WITH CHOICE OF MAJOR (QUESTIONS 13-25)

Factors	Freshmen	No Influence	%	Some Influence	%	Much Influence	%	Chi Square	d.F.	Prob.
A Parent	Technology	17	(57)	10	(33)	3	(10)			
	Engineering	7	(23)	17	(57)	6	(20)	6.981	2	0.0305*
A Relative other than a Parent	Technology	17	(57)	8	(27)	5	(16)			
	Engineering	14	(47)	9	(30)	7	(23)	1.925	3	0.5880
Interest in subject matter	Technology	0		3	(10)	27	(90)			
	Engineering	0		4	(13)	26	(87)	.162	1	0.6876
Number of job opportunities	Technology	0		13	(43)	17	(57)			
	Engineering	0		11	(37)	19	(63)	.278	1	0.5982
Possible starting salaries	Technology	2	(7)	17	(57)	11	(37)			
	Engineering	4	(13)	9	(30)	17	(47)	4.414	2	0.1100
A Friend	Technology	19	(63)	7	(23)	4	(13)			
	Engineering	18	(60)	11	(37)	1	(3)	2.716	2	0.2572
A High School Teacher	Technology	25	(83)	4	(13)	1	(3)			
	Engineering	20	(67)	8	(27)	2	(7)	2.222	2	0.3292
A High School Counselor	Technology	22	(73)	7	(23)	1	(3)			
	Engineering	22	(73)	7	(23)	1	(3)	0.000	2	1.0000
Someone from a college	Technology	17	(57)	11	(37)	2	(7)			
	Engineering	15	(50)	13	(43)	2	(7)	.292	2	0.8643
Information obtained from a college	Technology	10	(33)	15	(50)	5	(17)			
	Engineering	6	(20)	18	(60)	6	(20)	1.364	2	0.5057
An Engineer	Technology	21	(70)	5	(17)	4	(13)			
	Engineering	15	(50)	5	(17)	10	(33)	3.571	2	0.1677
A Technologist	Technology	19	(63)	4	(13)	7	(23)			
	Engineering	27	(90)	3	(10)	0		8.534	2	0.0140*
Summer Job	Technology	17	(57)	9	(30)	4	(13)			
	Engineering	20	(67)	8	(27)	2	(7)	.969	2	0.6161

*significant

the .05 level using the Chi-square test. Seventy-seven percent of the engineering freshmen reported that parents had some or much influence on their choice of major, versus only 43 percent of the technology freshmen. Thirty-six percent of the technology freshmen reported that a "technologist" had some or much influence on their choice of major, versus only 10 percent of the engineering freshmen. It should be noted that "a technologist" was not an influence of major choice in greater than 50 percent of both groups.

"Interest in the subject matter" was the factor most influential in choice of major by both freshmen groups. Ninety percent of the technology freshmen, versus 87 percent of the engineering freshmen stated that "interest in the subject matter" had much influence over their choice of majors.

The data from Table X indicate that high school teachers, counselors, and college representatives, were all very insignificant in their influence on choice of major by freshmen. The results of the present study with freshmen are in contrast to the Alden (1, p. 33) study which indicated that "no factor other than family influence stood out strongly affecting the career choice of students who reported to be going on to pursue an engineering or technology degree."

Seniors

Summarized in Table XI are data showing the factors that influenced engineering and technology seniors with their choice of academic major. "A high school teacher" was the only factor which was significant at the .05 level. Sixty percent of the engineering seniors

TABLE XI

FACTORS THAT INFLUENCED ENGINEERING AND TECHNOLOGY SENIORS WITH CHOICE OF MAJOR (QUESTIONS 13-25)

Factors	Freshmen	No Influence	%	Some Influence	%	Much Influence	%	Chi Square	d.F.	Prob.
A Parent	Technology	12	(40)	14	(47)	4	(13)			
	Engineering	8	(27)	15	(50)	7	(23)	1.653	2	0.4377
A Relative other than a Parent	Technology	15	(50)	13	(43)	2	(7)			
	Engineering	16	(53)	14	(47)	0		2.069	2	0.3554
Interest in subject matter	Technology	0		4	(13)	26	(87)			
	Engineering	0		2	(7)	28	(93)	.741	1	0.3894
Number of job opportunities	Technology	3	(10)	10	(33)	17	(57)			
	Engineering	2	(7)	12	(40)	16	(53)	.412	2	0.8138
Possible starting salaries	Technology	5	(17)	14	(47)	11	(37)			
	Engineering	3	(10)	9	(30)	18	(60)	3.277	2	0.1943
A Friend	Technology	19	(63)	9	(30)	2	(7)			
	Engineering	21	(70)	8	(27)	1	(3)	.492	2	0.7819
A High School Teacher	Technology	25	(83)	4	(13)	1	(3)			
	Engineering	12	(40)	14	(47)	4	(13)	11.923	2	0.0026*
A High School Counselor	Technology	28	(93)	2	(7)	0				
	Engineering	24	(80)	5	(17)	1	(3)	2.593	2	0.2734
Someone from a college	Technology	23	(77)	6	(20)	1	(3)			
	Engineering	20	(67)	9	(30)	1	(3)	.809	2	0.6672
Information obtained from a college	Technology	11	(37)	13	(43)	6	(20)			
	Engineering	11	(37)	15	(50)	4	(13)	.543	2	0.7623
An Engineer	Technology	23	(77)	5	(17)	2	(7)			
	Engineering	15	(50)	11	(37)	4	(13)	4.601	2	0.1002
A Technologist	Technology	24	(80)	3	(10)	3	(10)			
	Engineering	28	(93)	2	(7)	0		3.508	2	0.1731
Summer Job	Technology	17	(57)	9	(30)	4	(13)			
	Engineering	23	(77)	7	(23)	0		5.150	2	0.0762

*significant

reported that "a high school teacher" had some or much influence on their choice of major versus only 16 percent of the technology seniors.

"Interest in the subject matter" was the factor most influential in choice of major by both senior groups. Ninety-three percent of the engineering seniors, versus 87 percent of the technology seniors stated that "interest in the subject matter" had much influence over their choice of major.

"A high school counselor" was the one factor having the least amount of influence on the technology seniors. Ninety-three percent stated that "a high school counselor" had no influence on their choice of major, versus only 80 percent for engineering seniors. "A technologist" was the one factor having the least amount of influence on the engineering seniors. Ninety-three percent stated that "a technologist" had no influence on their choice of major, versus 80 percent of the technology seniors.

The results of the present study with seniors are in contrast to the Alden (1, p. 33) study which indicated that "no factor other than family influence stood out strongly affecting career choice of students going on to pursue an engineering or technology degree."

Transfers

Presented in Table XII are data showing the factors that influenced transfers to engineering and to technology with their choice of academic major. There were no significant differences between any of the responses of the engineering and technology transfers.

TABLE XII

FACTORS THAT INFLUENCED ENGINEERING AND TECHNOLOGY TRANSFERS WITH CHOICE OF MAJOR (QUESTIONS 13-25)

Factors	Freshmen	No Influence	%	Some Influence	%	Much Influence	%	Chi Square	d.F.	Prob.
A Parent	Technology	11	(37)	14	(47)	5	(17)			
	Engineering	8	(44)	9	(50)	1	(6)	1.309	2	0.5197
A Relative other than a Parent	Technology	18	(60)	11	(37)	1	(3)			
	Engineering	8	(44)	9	(50)	1	(6)	1.116	2	0.5724
Interest in subject matter	Technology	1	(3)	6	(20)	23	(77)			
	Engineering	0		3	(17)	15	(83)	.730	2	0.6943
Number of job opportunities	Technology	2	(7)	13	(43)	15	(50)			
	Engineering	1	(6)	4	(22)	13	(72)	2.390	2	0.3027
Possible starting salaries	Technology	1	(3)	17	(57)	12	(40)			
	Engineering	1	(6)	7	(39)	10	(56)	1.438	2	0.4871
A Friend	Technology	12	(40)	13	(43)	5	(17)			
	Engineering	7	(39)	9	(50)	2	(11)	.351	2	0.8392
A High School Teacher	Technology	22	(73)	5	(17)	3	(10)			
	Engineering	16	(89)	2	(11)	0		2.382	2	0.3039
A High School Counselor	Technology	25	(83)	4	(13)	1	(3)			
	Engineering	15	(83)	3	(17)	0		.686	2	0.7097
Someone from a college	Technology	15	(50)	13	(43)	2	(7)			
	Engineering	12	(67)	5	(28)	1	(6)	1.304	2	0.5211
Information obtained rom a college	Technology	13	(43)	13	(43)	4	(13)			
	Engineering	9	(50)	6	(33)	3	(17)	.479	2	0.7870
An Engineer	Technology	17	(57)	5	(17)	8	(27)			
	Engineering	9	(50)	6	(33)	3	(17)	1.947	2	0.3778
A Technologist	Technology	17	(57)	5	(17)	8	(27)			
	Engineering	13	(72)	4	(22)	1	(6)	3.295	2	0.1925
Summer Job	Technology	16	(53)	5	(17)	9	(30)			
	Engineering	13	(72)	3	(17)	2	(11)	2.669	2	0.2633

"Interest in the subject matter" was the factor most influential in choice of major by both transfers groups. Eighty-three percent of the transfers to engineering, versus 77 percent of the transfers to technology stated that "interest in the subject matter" had much influence over their choice of major.

As was the case with freshmen and seniors, the transfer groups reported that high school teachers and counselors were not a significant force in their choosing a major. The literature offered by O'Bryant (26) indicates that students interested in engineering and technology must seek information from school counselors and teachers who have little understanding of the engineering career spectrum. Influence by "someone from a college" or "information obtained from a college" appears to have more impact on major choice than either high school teachers or counselors. Further data in Tables X, XI, and XII, show, in contrast to the Alden (1) study, "interest in the subject matter," "the number of job opportunities," and "possible starting salaries," are all important in effecting career choice of engineering and technology students.

Engineering Curricula

Research question two dealt with perceptions of the engineering curricula. Question two is stated below:

1. Is there a significant difference in the way the engineering curricula is perceived by freshmen in engineering and technology, seniors in engineering and technology, and transfers in engineering and technology?

Tables XIII thru XX show the data for questions dealing with the engineering curricula. These questions are: 11, 12, 27, 29, 30, 32, 45, and 48.

Presented in Table XIII are data concerning question eleven. The question concerned perceptions of the first mathematics course which meets degree requirements in engineering. According to DETA, "calculus" is the first mathematics course required in engineering.

The data show that there was a significant difference between the two groups of freshmen and the two groups of seniors, using the Chi-square test. There was no significant difference between the two groups of transfers. Eighty percent of the engineering freshmen perceived "calculus" as the first mathematics course required in engineering, versus only 20 percent of the technology freshmen. Ninety percent of the engineering seniors perceived "calculus," versus 53 percent of the technology seniors. Seventy-eight percent of the transfers to engineering perceived "calculus," versus 53 percent of the transfers to technology.

Table XIV shows the results concerning question 12. The question concerned perceptions of the last mathematics course required in engineering. According to DETA, linear algebra is the last mathematics course required in engineering.

