OUTPUT OF ENGINEERING AND PHYSICAL SCIENCE-RELATED TECHNICIANS FROM OKLAHOMA SCHOOLS, 1960-1967

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CHAPTER I

INTRODUCTION TO THE PROBLEM

The demand for engineering and physical science-related technicians in Oklahoma has taken a sharp upswing within the last few years. During this same time the national demand for technicians appears to have been increasing at an even more rapid rate. The Oklahoma Employment Security Commission anticipates that Oklahoma's need for technicians will increase from the 35,000 employed in 1963 to 45,000 in 1975, an increase of about 30%.[1] This means an anticipated average annual growth rate of about 2.5% per year. The Bureau of Labor Statistics projects an average annual growth rate of about 6% for the entire nation in the employment of these same workers in the years 1963 to 1975.[2]

Voices from all segments of the economy are pointing out a general national shortage of engineering and physical science-related technicians. With the shortage being a national problem, Oklahoma needs to devote particular attention

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[1] Manpower in Oklahoma, (Oklahoma City: Oklahoma Economic Security Commission, 1964).

[2] U.S. Bureau of Labor Statistics, Technician Manpower: Requirements, Resources, and Training Needs, (Bulletin No. 1512, Washington: U.S. Government Printing Office, 1966) p. 21.

either to attracting technicians from outside the state or to preparing its own. The ability of the state to attract technicians from outside may or may not be greater than the ability of other states to attract technicians away from Oklahoma. At any rate, it appears desirable to prepare Oklahomans to fill job vacancies created within Oklahoma. Depending on in-migration of workers to fill job vacancies is not always good business practice.

Statement of the Problem

For the industrialist needing technicians and for those persons involved in optimizing the utilization of human resources, identifying supply sources of engineering and physical science-related technicians is of pressing importance. The principle sources of trained technicians may be broken into three major categories: (1) immigration, (2) in-service training programs, and (3) schools. Only the second and third means of supplying trained personnel are basic supply sources utilizing inputs of untrained manpower and turning out a trained, or semitrained product.

The relative merits of in-service training and training in the public school system will not be debated here. Each process has its own merits. It is generally conceded, however, that training technicians within the public school system allows the human resources within the economy to be more broadly trained than they would be with in-service training programs keyed to fitting specific people to

specific jobs. This broad training allows enhanced mobility potential for the technician and allows him to fill a wider variety of societal needs than he could with the more narrow specialized training.

The need for information concerning the in-school training programs for technicians in Oklahoma is a pressing one at this time. The problem considered herein is: In Oklahoma, how many technical programs of what type exist, and how many people do they train?

Objectives of the Study

The objectives of this study shall be to:

(1) Identify the principal suppliers of engineering and science-related technicians within the public and private school systems of Oklahoma,

(2) Identify the technical training programs offered by these institutions,

(3) Enumerate the outputs (graduates) and enrollments of these programs, and

(4) Briefly relate the technician output of Oklahoma schools to the expressed needs of Oklahoma industrialists.

Questions to be Answered

The questions to be answered by this study are derived directly from the objectives listed above.

(1) What public schools in Oklahoma offer programs training

engineering and physical science-related technicians?

(2) What private schools in Oklahoma offer programs training engineering and science-related technicians?

(3) What technical programs are offered at each of these institutions?

(4) How many graduates (by semester) has each of these programs supplied between the years 1960 and 1967?

(5) How many persons have each of these programs enrolled (by semester) between the years 1960 and 1967?

(6) Are Oklahoma public and private schools filling (in 1967) the demand by Oklahoma industry for engineering and physical science-related technicians?

(7) Using projections of the technician output of Oklahoma schools and projections of the demand for these technicians in Oklahoma industry, will future industrial needs be filled by the schools in Oklahoma--assuming no change in the rate of change of either?

Need for the Study

The utility of technical education must be repeatedly demonstrated by supplying industry with workers having specific, usable qualifications. Technical program administrators must probe frequently seeking employment markets for graduating seniors. Each training facility is not only affected by the demand of industry for their graduates, but also by the number of technicians that are being supplied by other training facilities.

Many of the technicians hired by Oklahoma industry are experienced workers. Many other technicians, however, are hired fresh out of school. Recruiters need to know where to look for these persons and how many graduates to expect at each of the supply points.

Perhaps the most important need for this study is felt by those persons and agencies who attempt to correlate the needs of industry with the overall distribution of public training programs around the state. If an area has a pressing need for specific types of technicians, is there a training facility for these persons in the area? If not, technicians must be induced to come in from other areas or some new training programs must be established.

The supply of technicians in Oklahoma may appear adequate at a given point in time, but will that supply projected be adequate in consideration of the projected demand for technicians? Data are needed to answer these questions. Prior studies have brought together much information on the demand for technicians by Oklahoma industry, but, to date, no study has brought together reliable and accurate information on the enrollments and graduates from Oklahoma schools in a manner such that projections can be made of trends in the total Oklahoma school supply of engineering and physical science-related technicians.

Scope of the Study

The scope of this study shall be essentially limited to the answering of the questions set forth in the section, "Questions to be Answered." Public and private schools will be investigated to determine the extent of training programs offering training for engineering and physical science-related technicians.

Public technician training programs which have not qualified (according to the Oklahoma State Board of Vocational and Technical Education) for monetary subsidy under Title VIII of the National Defense Education Act will not be considered here. To qualify for this subsidy it is necessary that a program fit a specified definition to be recognized as a Title VIII program. Those programs are the type with which this study is concerned.

The high school technical programs currently active in Oklahoma City will not be included in this study. The reason for this is twofold. First, they do not offer the "equivalent of two academic years of post-high school training in a specialized field of technical study", as required in the definition of "engineering and physical science-related technical programs" used in this report. Secondly, they do not have as a primary objective the furnishing of technical manpower for industry, being rather a "search program" for post-high school technical education. The State Board for Vocational Education describes these high school technical programs in this manner:

> The high school technical education program is the basic element involved in preparing students for continuing study and improvement...Once the technical field has been introduced to high school students, those who are interested can be encouraged to study courses during their high school years which will be beneficial to them in their technical studies later.[3]

Area Vocational-Technical schools will also be excluded from this study for the reason that their programs do not fit the guiding definitions. They do not generally offer an "equivalent of two academic years of post-high school training in a specialized field of technical training." They do offer many courses on a post-high school basis, such as evening classes for adults in electronics technology, but these courses do not lead directly to an associate degree or its equivalent. They are aimed primarily at updating the skills of persons already employed, rather than preparing persons to enter the work force.