The data show that there was no significant difference in perceptions between the two groups of freshmen and the two groups of transfers. There was a significant difference between the two groups of seniors. Ninety percent of the engineering seniors perceived "linear algebra," versus 60 percent of the technology seniors. It

TABLE XIII

STUDENTS' PERCEPTIONS OF: THE FIRST MATHEMATICS COURSE REQUIRED IN ENGINEERING (QUESTION 11)

Groups	No Response	%	Algebra	%	Trigonometry	%	Calculus	%	Differential Equations	%	Linear Algebra	%	Chi Square	DF	Prob.
Technology Freshmen	1	(3)	16	(53)	7	(23)	6	(20)	0		0				
Engineering Freshmen	0		3	(10)	3	(10)	24	(80)	0		0		21.284	2	0.0001*
Technology Seniors	2	(7)	10	(33)	2	(7)	16	(53)	0		0				
Engineering Seniors	0		3	(10)	0		27	(90)	0		0		8.524	2	0.0141*
Transfers To Technology	0		8	(27)	6	(20)	16	(53)	0		0				
Transfers To Engineering	0		3	(17)	1	(5)	14	(78)	0		0		3.176	2	0.2043

*significant

TABLE XIV

STUDENTS' PERCEPTIONS OF: THE LAST MATHEMATICS COURSE REQUIRED IN ENGINEERING (QUESTION 12)

Groups	No Response	%	Algebra	%	Trigonometry	%	Calculus	%	Differential Equations	%	Linear Algebra	%	Chi Square	DF	Prob.
Technology Freshmen	1	(3)	0		6	(20)	4	(13)	19	(64)	0				
Engineering Freshmen	0		1	(3)	0		5	(17)	24	(80)	0		7.678	3	0.0532
Technology Seniors	2	(7)	0		0		0		10	(33)	18	(60)			
Engineering Seniors	0		0		0		0		3	(10)	27	(90)	5.507	1	0.0189*
Transfers To Technology	0		0		0		1	(3)	10	(33)	19	(64)			
Transfers To Engineering	0		0		0		1	(6)	2	(11)	15	(83)	2.991	2	0.2242

*significant

should be noted that none of the freshmen perceived linear algebra to be the last mathematics course required in engineering.

The data from question 27 are presented in Table XV. The question dealt with perceptions of when an engineering student begins the course work in a specialty area. According to DETA, an engineering student begins work in a specialty area as a junior.

The data show that there was a significant difference in perceptions between the two groups of freshmen and the two groups of seniors. Ninety-three percent of the engineering freshmen perceived "junior year," versus only 37 percent of the technology freshmen. Ninety-three percent of the engineering seniors perceived "junior year," versus 57 percent of the technology seniors. There was no significant difference between the two groups of transfers.

Presented in Table XVI are data concerning question 29. The question concerned the grade point average, (g.p.a.) required to enter the "professional school" in engineering at O.S.U. According to DETA, a cumulative g.p.a. of at least a 2.30 is required for admission to the professional school."

The data show that there was no significant difference in perceptions between the two groups of freshmen and the two groups of transfers. There was a significant difference in the perceptions of the two groups of seniors. Sixty percent of the engineering seniors perceived a "2.3" as the g.p.a. required to enter professional school, versus 27 percent of the technology seniors. It should be noted that only 10 percent of the technology freshmen and 17 percent of the engineering freshmen perceived "2.3".

TABLE XV

STUDENTS' PERCEPTIONS OF: WHEN AN ENGINEERING STUDENT BEGINS COURSE WORK IN A SPECIALTY AREA (QUESTION 27)

Groups	Freshman Year	%	Sophomore Year	%	Junior Year	%	Senior Year	%	Don't Know	%	Chi Square	DF	Prob.
Technology Freshmen	5	(17)	5	(17)	11	(37)	1		8	(26)			
Engineering Freshmen	0		2	(7)	28	(93)	0		0		22.696	4	0.0001*
Technology Seniors	5	(17)	4	(13)	17	(57)	0		4	(13)			
Engineering Seniors	0		2	(7)	28	(93)	0		0		12.356	3	0.0063*
Transfers To Technology	0		6	(20)	23	(77)	1	(3)	0				
Transfers To Engineering	0		1	(6)	17	(94)	0		0		2.636	2	0.2676

*significant

TABLE XVI

STUDENTS' PERCEPTIONS OF: THE G.P.A. REQUIRED FOR ADMISSION TO THE PROFESSIONAL SCHOOL IN ENGINEERING (QUESTION 29)

Groups	2.0 GPA	%	2.3 GPA	%	2.6 GPA	%	2.9 GPA	%	3.2 GPA	%	Don't Know	%	Chi Square	DF	Prob.
Technology Freshmen	9	(30)	3	(10)	2	(7)	1		1	(3)	14	(47)			
Engineering Freshmen	6	(20)	5	(17)	6	(20)	0		0		13	(43)	5.137	5	0.3994
Technology Seniors	7	(23)	8	(27)	2	(7)	0		0		13	(43)			
Engineering Seniors	6	(20)	18	(60)	4	(13)	0		0		2	(7)	12.656	3	0.0054*
Transfers To Technology	6	(20)	11	(37)	3	(10)	1	(3)	0		9	(30)			
Transfers To Engineering	6	(33)	9	(50)	2	(11)	0		0		1	(6)	5.120	4	0.2752

*significant

Data for questions 30 and 32 were analyzed by use of the "t" test. according to VanDalen (32, p. 82) "the "t" test is used to determine if the mean response of two groups are significantly different. Further, "t" is the difference between two samples means, measured in terms of the standard error of those means."

Table XVII presents the data concerning question 30. The students were asked to rate, on a scale of 1-9 (with 1 being low, and 9 being high) their perceptions of the amount of analytical design work taught in engineering. According to DETA, the engineering curricula stresses the teaching of a high amount of analytical design work.

The data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. If should be noted that engineering seniors perceived the amount of analytical design work taught in engineering to be 6.1. This figure is somewhat less than data reported for the other groups.

Presented in Table XVIII are data concerning question 32. The question concerned perceptions of the amount of practical applications taught in engineering. According to DETA, technology education places laboratory emphasis on practical applications. Those courses in engineering that do contain laboratory work show a strong orientation toward expriementation and research.

The data in Table XVIII show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. It should be noted that the engineering freshmen, seniors, and transfers, perceived the teaching of a higher amount of practical applications in the engineering

TABLE XVII

A SUMMARY OF "t" TEST DATA ON THE AMOUNT OF ANALYTICAL DESIGN WORK TAUGHT IN ENGINEERING (QUESTION 30)

Groups	N	Mean	Prob. > |T|
Technology Freshmen	30	6.96666667	
Engineering Freshmen	30	7.16666667	0.6518
Technology Seniors	30	6.90000000	
Engineering Seniors	30	6.10000000	0.0851
Transfers to Technology	30	7.00000000	
Transfers to Engineering	18	6.88888889	0.8383

TABLE XVIII

A SUMMARY OF "t" TEST DATA ON THE AMOUNT OF PRACTICAL APPLICATIONS TAUGHT IN ENGINEERING (QUESTION 32)

Groups	N	Mean	Prob. > |T|
Technology Freshmen	30	5.96666667	
Engineering Freshmen	30	6.46666667	0.3135
Technology Seniors	30	4.50000000	
Engineering Seniors	30	5.26666667	0.1200
Transfers to Technology	30	4.33333333	
Transfers to Engineering	18	4.94444444	0.3797

curricula as did the technology groups. Freshmen engineering students perceived a mean of 6.46. This mean was higher than any of the other groups.

Table XIX presents data concerning question 45. The question concerned perceptions of which curriculum, engineering or technology, is most likely to require students to take a common set of courses. According to DETA, the engineering curriculum is most likely to require students to take a common set of courses.

The data show that there was a significant difference in perceptions between the two groups of freshmen. Thirty percent of the engineering freshmen perceived "engineering," versus 20 percent of the technology freshmen. It should be noted that 50 percent of the technology freshmen perceived "both" curricula as requiring a common set of courses and 30 percent perceived "technology." Forty percent of the engineering freshmen perceived "technology." There was no significant difference between the two groups of seniors and the two groups of transfers. With the exception of engineering seniors, less than 50 percent of the seniors and transfers perceived engineering as the curriculum most likely to require a common set of courses.

Presented in Table XX are data concerning question 48. The question concerned perceptions of which programs laboratory work shows a strong orientation towards experimentation and research. As previously mentioned, the engineering laboratories show a strong orientation towards experimentation and research.

The data show that there was a significant difference in the perceptions of the two groups of freshmen. There was no significant difference between the two groups of seniors and the two groups of

TABLE XIX

STUDENTS' PERCEPTIONS OF: WHICH CURRICULUM IS MOST LIKELY TO REQUIRE STUDENTS TO TAKE A COMMON SET OF COURSES (QUESTION 45)

Groups	No Response	%	Engineering	%	Technology	%	Both	%	Neither	%	Chi Square	DF	Prob.
Technology Freshmen	0		6	(20)	9	(30)	15	(50)	0				
Engineering Freshmen	1	(3)	9	(30)	12	(40)	5	(17)	3	(10)	9.014	3	0.0291*
Technology Seniors	0		13	(43)	5	(17)	10	(33)	2	(7)			
Engineering Seniors	0		16	(53)	5	(17)	9	(30)	0		2.363	3	0.5006
Transfers To Technology	0		11	(37)	4	(13)	14	(47)	1	(3)			
Transfers To Engineering	0		8	(44)	2	(11)	6	(33)	2	(11)	1.785	3	0.6181

*significant

TABLE XX

STUDENTS' PERCEPTIONS OF: WHICH PROGRAMS LABABORATORY WORK SHOWS A STRONG ORIENTATION TOWARDS EXPERIMENTATION AND RESEARCH (QUESTION 48)

Groups	No Response	%	Engineering	%	Technology	%	Both	%	Neither	%	Chi Square	DF	Prob.
Technology Freshmen	0		19	(63)	6	(20)	5	(17)	0				
Engineering Freshmen	0		27	(90)	0		3	(10)	0		7.891	2	0.0193*
Technology Seniors	0		15	(50)	8	(27)	5	(17)	2	(6)			
Engineering Seniors	0		20	(66)	5	(17)	5	(17)	0		3.407	3	0.3331
Transfers To Technology	0		12	(40)	13	(43)	4	(13)	1	(3)			
Transfers To Engineering	0		12	(67)	2	(10)	3	(17)	2	(6)	5.557	3	0.1353

*significant

transfers. Ninety percent of the engineering freshmen perceived "engineering," versus 63 percent of the technology freshmen. Twenty percent of the technology freshmen perceived "technology," versus none of the engineering freshmen. It should be noted that 17 percent of engineering and technology seniors perceived "both."

Technology Curricula

Research question three dealt with perceptions of the technology curricula. Question three is stated below:

3. Is there a significant difference in the way the technology curricula is perceived by freshmen in engineering and technology, seniors in engineering and technology, and transfers in engineering and technology?

Tables XXI thru XXX show the data for questions dealing with the technology curricula. These questions are: 9, 10, 28, 31, 33, 46, 47, 49, 52, and 53.

The students were asked to give their perceptions of what is the first mathematics couse which meets degree requirements in technology. The results are reported in Table XXI. According to DETA, "algebra" is the first mathematics course required in technology.

The data show that there was a significant difference in perceptions between the two groups of freshmen and the two groups of seniors. There was no significant difference in perceptions between the two groups of transfers. Ninety percent of the technology freshmen perceived "algebra" as the first math course required in technology, versus only 50 percent of the engineering freshmen. One hundred percent of the technology seniors perceived "algebra" versus 60 percent

TABLE XXI

STUDENTS' PERCEPTIONS OF: THE FIRST MATHEMATICS COURSE REQUIRED IN TECHNOLOGY (QUESTION 9)

Groups	No Response	%	Algebra	%	Trigonometry	%	Calculus	%	Differential Equations	%	Linear Algebra	%	Chi Square	DF	Prob.
Technology Freshmen	1	(3)	27	(90)	2	(7)	0		0		0				
Engineering Freshmen	2	(7)	15	(50)	10	(33)	3	(10)	0		0		11.748	2	0.0028*
Technology Seniors	0		30	(100)	0		0		0		0				
Engineering Seniors	3	(10)	18	(60)	7	(24)	2	(6)	0		0		11.875	2	0.0026*
Transfers To Technology	0		24	(80)	5	(17)	1	(3)	0		0				
Transfers To Engineering	0		14	(78)	2	(11)	2	(11)	0		0		1.334	2	0.5132

*significant

of the engineering seniors. Eighty percent of the transfers to technology perceived "algebra," versus 78 percent of the transfers to engineering.

Table XXII presents data concerning question 10. The question concerned perceptions of the last mathematics course required in technology. According to DETA, "calculus" is the last mathematics course required in technology. The data show that there was a significant difference between the perceptions of the two groups of freshmen. There was no significant difference between the two groups of seniors and the two groups of transfers. Eighty-eight percent of the technology freshmen perceived "calculus" to be the last mathematics course required in technology, versus only 47 percent of the engineering freshmen.

The IEEE (14) study pointed out that technology students normally terminate their mathematics preparation with a six semester hour applied calculus sequence. Engineering students add two or more additional mathematics courses to a 10 hour calculus sequence.

Presented in Table XXIII are data concerning question 28. The question concerned perceptions of when a technology student begins course work in a specialty area. According to DETA, a technology student begins course work in his specialty area in the freshman year. The IEEE (14) study, explains that during the first two years of study, the engineering student is much more occupied with liberal studies while obtaining the appropriate math and science background whereas the technology student is proceeding directly into technical courses.

The data show that there was a significant difference in perceptions between the two groups of freshmen and the two groups of

TABLE XXII

STUDENTS' PERCEPTIONS OF: THE LAST MATHEMATICS COURSE REQUIRED IN TECHNOLOGY (QUESTION 10)

Groups	No Response	%	Algebra	%	Trigonometry	%	Calculus	%	Differential Equations	%	Linear Algebra	%	Chi Square	DF	Prob.
Technology Freshmen	1	(3)	0		1	(3)	26	(88)	1	(3)	1	(3)			
Engineering Freshmen	2	(7)	1	(3)	0		14	(47)	8	(27)	5	(17)	13.698	4	0.0083
Technology Seniors	0		0		0		29	(97)	0		1	(3)			
Engineering Seniors	3	(10)	0		2	(7)	24	(80)	0		1	(3)	2.320	2	0.3135
Transfers To Technology	0		0		0		26	(87)	2	(7)	2	(7)			
Transfers To Engineering	0		0		0		14	(78)	3	(17)	1	(5)	1.209	2	0.5464

TABLE XXIII

STUDENTS' PERCEPTIONS OF: WHEN A TECHNOLOGY STUDENT BEGINS COURSE WORK IN A SPECIALTY AREA (QUESTION 28)

Groups	Freshman Year	%	Sophomore Year	%	Junior Year	%	Senior Year	%	Don't Know	%	Chi Square	DF	Prob.
Technology Freshmen	21	(70)	7	(23)	2	(7)	0		0				
Engineering Freshmen	7	(23)	11	(37)	5	(17)	0		7	(23)	16.175	3	0.0010*
Technology Seniors	22	(73)	8	(27)	0		0		0				
Engineering Seniors	7	(23)	7	(23)	4	(13)	0		12	(40)	23.825	3	0.0001*
Transfers To Technology	20	(67)	5	(17)	5	(17)	0		0				
Transfers To Engineering	11	(61)	3	(17)	4	(22)	0		0		.239	2	0.8874

*significant

seniors. There was no significant difference between the two groups of transfers. Seventy percent of the technology freshmen perceived "freshmen year" as the point when a technology student begins course work in a specialty area, versus only 23 percent of the engineering freshmen. Seventy-three percent of the technology seniors perceived "freshman year," versus 23 percent of the engineering seniors.

Table XXIV presents data concerning question 31. The question concerned perceptions of the amount of analytical design work taught in technology. The ASEE study indicated that "the ability to design is the professional hallmark of the engineer. Engineering Technology education developes a capacity to achieve a practical result based upon an engineering design" (6, p. 8).

The data show that there was a significant difference in the perceptions of the two groups of seniors and the two groups of transfers. There was no significant difference between the two groups of freshmen. Technology seniors perceived a mean ranking of 5.33 on the 1-9 scale, versus a mean of 4.53 for engineering seniors. Transfers to technology perceived a rank of 5.80, versus 4.38 for transfers to engineering. It should be noted that none of the groups perceived a ranking higher than 5.80.

Presented in Table XXV are data concerning question 33. The question concerned perceptions of the amount of practical applications taught in technology. According to DETA, the technology curriculum places stress on the considerable amount of practical applications taught.

TABLE XXIV

A SUMMARY OF "t" TEST DATA ON THE AMOUNT OF ANALYTICAL DESIGN WORK TAUGHT IN TECHNOLOGY (QUESTION 31)

Groups	N	Mean	Prob. > |T|
Technology Freshmen	30	5.30000000	
Engineering Freshmen	30	5.06666667	0.6475
Technology Seniors	30	5.33333333	
Engineering Seniors	30	4.53333333	0.0478*
Transfers to Technology	30	5.80000000	
Transfers to Engineering	18	4.38888889	0.0155*

*significant

TABLE XXV

A SUMMARY OF "T" TEST DATA ON THE AMOUNT OF PRACTICAL APPLICATIONS TAUGHT IN TECHNOLOGY (QUESTION 33)

Groups	N	Mean	Prob. > |T|
Technology Freshmen	30	7.10000000	
Engineering Freshmen	30	7.00000000	0.8350
Technology Seniors	30	7.83333333	
Engineering Seniors	30	6.56666667	0.0001*
Transfers to Technology	30	8.10000000	
Transfers to Engineering	18	6.83333333	0.0216*

*significant

The data show that there was a significant difference in the perceptions of the two groups of seniors and the two groups of transfers. There was no significant difference in the perceptions of the two groups of freshmen. Technology seniors perceived a mean ranking of 7.83, versus 6.56 for the engineering seniors. This data is very significant at the .05 level. Transfers to technology perceived a mean ranking of 8.10, versus 6.83 for transfers to engineering. It should be noted that the 8.0 ranking by the transfers to technology was the highest ranking perceived for this question.

In question 46, the students were asked to give their perception of which program, engineering or technology, require laboratories in most courses. The results are reported in Table XXVI. According to DETA, most courses in technology have laboratories associated with them.

The data show that there was a significant difference in perceptions between the two groups of seniors. There was no significant difference in perceptions between the two groups of freshmen and the two groups of transfers. Seventy-seven percent of the technology seniors perceived "technology," versus 50 percent of the engineering seniors. It should be noted that nearly half of the freshmen in engineering and technology perceived "both" as their response. Seventy-three percent of the transfers to technology perceived "technology," versus 44 percent of the transfers to engineering.

Presented in Table XXVII are data concerning question 47. The question concerned perceptions of which curriculum requires the least mathematics and science courses. According to DETA, the "technology" curriculum requires the least mathematics and science courses.

TABLE XXVI

STUDENTS' PERCEPTIONS OF: MOST COURSES IN WHICH CURRICULUM HAVE LABORATORIES ASSOCIATED WITH THEM (QUESTION 46)

Groups	No Response	%	Engineering	%	Technology	%	Both	%	Neither	%	Chi Square	DF	Prob.
Technology Freshmen	0		1	(3)	14	(47)	14	(47)	1	(3)			
Engineering Freshmen	0		5	(17)	13	(43)	12	(40)	0		3.858	3	0.2773
Technology Seniors	0		0		23	(77)	7	(23)	0				
Engineering Seniors	0		4	(13)	15	(50)	11	(37)	0		6.573	2	0.0374*
Transfers To Technology	0		1	(3)	22	(73)	7	(23)	0				
Transfers To Engineering	0		3	(17)	8	(44)	7	(39)	0		4.836	2	0.0891

*significant

TABLE XXVII

STUDENTS' PERCEPTIONS OF: WHICH CURRICULUM REQUIRES THE LEAST MATHEMATICS AND SCIENCE COURSES (QUESTION 47)

Groups	No Response	%	Engineering	%	Technology	%	Both	%	Neither	%	Chi Square	DF	Prob.
Technology Freshmen	0		0		24	(80)	1	(3)	5	(17)			
Engineering Freshmen	0		2	(7)	24	(80)	1	(3)	3	(10)	2.500	3	0.4753
Technology Seniors	0		0		28	(93)	1	(3)	1	(3)			
Engineering Seniors	0		1	(3)	23	(77)	0		6	(20)	6.062	3	0.1087
Transfers To Technology	0		0		27	(90)	1	(3)	2	(7)			
Transfers To Engineering	0		0		16	(89)	0		2	(11)	.868	2	0.6478

The data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. It should be noted that a high proportion of respondents in all groups perceived "technology."

Table XXVIII shows the results of question 49. This question concerned perceptions of which programs laboratory work shows a strong orientation towards working models and production equipment.

The data show that there was no significant difference between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. It should be noted that a fairly high proportion of respondents in all groups perceived "technology."

Table XXIX presents data concerning question 52. The question concerned perceptions of whether a technology program is virtually the same as an engineering program, only easier. The review of literature describes the findings of a recent DETA workshop and concludes that:

> the primary differences between Engineering and Technology Bachelor of Science degree programs at O.S.U. are: 1. The significantly greater use of mathematics and computer methods in engineering, and 2. the significantly greater 'hands on' laboratory activity in technology (20, p. 2).

The data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. It should be noted that well over 50 percent of each group either mildly or strongly disagreed.

Presented in Table XXX are data concerning question 53. The question concerned perceptions of whether the technology curriculum at O.S.U. is similar in nature to the state Vo-Tech programs.

The data show that there was a significant difference in perceptions between the two groups of seniors. Seventy-four percent

TABLE XXVIII

STUDENTS' PERCEPTIONS OF: WHICH PROGRAMS LABORATORY WORK SHOWS A STRONG ORIENTATION TOWARDS WORKING MODELS AND PRODUCTION EQUIPMENT (QUESTION 49)

Groups	No Response	%	Engineering	%	Technology	%	Both	%	Neither	%	Chi Square	DF	Prob.
Technology Freshmen	0		4	(13)	23	(77)	3	(10)	0				
Engineering Freshmen	0		5	(17)	20	(67)	5	(17)	0		.820	2	0.6635
Technology Seniors	0		4	(13)	21	(70)	5	(17)	0				
Engineering Seniors	0		4	(13)	23	(77)	3	(10)	0		.591	2	0.7442
Transfers To Technology	0		2	(7)	23	(77)	4	(13)	1	(3)			
Transfers To Engineering	0		4	(22)	10	(56)	3	(17)	1	(3)	3.126	3	0.3726

TABLE XXIX

STUDENTS' PERCEPTIONS OF: WHETHER A TECHNOLOGY PROGRAM IS VIRTUALLY THE SAME AS AN ENGINEERING PROGRAM, ONLY EASIER (QUESTION 52)

Groups	Strongly Agree	%	Mildly Agree	%	Mildly Disagree	%	Strongly Disagree	%	No Opinion	%	Chi Square	DF	Prob.
Technology Freshmen	3	(10)	5	(17)	8	(27)	13	(43)	1	(3)			
Engineering Freshmen	1	(3)	5	(17)	12	(40)	10	(33)	2	(7)	2.525	4	0.6402
Technology Seniors	1	(3)	7	(23)	8	(27)	13	(43)	1	(3)			
Engineering Seniors	2	(7)	6	(20)	11	(37)	9	(30)	2	(7)	1.945	4	0.7460
Transfers To Technology	2	(7)	8	(27)	8	(27)	12	(40)	0				
Transfers To Engineering	1	(3)	4	(22)	4	(22)	7	(39)	2	(11)	3.537	4	0.4723

TABLE XXX

STUDENTS' PERCEPTIONS OF: WHETHER THE TECHNOLOGY CURRICULUM IS SIMILAR IN NATURE TO THE STATE VO-TECH PROGRAMS (QUESTION 53)

Groups	Strongly Agree	%	Mildly Agree	%	Mildly Disagree	%	Strongly Disagree	%	No Opinion	%	Chi Square	DF	Prob.
Technology Freshmen	2	(7)	4	(13)	6	(20)	8	(27)	10	(33)			
Engineering Freshmen	2	(7)	8	(27)	9	(30)	5	(17)	6	(20)	3.626	4	0.4590
Technology Seniors	0		2	(7)	2	(7)	20	(67)	6	(20)			
Engineering Seniors	0		8	(27)	5	(17)	7	(23)	10	(33)	12.145	3	0.0069*
Transfers To Technology	0		3	(10)	5	(17)	14	(47)	8	(27)			
Transfers To Engineering	0		2	(11)	4	(22)	6	(33)	6	(33)	.850	3	0.8375

*significant

percent of the technology seniors perceived mildly or strongly disagree, versus only 40 percent of the engineering seniors. It is important to note that 47 percent of the freshmen in both groups either mildly or strongly disagreed. The remainder either agreed or had no opinion.