Private technician training programs, to qualify for consideration in this study, must train technicians who fit the "technician" description in the section of this study entitled, "Definition of Terms."

Data will be sought only for the years 1960 through the spring of 1967. Many of the programs will not have been active for that length of time, but a sufficient number will have been to establish trend lines suitable for reasonable projections.

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[3]Hardwick, Arthur Lee, Technical Education in Oklahoma--1965-66. (Stillwater, Oklahoma: State Board for Vocational Education, 1966).

No original research will be attempted in this study concerning the demand for technicians in Oklahoma. The emphasis herein shall be rather on the supply of these technicians. This supply shall be related to the demand for these workers as seen by other researchers in Oklahoma.

Definition of Terms

The term technician, as used herein, shall refer to the "engineering and physical science-related technician" unless otherwise specified.

The term engineering and physical science-related technician, as used herein, shall refer to a person who has received the equivalent of two academic years of post-high school training in a specialized field of technical training. His academic training is culminated with either the Associate Degree or an equivalent thereof. He will be trained specifically to apply scientific and engineering knowledge and methods combined with technical skills in support of engineering or scientific activities. For public schools, the judgmental criterion used to determine whether or not to count them as engineering and physical science-related technologies in this study is their qualification for monetary subsidy under Title VIII of the National Defense Education Act. For a listing of the criteria outlined in this Act, see page 11 in the "Review of the Literature."

The term enrollment, as used herein, shall refer to the number of students formally enrolled in a given program three weeks after the beginning of the term under consideration.

CHAPTER II

REVIEW OF THE LITERATURE

Much has been done in recent years toward identification of the technician and his characteristics, yet no accurate comprehensive data concerning technical program output has been gathered prior to the initiation of this study.

In 1962 the American Society for Engineering Education set down basic guidelines for the definition and recognition of the engineering technician.

> Engineering technology is that part of the engineering 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 area between the craftsman and the engineer at the end of the area closest to the engineer.
>
> Engineering technology is identified as a part of the engineering field to indicate that it does not by any means encompass the entire field and also to differentiate it from other types of technology in areas such as medicine and the biological sciences. The engineering field is viewed as a continuum between the craftsman and the engineer and closer to the engineer than to the craftsman.
>
> Engineering technology is concerned primarily with the application of established scientific and engineering knowledge and methods. Normally engineering technology is not concerned with the development of new principles and methods.
>
> Technical skills such as drafting are characteristic of engineering technology. Engineers graduated from scientifically oriented curricula may be expected to have acquired less of these

> skills than previously and the engineering technician will be expected to supply them.
>
> Engineering technology is concerned with the support of engineering activities whether or not the engineering technician is working under the immediate supervision of an engineer. It may well be that in a complex engineering activity he would work under the supervision of an engineer, a senior engineering technician, or a scientist.[4]

Title VIII of the National Defense Education Act provides monetary subsidies for the training of "highly skilled technicians." Their definition for these technicians embraces the engineering technician, and more broadly, what will be referred to in this study as the "engineering and physical science-related technician." Title VIII lists these general abilities as belonging to the category they refer to as the "highly skilled technician":

> (1) Facility with mathematics; ability to use algebra and trigonometry as tools in the development of ideas that make use of scientific and engineering principles; an understanding of, though not necessarily facility with, higher mathematics through analytical geometry, calculus, and differential equations, according to the requirements of the technology.
>
> (2) Proficiency in the application of physical science principles, including the basic concepts and laws of physics and chemistry that are pertinent to the individual's field of technology.
>
> (3) An understanding of the materials and processes commonly used in the technology.
>
> (4) An extensive knowledge of a field of specialization with an understanding of the engineering and scientific activities that distinguish the technology of the field. The degree of competency

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[4] Characteristics of Excellence in Engineering Technology Education (Urbana, Illinois: American Society for Engineering Education, 1962), pp. 11-12.

> and the depth of understanding should be sufficient to enable the individual to do such work as detail design using established design procedures.
>
> (5) Communication skills that include the ability to interpret, analyze, and transmit facts and ideas graphically, orally, and in writing.[5]

The Manpower Report of the President, 1966, lists as the fastest growing segment of the U.S. labor force between the years 1965 and 1970 "professional, technical, and kindred workers." This occupational group is expected to increase about 25% during that, or about 5% per year. The next fastest growing occupational group listed has an expected expansion rate of only 18.2% during that time, with the expansion rate of the entire labor force anticipated to be about 12.5%.[6]

The Bureau of Labor Statistics anticipates a growth rate for technicians in the labor force to be about 6¼% per year on the national level.[7] During that same period the Oklahoma Employment Security Commission anticipates the employment of technicians in Oklahoma to increase from 35,000 employed in 1963 to 45,000 in 1975--a growth rate of about 2.5% annually.[8]

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[5]Emerson, Lynn A., Occupational Criteria and Preparatory Curriculum Patterns in Technical Education (Washington: U.S. Government Printing Office, 1962), p. 7.

[6]U.S. Department of Labor, Manpower Report of the President and a Report on Manpower Requirements, Resources, Utilization, and Training (Washington: U.S. Government Printing Office, 1966), p. 43.

[7]U.S. Bureau of Labor Statistics, Bulletin 1512, p. 21.

[8]Manpower in Oklahoma, p. 47.

According to a manpower study conducted by the Oklahoma Employment Security Commission in 1965, Tulsa Oklahoma employed 7,131 persons in 1963 in jobs classified by them as "technician." By 1975 the need for those technicians is anticipated to rise by about 4,109, an increase of roughly 4.8% annually.[9]

Oklahoma has been a leader in technical education, pioneering much of the work in the field. Oklahoma's technical programs have served as a supply source for much of the nation, perhaps due in part to the salary differentials between Oklahoma and other parts of the country. The results of a study conducted by Arthur Lee Hardwick and Lloyd Briggs of the Oklahoma State Board for Vocational Education in 1965 indicated "salaries of Oklahoma's graduate technicians, in general, were slightly less than the national average."[10]

A study performed by Maurice Roney and Paul Braden at Oklahoma State University in 1967 showed as many as a third of the 1967 spring technical graduates in Oklahoma accepting jobs out of state.[11] This indicates that whatever is the

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[9]Oklahoma Employment Security Commission of the Oklahoma State Employment Service, Manpower in Tulsa--A Current Inventory and Future Requirements Study (Oklahoma City: Oklahoma State Employment Service, 1965), p. 21.