Employment Opportunities For Engineers

Research question four dealt with perceptions of the employment opportunities for engineers. Question four is stated below:

4. Is there a significant difference in the way the employment opportunities for engineers are perceived by freshmen in engineering and technology, seniors in engineering and technology, and transfers in engineering and technology?

Tables XXXI thru XXXV show the data for questions dealing with the employment opportunities for engineers. These questions are: 34, 36, 38, 41, and 42.

Presented in Table XXXI are data concerning question 34. The question concerned perceptions of the amount of time an engineer spends in field work.

On the 1-9 scale, the data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. It should be noted that technology freshmen and seniors had a higher mean perception than did their engineering counterparts.

In question 36, the students were asked to rate the prestige level of an engineer. The results are reported in Table XXXII.

TABLE XXXI

A SUMMARY OF "t" TEST DATA ON THE AMOUNT OF TIME AN ENGINEER SPENDS IN FIELD WORK (QUESTION 34)

Groups	N	Mean	Prob. > |T|
Technology Freshmen	30	4.93333333	
Engineering Freshmen	30	4.50000000	0.3412
Technology Seniors	30	4.36666667	
Engineering Seniors	30	4.23333333	0.7527
Transfers to Technology	30	4.10000000	
Transfers to Engineering	18	4.94444444	0.1870

TABLE XXXII

A SUMMARY OF "t" TEST DATA ON THE PRESTIGE LEVEL OF THE ENGINEER (QUESTION 36)

Groups	N	Mean	Prob. > |T|
Technology Freshmen	30	7.96666667	
Engineering Freshmen	30	8.06666667	0.7273
Technology Seniors	30	7.40000000	
Engineering Seniors	30	7.56666667	0.5367
Transfers to Technology	30	7.90000000	
Transfers to Engineering	18	7.55555556	0.2390

The data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. It should be noted that engineering and technology seniors perceive the prestige level of an engineer to be lower than that perceived by both freshmen groups and by transfers to engineering.

In question 38, the students were asked to respond to whether engineering or technology graduates are best utilized in research and design functions. The results are reported in Table XXXIII.

According to an IEEE (14) study, engineering programs are intended to prepare graduates for the practice of engineering closest to the research, development and design functions. Although there are exceptions cited in the literature, DETA reports that the job opportunities of the O.S.U. engineering and technology graduates appear to be following their respective educational backgrounds fairly closely. That is to say, the engineering graduates generally are best utilized in research and design functions.

The data show that there was no significant difference in perceptions between the two groups of freshmen and the two groups of seniors. There was a significant difference in perceptions between the two groups of transfers. Eighty-nine percent of the transfers to engineering, versus 53 percent of the transfers to technology perceived "engineering." It should be noted that 37 percent of the technology seniors and 20 percent of the transfers to technology perceived likewise.

TABLE XXXIII

STUDENTS' PERCEPTIONS OF: WHICH GRADUATE IS BEST UTILIZED IN RESEARCH AND DESIGN FUNCTIONS (QUESTION 38)

Groups	No Response	%	Engineering	%	Technology	%	Both	%	Neither	%	Chi Square	DF	Prob.
Technology Freshmen	0		23	(77)	4	(13)	3	(10)	0				
Engineering Freshmen	0		27	(90)	0		2	(7)	1	(3)	5.520	3	0.1374
Technology Seniors	0		18	(60)	1	(3)	11	(37)	0				
Engineering Seniors	0		23	(77)	1	(3)	6	(20)	0		2.080	2	0.3534
Transfers To Technology	0		16	(53)	3	(10)	11	(37)	0				
Transfers To Engineering	0		16	(89)	0		2	(11)	0		6.646	2	0.0360*

*significant

Table XXXIV shows the results of question 41. The question concerned perceptions of which graduate is most likely found in positions of software design, and systems engineering.

The data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. Over 60 percent in each group perceived "engineering." It should be noted that 33 percent of the technology seniors and the transfers to technology perceived "both."

In question 42, the students were asked to give their perception of which graduate has the highest salary. The results are reported in Table XXXV.

The data show that there was no significant difference in perceptions between the two groups of freshmen and the two groups of transfers. There was a significant difference in perceptions between the two groups of seniors. Ninety-seven percent of the engineering seniors perceived "engineering," versus 67 percent of the technology seniors. The data concerning transfers, although not significant at the .05 level, is important to note. Ninety-four percent of the transfers to engineering perceived "engineering," versus only 67 percent of the transfers to technology. Twenty percent of the transfers to technology perceived "both," versus only 6 percent for the transfers to engineering.

According to DETA, question 43, 44, 50, and 51 concern "both" the engineering and technology job opportunities. These questions will be reviewed here prior to discussing questions strictly pertaining to technology job opportunities.

TABLE XXXIV

STUDENTS' PERCEPTIONS OF: WHICH GRADUATE IS MOST LIKELY FOUND IN POSITIONS OF SOFTWARE DESIGN, AND SYSTEMS ENGINEERING (Question 41)

Groups	No Response	%	Engineering	%	Technology	%	Both	%	Neither	%	Chi Square	DF	Prob.
Technology Freshmen	0		22	(73)	2	(7)	6	(20)	0				
Engineering Freshmen	0		22	(73)	4	(13)	3	(10)	1	(3)	2.667	3	0.4459
Technology Seniors	0		19	(63)	1	(3)	10	(33)	0				
Engineering Seniors	0		26	(87)	0		4	(13)	0		4.660	2	0.0973
Transfers To Technology	0		19	(63)	1	(3)	10	(33)	0				
Transfers To Engineering	0		16	(89)	1	(5)	1	(5)	0		4.929	3	0.0851

TABLE XXXV

STUDENTS' PERCEPTIONS OF: WHICH GRADUATE HAS THE HIGHEST SALARY (QUESTION 42)

Groups	No Response	%	Engineering	%	Technology	%	Both	%	Neither	%	Chi Square	DF	Prob.
Technology Freshmen	0		26	(87)	1	(3)	3	(10)	0				
Engineering Freshmen	0		28	(93)	1	(3)	1	(3)	0		1.074	2	0.5845
Technology Seniors	0		20	(67)	2	(7)	5	(17)	3	(10)			
Engineering Seniors	0		29	(97)	0		1	(3)	0		9.320	3	0.0253*
Transfers To Technology	0		20	(67)	1	(3)	6	(20)	3	(10)			
Transfers To Engineering	0		17	(94)	0		1	(6)	0		5.136	3	0.1621

*significant

Table XXXVI presents the data concerning question 43. The question concerned perceptions of which graduate has more job offers. According to DETA, "both" engineering and technology graduates have an equal number of job offers.

The data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. It is important to note that "both" was not perceived by greater than 50 percent in any group.

It should be noted that 57 percent of the engineering seniors perceived "engineering," versus 33 percent of the technology seniors. Fifty-six percent of the transfers to engineering perceived "engineering," versus 33 percent of the transfers to technology.

Presented in Table XXXVII are data concerning question 44. The question concerned perceptions of which graduate has greater chances for advancement.

The data show that there was no significant difference in perceptions between the two groups of freshmen. Greater than 50 percent of both freshmen groups perceived "engineering," while 17 percent perceived "both." There was a significant difference in perceptions between the two groups of seniors and the two groups of transfers. Forty percent of the technology seniors perceived "both" versus only 10 percent of the engineering seniors. Forty-three percent of the transfers to technology perceived "both," versus only 6 percent of the transfers to engineering. It should be noted that 27 percent of the technology seniors and 20 percent of the transfers to technology perceived "technology." Further, 77 percent of the engineering seniors and 94 percent of the transfers to engineering perceived "engineering"

TABLE XXXVI

STUDENTS' PERCEPTIONS OF: WHICH PROGRAMS GRADUATES HAVE MORE JOB OFFERS AVAILABLE (QUESTION 43)

Groups	No Response	%	Engineering	%	Technology	%	Both	%	Neither	%	Chi Square	DF	Prob.
Technology Freshmen	0		8	(27)	11	(37)	10	(33)	1	(3)			
Engineering Freshmen	0		10	(33)	7	(23)	11	(37)	2	(7)	1.492	3	0.6841
Technology Seniors	0		10	(33)	11	(37)	9	(30)	0				
Engineering Seniors	0		17	(57)	4	(13)	8	(27)	1	(3)	6.140	3	0.1050
Transfers To Technology	0		10	(33)	7	(23)	13	(44)	0				
Transfers To Engineering	0		10	(56)	3	(17)	5	(28)	0		2.299	2	0.3168

TABLE XXXVII

STUDENTS' PERCEPTIONS OF: WHICH GRADUATES CHANCES FOR ADVANCEMENT ARE GREATER (QUESTION 44)

Groups	No Response	%	Engineering	%	Technology	%	Both	%	Neither	%	Chi Square	DF	Prob.
Technology Freshmen	0		16	(53)	9	(30)	5	(17)	0				
Engineering Freshmen	0		23	(77)	2	(7)	5	(17)	0		5.711	2	0.0575
Technology Seniors	0		10	(33)	8	(27)	12	(40)	0				
Engineering Seniors	0		23	(77)	2	(7)	3	(10)	2	(7)	16.121	3	0.0011*
Transfers To Technology	1	(3)	9	(30)	6	(20)	13	(43)	1	(3)			
Transfers To Engineering	0		17	(94)	0		1	(6)	0		18.168	3	0.0004*

*significant

graduates as having a greater chance for advancement.

In question 50, the students were asked to give their perception of whether or not engineering and technology graduates assume approximately the same types of jobs upon graduation. The results are reported in Table XXXVIII. The IEEE (14) reports that, upon graduation, the technologist is prepared for rapid integration into industry and is ready to handle practical problems while the engineer is prepared to assimilate current practice quickly and to go beyond this in becoming involved in the complex areas of engineering design and practice. However, Moore (22), studying graduates from a bachelors degree program in engineering technology, found that the technology graduates job assignments in many instances were very similar to those of B.S. graduates in engineering. According to DETA, engineering and technology graduates normally find employment in areas parallel to their curricular development. That is to say, the O.S.U. engineering and technology graduates normally do not assume the same types of jobs upon graduation.

The data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. Sixty-three percent of the engineering seniors perceived "strongly disagree" or "mildly disagree," versus only 40 percent of the technology seniors. Fifty-six percent of the transfers to engineering perceived "strongly or mildly disagree," versus only 30 percent of the transfers to technology.

Presented Table XXXIX are data concerning question 51. The question concerned whether or not engineering and technology graduates assume approximately the same types of jobs ten years after graduation.