[10]Briggs, Lloyd D., and Hardwick, Arthur L., A Study of the Graduates from Oklahoma's Post-High School Programs of Technical Education (Stillwater, Oklahoma: State Board for Vocational Education, Technical Division, 1965), p. 23.

[11]Braden, Paul V., and Roney, Maurice W., Occupational Education Beyond the High School in Oklahoma (Stillwater, Oklahoma: The Research Foundation of Oklahoma State University; and Norman, Oklahoma: Center for Economic Development of the State of Oklahoma, 1967), p. 73.

supply of graduate technicians from Oklahoma schools, not all of that supply may be considered as applicable to the technician needs of Oklahoma.

Placement of graduate technicians from Oklahoma programs appears to be no problem. A study by Lloyd Briggs in 1965 showed 88% of the job-seeking associate degree graduates from Oklahoma technical programs obtaining jobs immediately upon graduation with the remaining graduates finding employment within an average of three months. For technical graduates holding the certificate of completion, employment was waiting on graduation for 65% of the group with the remainder of the group being employed within an average of less than two months.[12]

In 1965 the Oklahoma State Regents for Higher Education published its Self-Study of Higher Education in Oklahoma--Report 7. In the report, technical programs offered at the various public schools in the state are listed.[13] Some of these have since become inactive, and other new programs have been added. Since no listing of enrollments and graduate numbers is included for these programs, there is no indication in the report of the size of each of them.

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[12]Briggs, Lloyd Delano, "A Study of the Placement of Graduates from Oklahoma's Post-High School Programs of Electronics Technology" (unpublished Master's thesis, School of Industrial Education, Oklahoma State University, 1960), p. 30.

[13]Higher Education Opportunities and Needs in Oklahoma--Self-Study of Higher Education in Oklahoma--Report 7 (Oklahoma City: Oklahoma State Regents for Higher Education, 1965), pp. 53-55.

Arthur Lee Hardwick of the Technical Education Division of the State Board for Vocational Education published in Technical Education in Oklahoma--1965-66 descriptions of the various public technical programs in Oklahoma that fit the Title VIII criteria for technical education.[14] His descriptions are quite detailed, but he includes no information on the graduates or enrollments in these programs.

The Thirty-First Biennial Report of the State Department of Education of Oklahoma, published in 1966, contains a listing of the Title VIII-approved programs in Oklahoma with the dates of their approval. The report also contains a tabulation, by year, of the number of full and part-time students in all of Oklahoma technical programs combined.[15] Their figures indicate two or three times the number of students found in the investigation for this study. This same sort of discrepancy appears in a 1963 pamphlet circulated by the State Board for Vocational Education. In one part of the pamphlet 112 students are counted as being enrolled at an institution with only two teachers teaching two different technologies to those students. At another institution 373 students are shown in three technologies with six instructors. These two examples represent, respectively,

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[14]Hardwick, Technical Education in Oklahoma--1965-66.

[15]State Board of Education of Oklahoma, The Thirty-First Biennial Report of the State Department of Education in Oklahoma (Oklahoma City, Oklahoma: State Board of Education of Oklahoma, 1966), pp. 98-99.

pupil-teacher ratios of 56:1 and 62:1.[16] The student counts for this study show substantially different conditions at both of those institutions, and indeed, for all the institutions included in their report. Possible reasons for these discrepancies will be discussed in detail later in this study.

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[16]A Progress Report of Technical Training Services in Oklahoma, Oklahoma State Board for Vocational Education, Technical Division, October 18, 1963 (lithographed circular).

CHAPTER III

METHOD AND PROCEDURE

Instrumentation

The form of the instruments used in gathering the data in this study was suggested directly by the questions to be answered. At each of the schools to be reviewed the data to be gathered consisted of: (1) full-time enrollments, (2) part-time enrollments, and (3) graduates, all broken down by technology and semester. The necessary cross-listing of data suggests a matrix arrangement to allow a single entry of any of the three basic units of data to be noted such as to define all the parameters involved by the placement and size of the data entry. Table IV is an abbreviated form of the matrix used to record the total body of data.

Identification and Evaluation of Data Sources

The first potential source of data approached for this study was the Technical Division of the Oklahoma State Board for Vocational Education. Each semester the various programs around the state are required to furnish the Board with information including the sizes of each of their technical classes, a list of students enrolled in their technical programs (including addresses), and information on the

number of graduates. Many hours were spent poring over the information in the State Office, and some usable information was derived. For example, the names and locations of all the Title VIII technical programs were noted. The other information, such as number of graduates and enrollments turned out to be very spotty and unreliable when attempts were made to apply their information to the problems of this study. Enrollment figures, for example, as reported by the State Board for Vocational Education, appear to have been derived from their form TE-105. This form is the "Area Vocational Technical Education Enrollment Report", and asks for the number of full and part-time students enrolled in each of the technical courses. The percentage of technical majors in each course are noted also on the form. Some of the publicly-reported enrollments in technical education were derived by adding the enrollments in all the classes reported on these forms. The problem arising here is the problem of multiple counting of some students. For example, the same student might be enrolled in several of the technical courses at a given school and consequently counted more than once. Even courses which should contain the same students, such as concurrently-offered courses at equal levels, may have dissimilar enrollments, both in technical majors and non-technical majors. After several hours of working with form TE-105, it was discarded as being worthless for the purpose of determining total enrollment figures.

State Office records for graduates in the various programs also were eventually discarded as unusable. After finding multiple records (for some of the institutions) that should have been identical but differed considerably, it was decided to take these records as official only when nothing better could be found. These records were by no means complete, with complete yearly data for a given school being unusual, rather than typical.

Another potential source of graduate and enrollment data was the Oklahoma State Board of Regents for Higher Education. On examination of their records it was found that information for early years to be considered in this study was not to be found. Even though complete Regents Reports were later produced at Oklahoma State Tech for all the years needed in the study, no copies of these reports were found in the Regents Office.