TABLE XXXVIII

STUDENTS' PERCEPTIONS OF: WHETHER ENGINEERING AND TECHNOLOGY GRADUATES ASSUME THE SAME TYPES OF JOBS AT GRADUATION (QUESTION 50)

Groups	Strongly Agree	%	Mildly Agree	%	Mildly Disagree	%	Strongly Disagree	%	No Opinion	%	Chi Square	DF	Prob.
Technology Freshmen	1	(3)	13	(43)	13	(43)	2	(7)	1	(3)			
Engineering Freshmen	0		6	(20)	13	(43)	10	(33)	1	(3)	8.912	4	0.0633
Technology Seniors	3	(10)	15	(50)	7	(23)	5	(17)	0				
Engineering Seniors	1	(3)	7	(23)	12	(40)	7	(23)	3	(10)	8.558	4	0.0731
Transfers To Technology	2	(7)	18	(60)	8	(27)	1	(3)	1	(3)			
Transfers To Engineering	1	(6)	7	(39)	5	(28)	5	(28)	0		6.968	4	0.1376

TABLE XXXIX

STUDENTS' PERCEPTIONS OF: WHETHER ENGINEERING AND TECHNOLOGY GRADUATES ASSUME THE SAME TYPES OF JOBS AT GRADUATION (QUESTION 51)

Groups	Strongly Agree	%	Mildly Agree	%	Mildly Disagree	%	Strongly Disagree	%	No Opinion	%	Chi Square	DF	Prob.
Technology Freshmen	1	(3)	5	(17)	17	(57)	5	(17)	2	(7)			
Engineering Freshmen	0		1	(3)	6	(20)	23	(77)	0		22.499	4	0.0002*
Technology Seniors	6	(20)	7	(23)	12	(40)	4	(13)	1	(3)			
Engineering Seniors	0		7	(23)	10	(33)	12	(40)	1	(3)	10.182	4	0.0375*
Transfers To Technology	4	(13)	10	(33)	12	(40)	4	(13)	0				
Transfers To Engineering	0		2	(11)	5	(28)	10	(56)	1	(3)	13.640	4	0.0085*

*significant

The data from Table XXXIX show that there was a significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. Ninety-seven percent of the engineering freshmen perceived "mildly or strongly disagree," versus 74 percent of the technology freshmen. Seventy-seven percent of the engineering seniors perceived "mildly or strongly disagree," versus 53 percent of the technology seniors. Eighty-four percent of the transfers to engineering, versus 53 percent of the transfers to technology perceived "mildly or strongly disagree."

Employment Opportunities for Technologists

Research question five dealt with perceptions of the employment opportunities for technologists. Question five is stated below:

5. Is there a significant difference in the way the employment opportunities for technologists are perceived by freshmen in engineering and technology, seniors in engineering and technology, and transfers in engineering and technology?

Tables XL thru XLIII show the data for questions dealing with the employment opportunities for technologists. These questions are: 35, 37, 39, and 40.

Presented in Table XL are data concerning question 35. The question concerned perceptions of the amount of time a technologist spends in field work.

The data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. It should be noted that all of the groups perceived a fairly high amount of field work to be

TABLE XL

A SUMMARY OF "t" TEST DATA ON THE AMOUNT OF TIME A TECHNOLOGIST SPENDS IN FIELD WORK (QUESTION 35)

Groups	N	Mean	Prob. > |T|
Technology Freshmen	30	6.93333333	
Engineering Freshmen	30	7.16666667	0.6334
Technology Seniors	30	7.10000000	
Engineering Seniors	30	6.70000000	0.3345
Transfers to Technology	30	7.76666667	
Transfers to Engineering	18	7.27777778	0.2496

representative of a technologists work day.

In question 37, the students were asked their perception of the prestige level of the technologist. The results are reported in Table XLI.

The data show that there was a significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. The technology freshmen, seniors, and transfers all ranked the prestige level of a technologist as being higher than the perceived ranking of the engineering freshmen, seniors, and transfers. It should be noted that the transfers to technology perceived a mean ranking of 6.50 after having transfered from engineering. Further, the transfers to engineering perceived a mean ranking of 5.55 after having transfered from technology. It is interesting to note that engineering seniors perceived the lowest mean ranking with a 5.23 on the 1-9 scale.

Table XLII presents the data concerning question 39. This question concerned perceptions of which graduate usually fills positions in areas such as product testing, cost estimating, technical sales, or customer service.

The data show that there was a significant difference in perceptions between the two groups of freshmen. There was no significant difference in perceptions between the two groups of seniors and the two groups of transfers.

According to DETA, the technology graduate is best suited for the types of positions described in question 39. The data from Table XLII shows that 57 percent of the engineering and technology freshmen perceived "technology." However, 33 percent of the engineering

TABLE XLI

A SUMMARY OF "t" TEST DATA ON THE PRESTIGE LEVEL OF THE TECHNOLOGIST (QUESTION 37)

Groups	N	Mean	Prob. > |T|
Technology Freshmen	30	6.50000000	
Engineering Freshmen	30	5.60000000	0.0468*
Technology Seniors	30	6.30000000	
Engineering Seniors	30	5.23333333	0.0028*
Transfers to Technology	30	6.50000000	
Transfers to Engineering	18	5.55555556	0.0282*

*significant

TABLE XLII

STUDENTS' PERCEPTIONS OF: WHICH GRADUATE USUALLY FILLS POSITIONS IN AREAS SUCH AS PRODUCT TESTING, TECHNICAL SALES, OR CUSTOMER SERVICE (QUESTION 39)

Groups	No Response	%	Engineering	%	Technology	%	Both	%	Neither	%	Chi Square	DF	Prob.
Technology Freshmen	0		5	(17)	17	(57)	1	(3)	7	(23)			
Engineering Freshmen	0		10	(33)	17	(57)	3	(10)	0		9.667	3	0.0216*
Technology Seniors	0		2	(7)	20	(67)	7	(23)	1	(3)			
Engineering Seniors	0		6	(20)	20	(67)	3	(10)	1	(3)	3.600	3	0.3080
Transfers To Technology	0		3	(10)	23	(77)	3	(10)	1	(3)			
Transfers To Engineering	0		1	(6)	13	(72)	4	(22)	0		2.049	3	0.5624

*significant

freshmen perceived "engineering," versus only 17 percent of the technology freshmen. Twenty-three percent of the technology freshmen perceived "neither," versus 0 percent of the engineering freshmen. It is interesting to note that 20 percent of the engineering seniors perceived "engineering," while 23 percent of the technology seniors perceived "both."

Presented in Table XLIII are data concerning question 40. This question concerned perceptions of which graduate often operates in a repair and maintenance capacity. According to DETA, neither graduate operates in a repair and maintenance capacity.

The data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. The great majority of all groups perceived "technology." The engineering seniors perceived "technology" in 97 percent of the cases, while the technology seniors perceived "technology" in 83 percent of the cases. Thirteen percent of the technology freshmen and seniors perceived "neither," versus 7 percent for engineering freshmen and 0 percent for engineering seniors.

DETA Characterizations of Engineering and Technology

Research question six dealt with perceptions of the DETA characterizations of engineering and technology. Question six is stated below:

6. Is there a significant difference in the way the DETA characterizations are perceived by freshmen in engineering and technology, seniors in engineering and technology, and transfers in

TABLE XLIII

STUDENTS' PERCEPTIONS OF: WHICH GRADUATE OFTEN OPERATES IN A REPAIR AND MAINTENANCE CAPACITY (QUESTION 40)

Groups	No Response	%	Engineering	%	Technology	%	Both	%	Neither	%	Chi Square	DF	Prob.
Technology Freshmen	0		2	(7)	22	(73)	2	(7)	4	(13)			
Engineering Freshmen	0		2	(7)	23	(77)	3	(10)	2	(7)	.889	3	0.8281
Technology Seniors	0		0		25	(83)	1	(3)	4	(13)			
Engineering Seniors	0		0		29	(97)	1	(3)	0		4.296	2	0.1167
Transfers To Technology	0		0		29	(97)	1	(3)	0				
Transfers To Engineering	0		0		14	(78)	3	(17)	1	(6)	4.515	2	0.1046

engineering and technology?

Tables XLIV thru LIII show the data for questions dealing with the DETA characterizations. These questions are: 54, 55, 56, 57, 58, 59, 60, 61, 62, and 63.

Presented in Table XLIV are data concerning question 54. The question concerned perceptions of which program, engineering or technology, develops specific skills, versus develops conceptual abilities. According to the DETA characterizations, the technology program develops specific skills while the engineering, program develops conceptual abilities.

The data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. All of the groups agreed with the DETA characterizations with at least an 80 percent response rate. It should be noted that 20 percent of the transfers to technology were not in agreement with the DETA characterizations.

In question 55, the students were asked to give their perceptions of which curriculum provides a common language and a fundmental base, versus the curriculum being relatively unique and specialized. The results are reported in Table XLV. According to the DETA characterizations, the engineering curriculum provides a common language and a fundamental base while the technology curriculum is relatively unique and specialized.

The data show that there was no significant difference in perceptions between the two groups of freshmen and the two groups of seniors. There was a significant difference in perceptions between the two groups of transfers. Fifty-seven percent of the transfers to

TABLE XLIV

STUDENTS' PERCEPTIONS OF: WHICH PROGRAM DEVELOPS SPECIFIC SKILLS, VERSUS CONCEPTUAL ABILITIES (QUESTION 54)

Groups	No Response	Engineering Develops Specific Skills while Technology Develops Conceptual Abilities	Technology Develops Specific Skills while Engineering Develops Conceptual Abilities	Chi Square	DF	Prob.
Technology Freshmen	1 (3%)	2 (7%)	27 (90%)			
Engineering Freshmen	1 (3%)	0	29 (97%)	2.071	1	0.1501
Technology Seniors	1 (3%)	3 (10%)	26 (87%)			
Engineering Seniors	0	3 (10%)	27 (90%)	0.002	1	0.9651
Transfers To Technolgy	0	6 (20%)	24 (80%)			
Transfers To Engineering	1 (6%)	2 (11%)	15 (83%)	0.521	1	0.4704

TABLE XLV

STUDENTS' PERCEPTIONS OF: WHICH PROGRAM PROVIDES A COMMON LANGUAGE AND A FUNDAMENTAL BASE, VERSUS BEING RELATIVELY UNIQUE AND SPECIALIZED (QUESTION 55)

Groups	No Response	Engineering provides a common language and base while Technology is unique and specialized	Technology provides a common language and base while Engineering is unique and specialized	Chi Square	DF	Prob.
Technology Freshmen	1 (3%)	15 (50%)	14 (47%)			
Engineering Freshmen	2 (7%)	18 (60%)	10 (33%)	0.922	1	0.3369
Technology Seniors	1 (3%)	14 (47%)	15 (50%)			
Engineering Seniors	0	20 (67%)	10 (33%)	2.042	1	0.1530
Transfers To Technolgy	0	13 (43%)	17 (57%)			
Transfers To Engineering	1 (6%)	15 (83%)	2 (11%)	9.084	1	0.0026*

*significant

technology did not agree with the DETA characterizations. Forty-three percent of these students did agree with DETA. Eighty-three percent of the transfers to engineering agreed with the DETA characterizations.

Table XLVI presents the data for question 56. This question concerned perceptions of which curriculum stresses physical demonstrations in laboratories and practical applications, versus stressing the underlying theory of the subject matter. According to the DETA characterizations, the former is a characteristic of the technology program, while the latter is characteristic of the engineering program.

The data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. Over 77 percent in all groups agreed with the DETA characterizations. It should be noted that 16 percent of the engineering freshmen were not in agreement with the DETA characterizations.

Presented in Table XLVII are data concerning question 57. This question concerned perceptions of which program offers graduate study at O.S.U. for qualified students. According to the DETA characterizations, engineering offers graduate programs for qualified students while technology does not.

The data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. It should be noted that 20 percent of the technology freshmen, 13 percent of the transfers to technology, and 11 percent of the transfers to engineering, were not in agreement with the DETA characterizations. The large majority of all groups were in agreement with the DETA characterizations.

TABLE XLVI

STUDENTS' PERCEPTIONS OF: WHICH PROGRAM STRESSES DEMONSTRATIONS IN LABS AND PRACTICAL APPLICATIONS, VERSUS STRESSING THE UNDERLYING THEORY OF THE SUBJECT (QUESTION 56)

Groups	No Response	Engineering stresses demonstrations in labs and applications while Technology stresses underlying theory	Technology stresses demonstrations in labs and applications while Engineering stresses underlying theory	Chi Square	DF	Prob.
Technology Freshmen	0	2 (7%)	28 (93%)			
Engineering Freshmen	2 (7%)	5 (16%)	23 (77%)	1.709	1	0.1911
Technology Seniors	0	0	30 (100%)			
Engineering Seniors	0	1 (3%)	29 (97%)	1.017	1	0.3132
Transfers To Technolgy	0	2 (7%)	28 (93%)			
Transfers To Engineering	1 (6%)	1 (6%)	16 (89%)	0.011	1	0.9158

TABLE XLVII

STUDENTS' PERCEPTIONS OF: WHICH PROGRAM OFFERS GRADUATE STUDY AT OSU, VERSUS DOES NOT OFFER GRADUATE STUDY (QUESTION 57)

Groups	No Response	Engineering offers graduate study while Technology does not	Technology offers graduate study while Engineering does not	Chi Square	DF	Prob.
Technology Freshmen	0	24 (80%)	6 (20%)			
Engineering Freshmen	0	28 (93%)	2 (7%)	2.308	1	0.1287
Technology Seniors	1 (3%)	29 (97%)	0			
Engineering Seniors	0	29 (97%)	1 (3%)	0.983	1	0.3214
Transfers To Technolgy	1 (3%)	25 (83%)	4 (13%)			
Transfers To Engineering	0	16 (89%)	2 (11%)	0.072	1	0.7888

Table XLVIII presents the data for question 58. The question concerned perceptions of which graduate engineering or technology, is relatively specialized; prefers routine standardized job environment, versus is relatively broad; has an analytical mind challenged by unsolved problems. According to the DETA characterizations the former is a characteristic of the technology graduate, while the later is characteristic of the engineeering graduate.

The data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. Over 63 percecent in all groups, and as high as 93 percent agreed with the DETA characterizations. It should be noted that a higher percentage of technology students' perceptions did not agree with DETA.

In question 59, the students were asked to give their perceptions of which student applies knowledge of materials, forces, energy, to operations, equipment components, and maintenance procedures, versus uses fundamental and basic knowledge of materials, forces, energy, physical and chemical behavior. According to the DETA characterizations, the former is a characteristic of the technology program, while the later is characteristic of the engineering program.

The results are reported in Table XLIX. The data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. It should be noted that the technology students had a higher percentage of agreement with the DETA characterizations than the engineering students.

TABLE XLVIII

STUDENTS' PERCEPTIONS OF: WHICH GRADUATE IS RELATIVELY SPECIALIZED, PREFERS ROUTINE JOB ENVIRONMENT, VERSUS IS BROAD WITH AN ANALYTICAL, CREATIVE MIND (QUESTION 58)

Groups	No Response	Engineering graduate is specialized, prefers routine job environment while Technology graduate is broad with an analytical mind	Technology graduate is specialized, prefers routine job environment while Engineering graduate is broad with an analytical mind	Chi Square	DF	Prob.
Technology Freshmen	1 (3%)	6 (20%)	23 (77%)			
Engineering Freshmen	0	2 (7%)	28 (93%)	2.474	1	0.1157
Technology Seniors	2 (7%)	6 (20%)	22 (73%)			
Engineering Seniors	0	2 (7%)	28 (93%)	2.654	1	0.1033
Transfers To Technolgy	1 (3%)	10 (33%)	19 (63%)			
Transfers To Engineering	1 (6%)	2 (11%)	15 (83%)	2.869	1	0.0903

TABLE XLIX

STUDENTS' PERCEPTIONS OF: WHICH GRADUATE APPLIES KNOWLEDGE TO OPERATIONS, EQUIPMENT, ETC., VERSUS, USES FUNDAMENTAL KNOWLEDGE OF PHYSICAL AND CHEMICAL BEHAVIOR (QUESTION 59)

Groups	No Response	Engineering graduate applies knowledge to equipment, operations, etc., while Technology graduate uses basic knowledge of physical and chemical behavior	Technology graduate applies knowledge to equipment, operations, etc., while Engineering graduate uses basic knowledge of physical and chemical behavior	Chi Square	DF	Prob.
Technology Freshmen	0	13 (43%)	17 (57%)			
Engineering Freshmen	3 (10%)	16 (53%)	11 (37%)	1.442	1	0.2298
Technology Seniors	0	13 (43%)	17 (57%)			
Engineering Seniors	1 (6%)	14 (47%)	15 (50%)	0.145	1	0.7032
Transfers To Technolgy	0	9 (30%)	21 (70%)			
Transfers To Engineering	1 (6%)	8 (44%)	9 (50%)	1.368	1	0.2422

Table L shows the results of question 60. This question concerned perceptions of which graduate translates basic knowlege of science and math into products, processes, machine structures, and materials for use by mankind, versus generally serves a support role to the engineering profession through state of the art design procedures to produce engineering drawings, machine placement, maintenance procedures, safety practices.

According to DETA, the former is characteristic of the engineering graduate while the latter is characteristic of the technology graduate.

The data show that there was no significant difference in perceptions between the two groups of freshmen and the two groups of seniors. There was a significant difference between the two groups of transfers. Eighty-three percent of the transfers to engineering agreed with the DETA characterizations, while only 57 percent of the transfers to technology agreed. Forty percent of the transfers to technology did not agree with the characterizations. Further, it should be noted that 23 percent of the technology seniors' perceptions failed to agree with DETA.

Presented in Table LI are data concerning question 61. This question concerned perceptions of which graduate will be ready to contribute immediately, since he has been trained in current procedures, versus will require a period of training by his employer, since his program stressed the development of a capacity for continuing self education. According to DETA, the former is characteristic of the technology graduate while the latter is characteristic of the engineering graduate.

TABLE L

STUDENTS' PERCEPTIONS OF: WHICH GRADUATE TRANSLATES BASIC KNOWLEDGE OF SCIENCE AND MATH INTO PRODUCTS FOR USE BY MANKIND, VERSUS SERVES A SUPPORT RUE (QUESTION 60)

Groups	No Response	Engineers translates basic knowledge into products while Technologists serve a support role	Technologists translates basic knowledge into products while Engineers serve a support role	Chi Square	DF	Prob.
Technology Freshmen	0	25 (83%)	5 (17%)			
Engineering Freshmen	4 (13%)	22 (73%)	4 (13%)	0.017	1	0.8963
Technology Seniors	0	23 (77%)	7 (23%)			
Engineering Seniors	0	26 (87%)	4 (13%)	1.002	1	0.3169
Transfers To Technolgy	1 (3%)	17 (57%)	12 (40%)			
Transfers To Engineering	1 (6%)	15 (83%)	2 (11%)	4.440	1	0.0351*

*significant

TABLE LI

STUDENTS' PERCEPTIONS OF: WHICH GRADUATE IS READY TO CONTRIBUTE IMMEDIATELY, VERSUS REQUIRES A PERIOD OF TRAINING BY HIS EMPLOYER (QUESTION 61)

Groups	No Response	Engineer is ready to contribute immediately while the Technologist requires a training period	Technologist is ready to contribute immediately while the Engineer requires a training period	Chi Square	DF	Prob.
Technology Freshmen	0	7 (23%)	23 (77%)			
Engineering Freshmen	0	6 (20%)	24 (80%)	0.098	1	0.7540
Technology Seniors	0	7 (23%)	23 (77%)			
Engineering Seniors	0	1 (3%)	29 (97%)	5.192	1	0.0227*
Transfers To Technolgy	0	4 (13%)	26 (87%)			
Transfers To Engineering	0	2 (11%)	16 (89%)	0.051	1	0.8217

*significant

The data show that there was no significant difference in perceptions between the two groups of freshmen and the two groups of transfers. There was a significant difference between the two groups of seniors. Ninety-seven percent of the engineering seniors' perceptions agreed with DETA, versus 77 percent of the technology seniors. It should be noted that a greater percentage of the technology groups' perceptions failed to agree with the DETA characterizations.

Table LII presents the data concerning question 62. This question concerned perceptions of which graduate can move into supervisory positions, since his training emphasized current, production oriented practices, versus may move into management positions. According to DETA, the former is a characteristic of the technology graduate, while the latter is characteristic of the engineering graduate.

The data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. It should be noted that only 56 percent of the transfers to engineering perceived in agreement with DETA.

Presented in Table LIII are data concerning question 63. The question concerned perceptions of which graduate may become Registered Professionals whose testimony is admissable as "expert evidence" in courts of law, versus may become certified as possessing specific skills in certain areas. According to DETA, the former is characteristic of the engineering graduate while the later is characteristic of the technology graduate.

TABLE LII

STUDENTS' PERCEPTIONS OF: WHICH GRADUATE CAN MOVE INTO SUPERVISION, VERSUS MOVE INTO MANAGEMENT (Question 62)

Groups	No Response	Engineers may move into supervisory positions while Technologists may move into management	Technologists may move into supervisory positions while Engineers may move into management	Chi Square	DF	Prob.
Technology Freshmen	3 (10%)	9 (30%)	18 (60%)			
Engineering Freshmen	3 (10%)	5 (17%)	22 (73%)	1.543	1	0.2142
Technology Seniors	0	7 (23%)	23 (77%)			
Engineering Seniors	0	4 (13%)	26 (87%)	1.002	1	0.3169
Transfers To Technolgy	0	6 (20%)	24 (80%)			
Transfers To Engineering	0	8 (44%)	10 (56%)	3.254	1	0.0713

TABLE LIII

STUDENTS' PERCEPTIONS OF: WHICH GRADUATE MAY BECOME REGISTERED PROFESSIONALS VERSUS MAY BECOME CERTIFIED AS HAVING SPECIFIC SKILLS (Question 63)

Groups	No Response	Engineers may become Registered Professionals while Technologists become certified as having specific skills	Technologists may become Registered Professional while Engineers become certified as having specific skills	Chi Square	DF	Prob.
Technology Freshmen	0	26 (87%)	4 (13%)			
Engineering Freshmen	1 (3%)	26 (87%)	3 (10%)	0.126	1	0.7227
Technology Seniors	0	23 (77%)	7 (23%)			
Engineering Seniors	0	27 (90%)	3 (10%)	1.920	1	0.1659
Transfers To Technolgy	0	27 (90%)	3 (10%)			
Transfers To Engineering	0	16 (89%)	2 (11%)	0.015	1	0.9029

The data show that there was no significant difference in perceptions between the two groups of freshmen, the two groups of seniors, and the two groups of transfers. A large proportion of all groups agreed with the DETA characteristics. It should be noted that 23 percent of the technology seniors did not agree with DETA.

CHAPTER V

SUMMARY, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to measure the perceptions of representative samples of engineering and technology students concerning career choice, curriculum and employment opportunities. The results of the measurements were used to compare these perceptions between the groups. The study also sought to compare the engineering and technology students' perceptions of the characteristics of the engineering and technology programs with the O.S.U. DETA characterizations of the two programs.

The results were to help determine if student perceptions concerning engineering and technology programs at O.S.U. are appropriate perceptions. Students that enter engineering and technology without appropriate perceptions of the programs, face a greater likelihood of disenchantment and failure. Students who remain in one of the two programs and continue to have misperceptions could become graduates without an appropriate appreciation of their partners on the engineering spectrum. The implications of the existence of misperceptions for students, colleges, and the engineering profession, are vast.

The study's purpose was accomplished by developing six research questions and then designing a questionnaire to collect the necessary data from the participants of this study. The study sample was composed of 270 engineering and technology students at Oklahoma State University. The Engineering and Technology Survey, shown in the Appendix, was used to survey the sample for this investigation. The data were collected during the fall semester, 1980.

The questionnaire was distributed to a random sample of 50 students in each of five groups and 20 students in one group. These groups were: freshmen in engineering, freshmen in technology, seniors in engineering, seniors in technology, transfers to engineering, and transfers to technology. The total return rate was 77 percent.

A random sample of 30 questionnaires was drawn from the returned questionnaires in five of the six groups. All useable returns were used in the sixth group. A Chi-square test and the "t" test were used for statistical purposes. The .05 level of confidence was chosen as the minimum level at which results would be considered significant. The remainder of this chapter will offer conclusions based upon the findings of the study, propose a profile of engineering and technology students, and outline implications and recommendations resulting from this study.

Findings and Conclusions

The first portion of this section will be concerned with describing the findings of the research on the six research questions outlined in Chapter I. Conclusions regarding the research questions and the purpose of the study will follow:

The six research questions and the findings are as follows:

The six research questions and the findings are as follows:

1. Is there a significant difference in the way selected factors influenced freshmen in engineering and technology, seniors in engineering and technology, and transfers in engineering and technology?

    Finding: There was a significant difference in perceptions between the two groups of freshmen on 2 of the 13 factors listed. These factors were "parental influence" and "a technologist."