The most reliable sources of information for this study, and the sources that were eventually tapped for the data, were officials at each institution having technical programs. In all cases where possible, instructors or department heads were contacted for information on graduates and enrollments. Many other questions were asked in an attempt to get as much insight into each program as possible.

Techniques Used in Gathering the Data

For gathering data from each of the schools, a personal interview technique was used. At schools having small

technical programs, each technical instructor was contacted for data and for extensive information concerning the scope, emphasis, and level of his program. In schools having large technical programs, department heads were contacted for the numerical data, then each individual instructor, when available, was interviewed concerning his program. In addition to the data gathered to answer the questions serving to guide this study, information was also sought specifically to help determine characteristics of Title VIII-approved programs so that extensive criteria would be available for the categorization of private technical programs when deciding whether or not to include them in this study.

It was found in many of the schools that only scattered records were available concerning the number of enrollees and graduates they had held in the past. In some cases instructors pulled old grade books and selected from the rolls the number of technical students enrolled on a full or part-time basis in preceding years. Regents Reports and reports to the State Vocational Education Office were only occasionally useful, being as useless to school officials as to the general public in determining the actual number of persons enrolled in any given program in any given year. In all fairness to the State Board, though, it should be noted that the primary purpose of the reports sent to them on the form TE-105 is for determining reimbursement schedules, rather than for determining actual enrollments.

CHAPTER IV

DISCUSSION AND ANALYSIS OF FINDINGS

The in-school training of engineering and science-related technicians in Oklahoma is accomplished primarily in the public school system. Training programs on the level required for training these personnel exist both in military and private institutions. These programs lack the length and breadth of those available through the public school system, however. At the Federal Aviation Academy in Oklahoma City, for example, technical programs are offered which approach engineering programs in mathematical and scientific principles usage. These programs are very short and narrow, however, being designed to train personnel specifically for a single job or a very narrow range of jobs. One of the longest of the technical programs at the Federal Aviation Academy is the electronics technician training program offered on a contract basis for Tinker Air Force Base. This program lasts 35 weeks, or roughly the equivalent of a single semester. Such short-duration programs are the type common also to private technical schools.

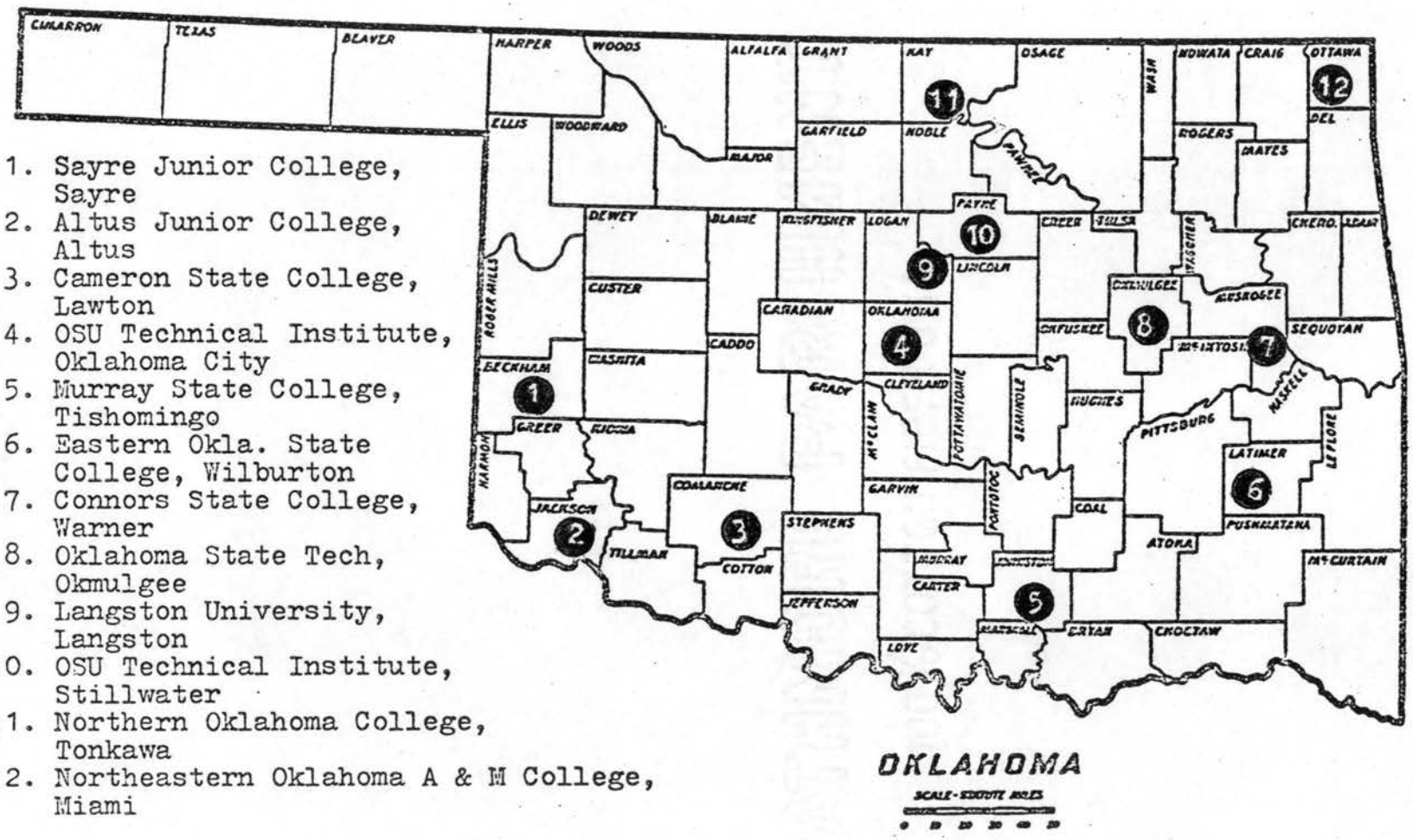
Some of the private schools, such as Oklahoma Technical Institute in Oklahoma City, offer technical programs which approach the length of those in the public school system.

These programs, however, are not on the engineering and physical science-related technician level, being aimed rather at the training of the "industrial technician." These programs emphasize manual skills more than the use of mathematical and scientific theory.

Associate degree-level programs for the training of engineering and physical science-related technicians in Oklahoma schools appear to be concentrated in the public sector. Figure 1 shows the locations of institutions of institutions offering technical programs in Oklahoma. Note that one of the most rapidly developing industrial centers in the state, Tulsa, has no technical programs offered closer than 40 miles away in Okmulgee. If a Tulsan wants technical training not available at Oklahoma State Tech in Okmulgee, the next closest technical programs for him would be in Stillwater, about 1½ hours drive for him by passenger car.

For many persons wanting technical training, the distance between technical schools and their locations may be of little significance. These persons may be able to move to the campus where the programs are offered and reside in dormatories or apartments. For persons desiring to work on technical degrees while holding on to their existent jobs, the commuting distance to a technical school might be of considerable importance.

Table I shows technical programs currently available at each of the Oklahoma institutions. One notable concentration that should be evident in the matrix is the large



1. Sayre Junior College, Sayre
2. Altus Junior College, Altus
3. Cameron State College, Lawton
4. OSU Technical Institute, Oklahoma City
5. Murray State College, Tishomingo
6. Eastern Okla. State College, Wilburton
7. Connors State College, Warner
8. Oklahoma State Tech, Okmulgee
9. Langston University, Langston
10. OSU Technical Institute, Stillwater
11. Northern Oklahoma College, Tonkawa
12. Northeastern Oklahoma A & M College, Miami

Figure 1. Active Post-High School Technical Program Locations: Fall 1966

TABLE I

ACTIVE POST-HIGH SCHOOL TECHNICAL PROGRAMS IN OKLAHOMA, FALL 1966

SCHOOL OFFERING POST-HIGH SCHOOL TECHNICAL PROGRAM / PROGRAMS	Aeronautical	Chemical	Civil	Civil & Highway	Construction	Data Processing	Drafting	Electronics	Fire Protection	Instrumentation & Process Control	Mechanical	Metals	Petroleum	Radiation	Refrigeration & Heating	PROGRAM TOTALS
Altus Junior College						x										1
Cameron State College						x	x	x								3
Connors State College							x									1
Eastern Oklahoma State College		x		x		x	x	x								5
Langston University								x								1
Murray State College							x									1
Northeastern Okla. A & M College		x				x	x	x			x				x	6
Northern Oklahoma College						x		x								2
Oklahoma State Tech						x	x	x							x	4
OSU Tech. Institute, Okla. City			x			x	x	x		x					x	6
OSU Tech. Institute, Stillwater	x				x		x	x	x		x	x	x	x		9
Sayre Junior College								x								1
PROGRAM TOTALS	1	2	1	1	1	7	8	9	1	1	2	1	1	1	3	40

proportion of the schools offering certain curricula. Electronics technology for example, is offered at nine of the institutions, drafting (or drafting and design) is offered at eight of the institutions, and data processing is offered at seven. After these three, the most widely offered program is refrigeration and heating, which is offered at only three schools.

This relative preponderance of technical offerings in electronics and drafting matches figures obtained from a recent return of questionaires sent out by the State Board of Vocational Education to 24 of Oklahoma's largest industrial concerns. Seven of them expressed an immediate need for 69 electronics technicians and 13 of them expressed an immediate need for 34 associate degree draftsmen. Interestingly, none of them asked for data processing technicians, though six B.S. degree programmers were listed. After the drafting, or drafting and design, needs, the most asked-for personnel were chemical technologists, with 17 being requested by two companies.[17]

In a recent Oklahoma Employment Security survey of the Tulsa region, the ranking in number of electronics technicians employed fell in fifth place behind mechanical draftsmen, draftsmen (all others), estimators (nonmanufacturing), and licensed practical nurses, in that order. By 1975, as shown in Table II, that order is anticipated to rearrange

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[17]"Oklahoma Companies Needing Trained Personnel", Oklahoma State Board for Vocational Education, Technical Division, April 7, 1967 (lithographed circular).

TABLE II

TULSA TECHNICIAN REQUIREMENTS (PARTIAL LIST)

	Net Additional Requirements			Rank Order		
	1965	1970	1975	1965	1970	1975
Mechanical Draftsman	104	168	269	1	3	3
Draftsman, All Other	99	431	614	2	1	1
Estimator, Nonmanufacturing	79	108	172	3	6	6
Licensed Practical Nurse	63	252	367	4	2	2
Electronics Technician	45	125	196	5	5	5
Production Planner	40	166	256	6	4	4
Architectural Draftsman	34	38	47	7	11-12	12
Mathematics Technician	20	41	64	8	9	11
Quality Control Technician	18	66	78	9	8	9
Programmer, Data Processing	14	40	69	10	10	10
Operating Room Technician	13	38	80	11	11-12	8
Medical Technician	8	67	111	12	7	7

Source: Oklahoma Employment Security Commission. Manpower in Tulsa--A Current Inventory and Future Requirements Study. (Oklahoma City: Oklahoma State Employment Service, May 1965), p. 22.

slightly with drafting and electronics maintaining their relative positions with respect to each other.[18]

Table III shows a breakdown of all graduates from all technical programs in Oklahoma in the years 1960-67. Notice that the bulk of all the graduates fall into three categories: electronics, drafting, and the composite group of mechanical-refrigeration and heating. These categories account for about 80% of the technical graduates from Oklahoma programs in the years 1960-67.

Figure 2 compares the number of graduates from all Oklahoma technical programs in those programs having as many as 20 graduates in either 1966 or 1967. Note that, in terms of numbers of graduates from these programs, the combined technical group of mechanical and refrigeration technologies leads all others. This seems odd in consideration of the complete lack of demand for these people in the Oklahoma Employment Security's Tulsa manpower report. In the questionaire sent out by the State Board for Vocational Education, only two refrigeration-heating-air conditioning technicians were listed on the "needs" list and only eight mechanical technicians. These graduates appear to be finding ready employment, however, which might indicate a communication breakdown between the educational services and industry on the actual naming of these technician types.

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[18]Oklahoma Employment Security Commission of the Oklahoma State Employment Service, p. 22.