    There was a significant difference in perceptions between the two groups of seniors on 1 of the 13 factors. This factor was "a high school teacher."

    There was no significant difference in perceptions between the two groups of transfers on any of the 13 factors.

2. Is there a significant difference in the way the engineering curricula is perceived by freshmen in engineering and technology, seniors in engineering and technology, and transfers in engineering and technology?

    Finding: The study contained eight questions which dealt with the engineering curriculum. As was shown in the data, there was a significant difference in perceptions between the two groups of freshmen and between the two groups of seniors on 4 of the 8 questions. There was no significant difference in perceptions between the two groups of transfers on any of the eight questions.

3. Is there a significant difference in the way the technology curricula is perceived by freshmen in engineering and

technology, seniors in engineering and technology, and transfers in engineering and technology.

<u>Finding</u>: The study contained ten questions which dealt with the technology curriculum. As was shown in the data, there was a significant difference in perceptions between the two groups of freshmen on 3 of the 10 questions. There was a significant difference in perceptions between the two groups of seniors on 6 of the 10 questions. There was a significant difference in perceptions between the two groups of transfers on 2 of the 10 questions.

4. Is there a significant difference in the way the employment opportunities for engineers are perceived by freshmen in engineering and technology, seniors in engineering and technology, and transfers in engineering and technology?

   <u>Finding</u>: The study contained five questions which dealt with the employment opportunities for engineers. As was shown in the data, there was a significant difference in perceptions between the two groups of seniors and the two groups of transfers on 1 of the 5 questions. There was no significant difference in perceptions between the two groups of freshmen on any of the five questions.

5. Is there a significant difference in the way the employment opportunities for technologists are perceived by freshmen in in engineering and technology, seniors in engineering and technology, and transfers in engineering and technology?

   <u>Finding</u>: The study contained four questions which dealt with the employment opportunities for technologists. There

groups of freshmen on 2 of the 4 questions. There was a significant difference in perceptions between the two groups of seniors and between the two groups of transfers on 1 of the 4 questions.

6. Is there a significant difference in the way the DETA characterizations are perceived by freshmen in engineering and technology, seniors in engineering and technology, and transfers in engineering and technology?

   Finding: The study contained ten questions which dealt with the DETA characterizations of engineering and technology. There was a significant difference in perceptions between the two groups of transfers on 2 of the 10 questions. There was no significant difference in perceptions between the two groups of freshmen. There was a significant difference in perceptions between the two groups of seniors on 1 of the 10 questions.

Conclusions

The following conclusions and how they relate to the purpose of the study are drawn from the data.

Career Choice

The results of this study are contrary to the findings of the Alden (1) study, which indicated that no factor other than family influence stood out as strongly affecting the career decisions of engineering and technology students. The data from the present study leads to the conclusion that "parents" have a strong influence on career choice but are not the dominant factor. Other family members appear to have a minimal effect. Sixty two percent of the respondents in all groups reported that "parents" had some or much influence on career choice. With the exception of the transfers to engineering, the engineering students were influenced more by "parents" than were the technology students. Further, as indicated in Chapter IV, there was a significant difference between the two groups of freshmen with regard to parental influence. Parents of engineering freshmen had a significantly higher influence than the parents of technology freshmen.

With the exception of engineering seniors, high school teachers did not appear to contribute a great deal to the career choice of engineering and technology students at O.S.U. In fact, there was a significant difference between the two groups of seniors concerning the influence of a high school teacher on career choice.

High school counselors have very little influence on the career choice of engineering or technology students as evidence by the data in this study. Further, there was no significant difference between any of the groups concerning the influence of counselors.

The results of this study lead to the conclusion, in support of research conducted previously and reported in Chapter II, that teachers and counselors have little influence on the career choice of engineering and technology students. This may be due to their lack of knowledge concerning the two career paths.

The review of literature indicated that college level recruiters have been ill-equipped to aid the student in career guidance since many are from the ranks of engineering or technology faculty and often support vested interests. Such findings were supported by this research since an average of only 39 percent of the total sample indicated that "someone from a college" had been influential in the career choice process. However, "information obtained from a college" was influential in career choice. An average of 63 percent of all groups support this conclusion.

The dominant factors influencing the career choice of freshmen were "interest in the the subject matter" and "the number of job opportunities." "Interest in the subject matter" was the single factor having greatest influence on the two groups of seniors. "Interest in the subject matter" and "starting salaries" were most influential on the career choice of both transfer groups.

In conclusion, high school teachers have a minimal effect on career choice while high school counselors provide even less influence. College recruiters appear to be ineffective, however, they are often the people responsible for the delivery of the college's recruitment materials. The conclusion may be drawn that career guidance efforts from these sources, being minimal, has not followed a developmental process. This would support the research of Goodson (11), Hillery (13), and O'Bryant (26).

"Parents" and "information obtained from a college" appear to be the current sources of information and influence on the career choice of engineering and technology students at O.S.U.. "Interest in the subject matter" was the single most influential factor leading engineering and technology students toward their career choice, followed by "the number of job opportunities" and "the possible starting salaries."

Curriculum

The data in Chapter IV, and the findings concerning the data, lead to the following conclusions regarding the group's perceptions of the engineering and technology curricula:

Freshmen. Both groups of freshmen have accurate perceptions of their own curricula, however, the technology freshmen have more accurate perceptions of the technology curricula than the engineering freshmen have concerning the engineering curricula.

Both groups of freshmen have inaccurate perceptions of the other's curricula, however, the engineering freshmen have more accurate perceptions of the technology curricula than the technology freshmen have concerning the engineering curricula.

Seniors. Both groups of seniors have accurate perceptions of their own curricula, however, the technology seniors have more accurate perceptions of the technology curricula than the engineering seniors have concerning the engineering curricula.

Both groups of seniors have inaccurate perceptions of the other's curricula, however, the engineering seniors have more accurate perceptions of the technology curricula than the technology seniors have concerning the engineering curricula.

Transfers. Both groups of transfers have accurate perceptions of their own curricula, however, the transfers to technology have more accurate perceptions of the technology curricula than the transfers to engineering have concerning the engineering curricula.

Both groups of transfers have inaccurate perceptions of the other's curricula, however, the transfers to technology have more accurate perceptions of the engineering curricula than the transfers to engineering have concerning the technology curricula.

Employment Opportunities

The data in Chapter IV, and the findings concerning the data, lead to the following conclusions regarding the group's perceptions of the engineering and technology employment opportunities.

Freshmen. The engineering freshmen have accurate perceptions of their own employeemnt opportunities, however, the technology freshmen have inaccurate perceptions of their employment opportunities.

The engineering freshmen have inaccurate perceptions of the employment opportunities for technologists, however, the technology freshmen have accurate perceptions of the employment opportunities for engineers.

Seniors. Both groups of seniors have accurate perceptions of their own employment opportunities, however, the engineering seniors have more accurate perceptions of the employment opportunities for engineers than the technology seniors have concerning the employment opportunities for technologists.

The engineering seniors have accurate perceptions of the employment opportunities for technologists and the technology seniors have accurate perceptions of the employment opportunities for engineers.

Transfers. Both groups of transfers have accurate perceptions of their own employment opportunities, however, the transfers to engineering have more accurate perceptions of the employment opportunities for engineers than the transfers to technology have concerning the employment opportunities for technologists.

The transfers to engineering have accurate perceptions of the employment opportunities for technologists, and the transfers to technology have accurate perceptions of the employment opportunities for engineers.

DETA Characterizations

The data in Chapter IV, and the findings concerning the data, lead to the following conclusions regarding the group's perceptions of the DETA characterizations of engineering and technology:

Freshmen. Both groups of freshmen have accurate perceptions of the DETA characterizations, however, the engineering freshmen have more accurate perceptions than do the technology freshmen.

Seniors. Both groups of seniors have accurate perceptions of the DETA characterizations, however, the engineering seniors have more accurate perceptions than do the technology seniors.

Transfers. Both groups of transfers have accurate perceptions of the DETA characterizations, however, the transfers to engineering have more accurate perceptions than do the transfers to technology.

Student Profiles

The following profiles were developed from the data to show typical characteristics and perceptions regarding each group studied in this research. It is the aim of the researcher that this information will be useful in the advisement and career guidance of present students and in the recruitment of new students. Further, the profiles provide a baseline against which future perceptual changes may be measured.

Technology Freshmen

Typically, technology freshmen are influenced to choose technology as a major by their "interest in the subject matter," "information from a college," and the "number of job opportunities," with lesser but important amounts of influence from "parents," and "someone from a college." "A technologist" was somewhat influential to technology freshmen but not to a significant degree. There was, however, a significant difference between engineering and technology freshmen with regards to the career influence of "a technologist." Technology freshmen have not been influenced greatly by "high school teachers," and "counselors."

The technology freshmen have accurate perceptions of the technology curricula but inaccurate perceptions of the engineering curricula. They have inaccurate perceptions of their employment opportunities but have accurate perceptions of the employment opportunities for engineers. Finally, the technology freshmen have accurate perceptions of the DETA characterizations.

Engineering Freshmen

Typically, engineering freshmen are influenced to choose engineering as a major by their "parents," "information from a college," "interest in the subject matter," and "the number of job opportunities." There was a significant difference between engineering and technology freshmen with regards to the amount of influence "parents" were on career choice. Engineering freshmen were significantly more influenced by "parents." They have not been influenced greatly by "high school teachers," "counselors," or "someone from a college."

The engineering freshmen have accurate perceptions of the engineering curricula but inaccurate perceptions of the technology curricula. They have accurate perceptions of their employment opportunities but inaccurate perceptions of the employment opportunities for technologists. Finally, the engineering freshmen have accurate perceptions of the DETA characterizations.

Technology Seniors

Typically, technology seniors were influenced to choose technology as a major by their "parents," "interest in the subject matter," and "information from a college." "Someone from a college," "high school teachers," and "high school counselors," did not have a great influence on their career choice.

The technology seniors have accurate perceptions of the technology curricula but inaccurate perceptions of the engineering curricula. They have accurate perceptions of the engineering and technology employment opportunities. Finally, the technology seniors have accurate perceptions of the DETA characterizations.

Engineering Seniors

Typically, engineering seniors were influenced to choose engineering as a major by their "parents," "interest in the subject matter," "information from a college," and "a high school teacher." Engineering seniors were influenced somewhat more by their parents than were the technology seniors. Also, a "high school teacher" was an important factor influencing career choice of many engineering seniors. There was a significant difference between engineering and technology seniors regarding the amount of influence on career choice by a high school teacher." "Someone from a college," and "high school counselors," did not have a great influence on their career choice.

The engineering seniors have accurate perceptions of their own curricula but inaccurate perceptions of the technology curricula. They have accurate perceptions of their employment opportunities and accurate perceptions of the employment opportunities for technologists. Finally, the engineering seniors have accurate perceptions of the DETA characterizations.

Technology Transfers

Typically, the transfers to technology were influenced to choose technology as a major by their "interest in the subject matter," "starting salaries," "parents," and "information from a college," and "someone from a college." "High school teachers and counselors" did not have a great influence on their career choice.

The transfers to technology have accurate perceptions of their own curricula but inaccurate perceptions of the engineering curricula. They have accurate perceptions of their employment opportunities and accurate perceptions of the employment opportunities for engineers. Finally, they have accurate perceptions of the DETA characterizations.

Engineering Transfers

Typically, the transfers to engineering were influenced to choose engineering as a major by their "interest in the subject matter," "starting salaries," and to a lesser extent, "parents," and "information from a college." "High school teachers and counselors" were not strong factors of influence.

The transfers to engineering have accurate perceptions of their own curricula but inaccurate perceptions of the technology curricula. They have accurate perceptions of the employment opportunities for engineers and accurate perceptions of the employment opportunities for technologists. Finally, the transfers to engineering have accurate perceptions of the DETA characterizations.

Implications

This section presents the subjective implications related to the study. The implications were made by the researcher after gathering and analyzing the data.