TABLE III

GRADUATES OF OKLAHOMA TECHNICAL PROGRAMS FOR THE SCHOOL YEARS 1960-61 TO 1966-67

SCHOOL YEAR / PROGRAM	Aeronautical	Chemical	Civil	Construction	Data Processing	Drafting	Electrical	Electronics	Fire Protection	Instrumentation & Process Control	Mechanical, Refrig. and Heating	Metals	Radiation	Total Graduates
1960-61	14	0	0	5	0	68	16	72	12	0	87	8	0	282
1961-62	10	0	0	13	0	67	9	79	19	0	55	0	0	252
1962-63	11	3	0	10	0	89	7	97	12	0	50	6	0	285
1963-64	16	8	0	11	14	96	4	99	12	0	112	7	0	379
1964-65	8	21	2	5	19	160	8	116	13	0	105	0	0	457
1965-66	9	18	1	5	34	141	8	116	12	3	107	7	11	472
1966-67	9	10	4	2	37	134	0	121	9	3	86	4	11	430
Total Graduates	77	60	7	51	104	755	52	700	89	6	602	32	22	2557

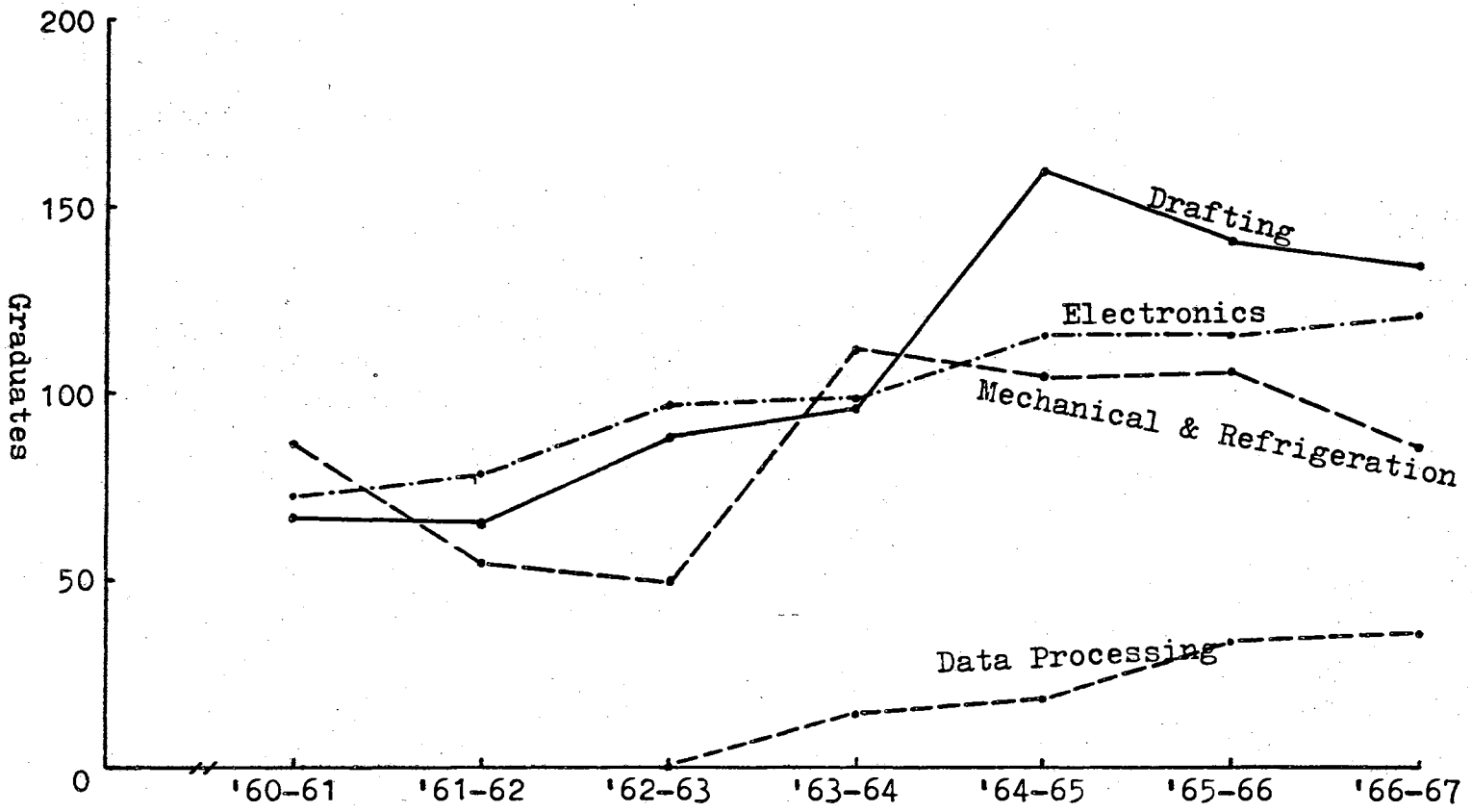

Figure 2. Comparison of Oklahoma Graduates From Selected Technical Programs

The Oklahoma Employment Security Commission predicts a growth rate of technical employment in Oklahoma at about 2.5% per year, compared to a 6% increase per year predicted by the Bureau of Labor Statistics for the entire nation. The present trend in Oklahoma technical education graduates is in considerable contrast to this, as figure 3 shows.