The results of this study have implications for student development specialists and for administrators in engineering and technology programs. The data supports the findings of the review of literature concerning the role of high school teachers, counselors, and college recruiters in the career development of prospective engineering and technology freshmen. Career choice for these students was not a product of a process called career development. If career development occurred with the students sampled, it took place at home.

Since parents and information from a college were found to be dominant sources of career guidance, it is clear that DETA student development specialists should concentrate their efforts towards improving career information, as well as, communications with parents.

Since freshmen in both groups had inaccurate perceptions of the other's curricula, additional emphasis should be placed on encouraging these students to explore both engineering and technology programs prior to matriculating. Since employment opportunities for technologists were not perceived accurately by either group of freshmen, special attention should be given towards alleviation of this problem area.

Seniors and transfers enrolled in DETA still maintain inaccurate perceptions concerning the other's curricula. These students are missing a link towards understanding each role on the engineering team. The interdependency being built using an engineering team approach is not enhanced when this occurs.

Recommendations

It is hoped that this study will serve as a baseline against which future changes in perceptions may be measured. The study could also be followed as a model for other institutions seeking to measure the perceptions of engineering and technology students.

Below are the specific recommendations resulting from this research:

1. DETA student development specialists should concentrate additional efforts towards informing parents of prospective students, as well as the students themselves, about the education and careers of engineers and technologists.
2. Guidance literature should be continually reviewed for necessary revisions. Printed information should be aimed at differentiating engineering and technology subject matter, job opportunities, and salaries.
3. DETA student development specialists should make efforts to alleviate misperceptions at the earliest possible point. DETA characterizations should be presented, along with more specific clarifying information, to prospective students and students who have already matriculated.
4. The literature reflects a widespread concern over engineering and technology career guidance. It is recommended that other institutions, having engineering and technology programs under the same dean, conduct similar research to determine student perceptions and whether or not intervention strategies are called for.
5. Future research efforts should investigate the following:
   a. What form does the career guidance efforts of parents of engineering and technology students assume?
   b. What level of attrition at O.S.U. can be attributed to students entering with inaccurate perceptions?

c. What can engineering educators do to move the engineer career spectrum back to school career education programs?

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APPENDIX

ENGINEERING AND TECHNOLOGY SURVEY

The questions listed below are designed to give the researcher some information about you. Please circle the appropriate number shown with each question.

(1) Academic Major: 1. engineering 2. technology

(2) College Classification: 1. freshman 2. sophomore 3. junior 4. senior

(3) Race: 1. Oriental 2. American Indian 3. Black 4. Spanish American 5. All Other

(4) Resident Status: 1. Oklahoma Resident 2. Out of State Resident 3. International Student

(5) I have: 1. transferred from engineering to technology.
2. transferred from technology to engineering.
3. been in engineering since starting college.
4. been in technology since starting college.
5. other, specify ______________________.

Please fill in the blanks:

(6) Age ______________

(7) My mother's occupation _________________________

(8) My father's occupation _________________________

(Continue on to next page)

Please place a check mark ✓ in the box indicating your response to each question below. (Check only one box per question.)

	(1) College Algebra	(2) Trigonometry	(3) Calculus	(4) Differential Equations	(5) Linear Algebra or Statistics
(9) The first math course which meets requirements in technology.					
(10) The last math course required in technology.					
(11) The first math course which meets degree requirements in engineering.					
(12) The last math course required in engineering.					

Below are some factors which may have influenced you in your choice of an academic major program. Please indicate the influence each of the following factors had on your choice of academic major by placing a check ✓ mark in the appropriate box for each factor. (Mark only one response for each possible reason.)

(Continue on to next page)

	Influence Level		
	No Influence	Some Influence	Much Influence
	(1) N	(2) S	(3) V
(13) A parent			
(14) A relative (other than a parent)			
(15) My interest in the subject matter			
(16) The number of job opportunities			
(17) The possible starting salaries			
(18) A friend			
(19) A high school teacher			
(20) A high school counselor			
(21) Someone from a college			
(22) Information obtained from a college			
(23) An engineer			
(24) A technologist			
(25) A summer job			
(26) Other, Please specify ______ ______________________			

(Continue on to next page)

Circle the number corresponding to the most appropriate answer.

(Circle only one response for each question.)

(27) An engineering student begins the major part of his course work in a specialty area, for example - mechanical, electrical, etc. as a:

1. freshman 2. sophomore 3. junior 4. senior 5. don't know

(28) A technology student begins his course work in a specialty area, for example - mechanical power, electronics, etc. as a:

1. freshman 2. sophomore 3. junior 4. senior 5. don't know

(29) In order to enter a Professional School of Engineering at O.S.U., a student must have an accumulative grade point average of at least:

(1) 2.0 (2) 2.0 (3) 2.6 (4) 2.9 (5) 3.2 (6) don't know

(30) On the scale to the right, 1 represents a low amount of analytical design work taught and 9 represents a high amount of analytical design work taught. Circle the number which you think represents the amount of analytical design work taught in engineering.

Analytical Design Work Taught

1 2 3 4 5 6 7 8 9

Low Design Taught — High Design Taught

(31) On the scale to the right, 1 represents a low amount of analytical design work taught and 9 represents a high amount of analytical design work taught. Circle the number which you think represents the amount of analytical design work taught in technology.

Analytical Design Work Taught

1 2 3 4 5 6 7 8 9

Low Design Taught — High Design Taught

(32) On the scale to the right, 1 represents a low amount of practical applications taught and 9 represents a high amount of practical applications taught. Circle the number which you think represents the amount of practical applications taught in engineering.

Practical Applications Taught

1 2 3 4 5 6 7 8 9

Low Applications Taught — High Applications Taught

(Continue on to next page)

(33) On the scale to the right, 1 represents a low amount of practical applications taught and 9 represents a high amount of practical applications taught. Circle the number which you think represents the amount of practical applications taught in technology.

Practical Applications Taught

1	2	3	4	5	6	7	8	9
Low Applications Taught								High Applications Taught

(34) On the scale to the right, 1 represents a low amount of time spent in field work and 9 represents a high amount of time spent in field work. Circle the number which you think represents the amount of time an engineer spends in field work.

Time Spent in Field Taught

1	2	3	4	5	6	7	8	9
Low Field Taught								High Field Taught

(35) On the scale to the right, 1 represents a low amount of time spent in field work and 9 represents a high amount of time spent in field work. Circle the number which you think represents the amount of time a technologist spends in field work.

Time Spent in Field Taught

1	2	3	4	5	6	7	8	9
Low Field Taught								High Field Taught

(36) On the scale to the right, 1 represents low prestige and 9 represents high prestige. Please circle the number which you think represents the prestige level of the engineer.

Prestige Level

1	2	3	4	5	6	7	8	9
Low Prestige								High Prestige

(37) On the scale to the right, 1 represents low prestige and 9 represents high prestige. Please circle the number which you think represents the prestige level of the technologist.

Time Spent in Field Taught

1	2	3	4	5	6	7	8	9
Low Field Taught								High Field Taught

(Continue on to next page)

In the following question answer either "E" for engineering or "T for technology. Note: (Should you feel that question applies to both areas or neither area, a "B" for both and "N" for neither will be appropriate.)

	Circle One			
(38) Which graduate is best utilized in research and design functions?	E	T	B	N
(39) Which graduate usually fills positions in areas such as product testing, cost estimating, technical sales, or customer service?	E	T	B	N
(40) Which graduate often operates in a repair and maintenance capacity?	E	T	B	N
(41) Which graduate is most likely found in positions of software design, and systems engineering?	E	T	B	N
(42) Which graduate has the highest salary?	E	T	B	N
(43) More job offers are available in ___?	E	T	B	N
(44) My chances for advancement are greater in ___?	E	T	B	N
(45) Which curriculum is most likely to require students to take a common set of courses?	E	T	B	N
(46) Most courses in ___ have laboratories associated with them.	E	T	B	N
(47) Which curriculum requires the least math and science courses?	E	T	B	N
(48) Which program's laboratory work shows a strong orientation towards experimentation and research?	E	T	B	N
(49) Which program's laboratory work shows a strong orientation towards working models and production equipment?	E	T	B	N

(Continue on to next page)

Please respond to the following questions in this manner: SA = Strongly Agree, MA = Mildly Disagree, SD = Strongly Disagree, NO = No Opinion. Place an X over the circle indicating your response.

Example: SA MA MD SD NO
() () () () ()

	SA	MA	MD	SD	NO
(50) Engineering and Technology graduates assume approximately the same types of jobs upon graduation.	()	()	()	()	()
(51) Engineering and technology graduates assume approximately the same types of jobs ten years after graduation.	()	()	()	()	()
(52) A technology program is virtually the same as an engineering program, only easier.	()	()	()	()	()
(53) The technology curriculum at O.S.U. is similar in nature to the State Vo-Tech programs.	()	()	()	()	()

For each pair of statements shown below, place an "E" by that statement which is most descriptive of the engineering program and a "T" by that statement best describing the technology program.

(54) ___ Develops specific skills.	(54) ___ Develops conceptual abilities.
(55) ___ Curriculum provides a common language and a fundmental base.	(55) ___ Curriculum relatively unique and specialized.
(56) ___ Courses stress physical demonstrations in laboratories and practical applications.	(56) ___ Courses stress underlying theory of the subject matter.
(57) ___ Graduate study is not available at O.S.U.	(57) ___ Graduate study is available at O.S.U. for qualified students.
(58) ___ is relatively specialized; prefers routine standardized job environment.	(58) ___ is relatively broad; has an analytical, creative mind challenged by unsolved problems.

(Continue on to next page)

(59)	___	applies knowledge of materials, forces, energy, physical and chemical behavior, to operations, equipment components, maintenance procedures.	(59)	___	uses fundamental and basic knowledge of materials, forces, energy, physical and chemical behavior.
(60)	___	translates basic knowledge of science and math into products, processes, machine structures, systems, and material for use by mankind.	(60)	___	generally serves a support role to the engineering profession through state of the art design procedures to produce engineering drawings, machine placement, maintenance procedures, safety practices, etc.
(61)	___	upon graduation is typically ready to begin contributing immediately, since he has been trained in relatively current procedures; as new technological advancements occur, retraining will be necessary.	(61)	___	upon graduation, typically requires a period of "training" by his employer, since his program stresses the development of a capacity for development and continuing self education.
(62)	___	can move into supervisory positions in the plant, since his training emphasized current, production oriented practices.	(62)	___	many move into management positions.
(63)	___	may become Registered Professionals whose testimony is admissable as "expert evidence" in courts of law.	(63)	___	may become certified as possessing specific skills in certain specific areas, such as safety inspection, tool designer, etc.

Please place this questionnaire in the campus envelope which is provided. Ask any campus secretary to place it in the campus mail <u>or</u> return it to 101 Industrial Building.

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VITA

Craig Bruce Robison

Candidate for the Degree of

Doctor of Education

Thesis: A COMPARISON OF SELECTED OKLAHOMA STATE UNIVERSITY ENGINEERING AND TECHNOLOGY STUDENTS' PERCEPTIONS OF CAREER CHOICE, CURRICULUM, AND EMPLOYMENT OPPORTUNITIES

Major Field: Student Personnel and Guidance

Biographical:

Personal Data: Born in Sioux Falls, South Dakota, January 30, 1948, the son of Clarence B. and Rebecca Robison; married to Patricia J. Winn, 1969; daughter Rachel A. Robison born July 27, 1975.

Education: Attended public schools in Oklahoma City, Oklahoma; graduated from John Marshall High School in May, 1966; received the Bachelor of Science degree with a major in Psychology from the Oklahoma State University in May, 1970; received the Master of Science degree from the Oklahoma State University with a major in Student Personnel and Guidance in May, 1973; completed the requirements for the Doctor of Education degree at Oklahoma State University with a major in Student Personnel and Guidance, in May, 1982.

Professional Experience: A Head Resident with the Oklahoma State University, Single Student Housing Office, 1972-1974; appointed Director of Student Services, Oklahoma State University, School of Technology, 1974 to present.