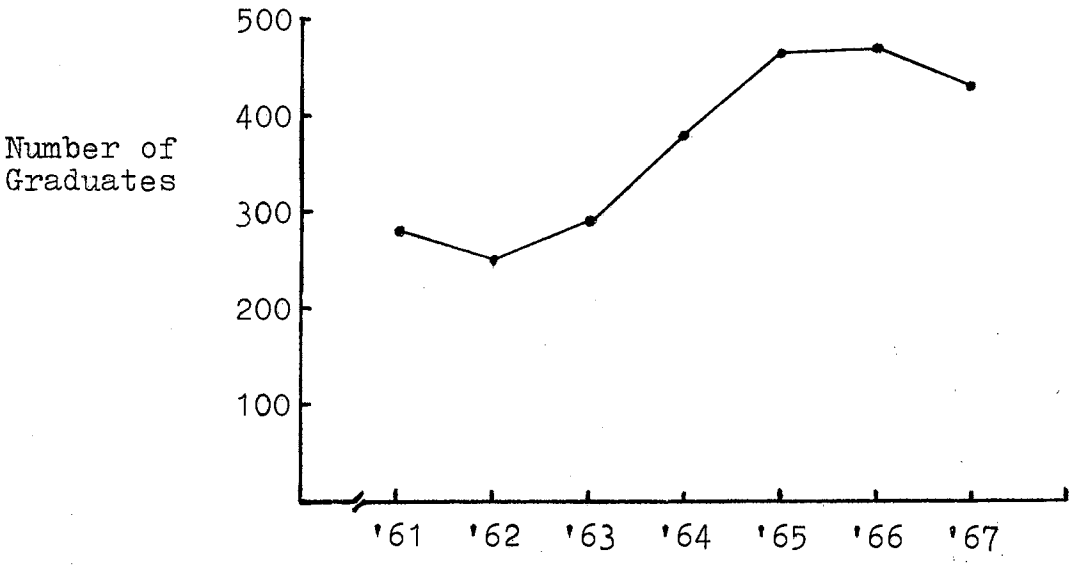

Figure 3. Yearly Spring Graduates From Oklahoma Technical Programs

A projection of the curve in Figure 3, no matter how statistically optimistic, shows a growth rate of less than 2.5% for the number of graduates from Oklahoma technical programs. This indicates that the present shortage of technical manpower in Oklahoma not only is failing to be completely filled by Oklahoma schools, but will be filled less by these schools in the following years if the present trends continue. The gap obviously is widening between the academic supply sources and industrial demand for technicians.

Enrollments in the post-high school technical programs considered in this report are tabulated in Table IV. Both the full and part-time enrollments are reported, since each is important for pointing out certain considerations. The complexity of the tabulation makes it desirable to break down the information so that more specific comparisons may be made. Figures on the following pages will illustrate the trends in full and part-time enrollments in the various types of institutions, that is, in the junior colleges, OSU technical institutes, and four-year colleges. Table IV depicts so many relationships, however, that to attempt to pursue all of them would extend far beyond the scope of this report.

Some of the individual technologies listed in the enrollment table, however, are worthy of mention here. Three of the newest programs are medical, petroleum, and radiation technologies. The enrollments in the radiation program have been relatively high from its beginning and it appears, at the present time, to be a success. Medical technology, offered at Oklahoma College of Liberal Arts, has been organized for the same number of years as the radiation program, yet has never been so popular. In its first year of operation, only one student was enrolled. In its second and third years of operation, eight students were enrolled in the program. At the time the program was discontinued in the 1966-67 school year, only one of the eight students who had enrolled in the program expected to graduate from it as a medical technician.

TABLE IV

OKLAHOMA POST-HIGH SCHOOL TECHNICAL PROGRAM ENROLLMENTS:
FALL 1960-61 TO FALL 1966-67

SCHOOL YEAR	PROGRAM	Aeronautical	Chemical	Civil	Construction	Data Processing	Drafting	Electrical	Electronics	Fire Protection	Instrumentation & Process Control	Mechanical, Refrig. and Heating	Medical	Metals	Petroleum	Radiation	Unclassified	Total Enrollments
'60-61 *	FT	40	0	0	41	0	256	39	252	40	0	277	0	12	0	0	0	957
	PT	0	0	0	0	0	41	0	60	0	0	0	0	0	0	0	0	101
'61-62	FT	38	0	0	30	0	327	25	283	45	0	295	0	25	0	0	0	1068
	PT	0	0	0	0	0	64	0	124	0	0	0	0	0	0	0	6	194
'62-63	FT	46	19	0	30	25	374	20	391	40	0	336	0	18	0	0	22	1321
	PT	0	0	8	0	63	114	0	174	0	0	96	0	0	0	0	75	530
'63-64	FT	28	42	5	27	96	441	14	465	43	4	395	0	7	0	0	2	1569
	PT	0	0	71	0	126	111	10	306	0	2	93	0	0	0	0	31	750
'64-65	FT	34	49	7	26	126	413	21	434	33	0	318	1	14	0	18	7	1501
	PT	0	0	31	0	91	104	0	297	0	0	115	0	0	0	0	145	783
'65-66	FT	48	30	9	32	147	481	9	523	46	17	309	8	17	0	39	2	1717
	PT	0	17	103	0	137	123	42	204	0	9	110	0	0	0	0	59	804
'66-67	FT	51	49	15	30	264	526	0	517	49	12	304	8	17	24	28	14	1908
	PT	0	0	39	0	299	164	0	204	0	21	52	0	0	0	0	245	1024

* FT signifies full-time enrollments, and PT signifies part-time

Full-time technical enrollments in Oklahoma for the years 1960-1967 are depicted in Figure 4. The full-time enrollments are shown for the junior colleges, Oklahoma State University technical schools, and four-year colleges. The growth rates for all three appear to be about the same when the enrollment graphs are replaced with their regression lines. Growth of junior college enrollments has started later and has been more constant than is the case for the technical school enrollments.

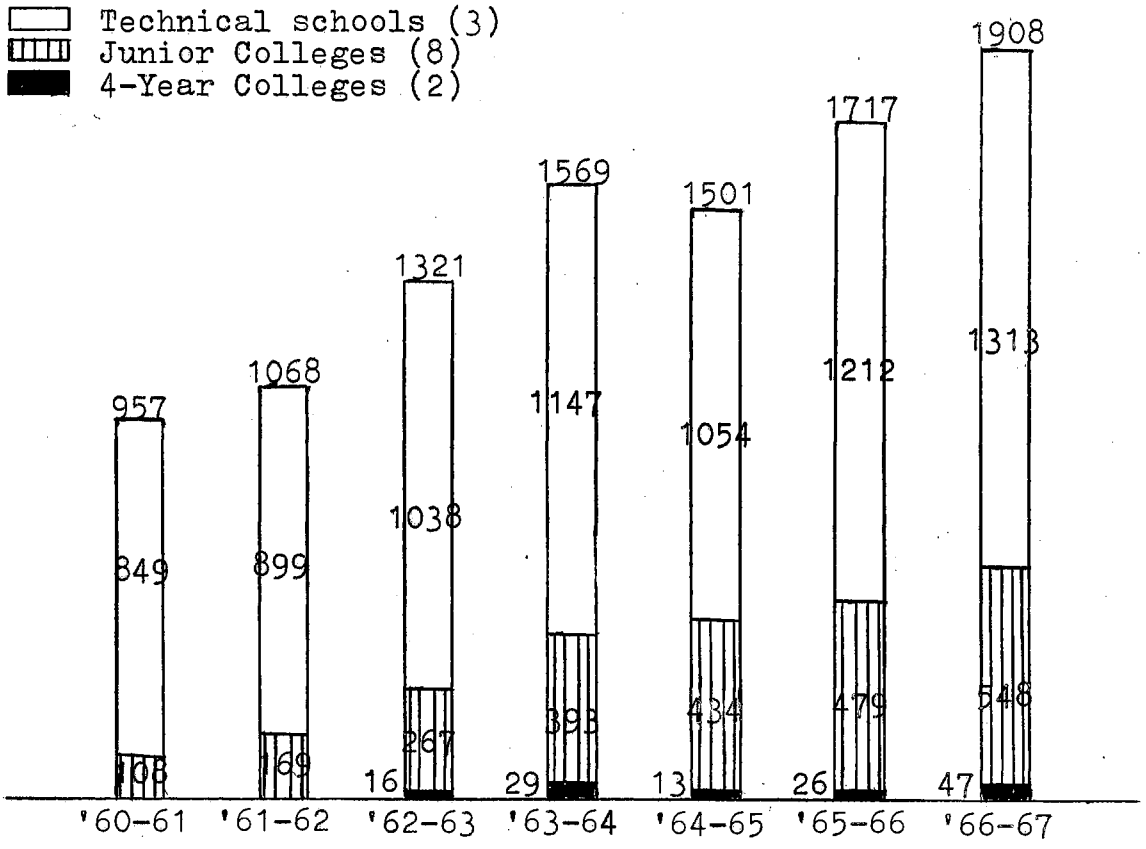

Figure 4. Full-Time Post-High School Technical Program Enrollments in Oklahoma from 1960-61 to '66-67.

The major break in the increase of full-time enrollments of the technical schools occurred in the school year

1964-65. That year saw a drop in the enrollments at the OSU technical schools in the areas of Civil, Construction, Data Processing, Drafting, Fire Protection, Instrument and Process Control, and Mechanical technologies. The technologies not suffering were Electronics, Electrical, Metals, and Aeronautical. To assume any particular phenomena to be the cause of this dip in enrollment, which hit all three of the Oklahoma State University technical schools to some extent, could be no more than an unsupportable speculation, so the dip will only be reported here.

The part-time enrollments at the OSU technical schools did not show the same dip in 1964-65 as did the full-time enrollments. Figure 5 depicts the part-time technical enrollments in the Oklahoma schools included in this report. The four-year schools, Langston and Oklahoma College of Liberal Arts, reported no part-time enrollments in any year in their technical programs.

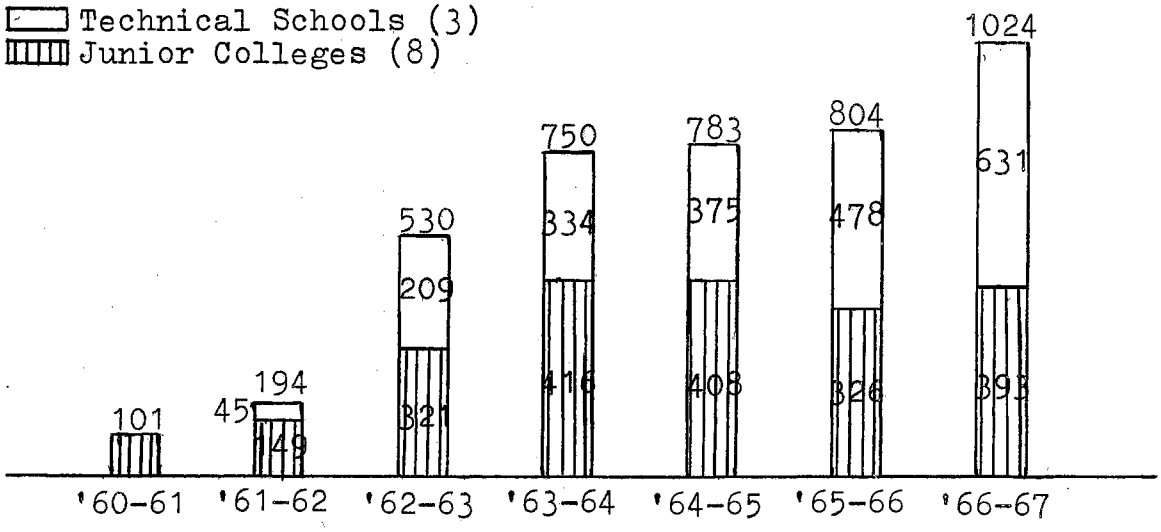

Figure 5. Part-Time Post-High School Technical Program Enrollments in Oklahoma from 1960-61 to 1966-67.

Note that in part-time enrollments, the OSU technical schools were led in the earlier years by the junior colleges. In the school year 1965-66, however, these enrollments took a dip in the junior colleges while increasing rapidly in the OSU schools. In the last two years shown on the graph, the OSU part-time enrollments have surpassed those of the junior colleges. The bulk of the OSU part-time enrollments are at the Oklahoma City branch of the Technical Institute. At that Institute, part-time enrollments comprise roughly half of the total enrollment in recent years, while at the other two OSU technical schools the part-time enrollments are a minor portion of their total enrollments. Almost all of the part-time enrollments reported by the Stillwater branch of the institute are extension students. Courses are offered by extension at points scattered about the entire state, usually in civil or general technology. Extension courses in electrical, electronics, and data processing technologies have also been conducted in the past.

The part-time enrollments appear to be comprised primarily of two types of students--those working eventually toward an associate degree and those taking courses to update their technical competance in jobs they already have. In either of these cases, it is generally the case that the student will be employed during the time of his enrollment in the technical program. The rapid growth of part-time enrollments at the Oklahoma City branch of the OSU Technical Institute is not at all surprising. Oklahoma City is one of

the industrial centers of the state, and as such is the home of many persons who can benefit by the "after-hours" technical programs to update their skills or to train for new industrial positions. It would also follow logically that Tulsa, another industrial center, should also find evening technical programs beneficial and popular. Tulsa, however, has no public institutions offering technical programs--either on a day-time basis or night-time basis.

Part-time enrollments are assuming an increasingly important position among total enrollments in Oklahoma technical programs. Figure 6 shows for the years 1960-67 the part-time enrollments compared to the full-time enrollments in Oklahoma technical programs. The increase in relative importance of the part-time enrollments may reflect the increasing importance of the institutions offering the part-time programs, or it may reflect some other phenomena.

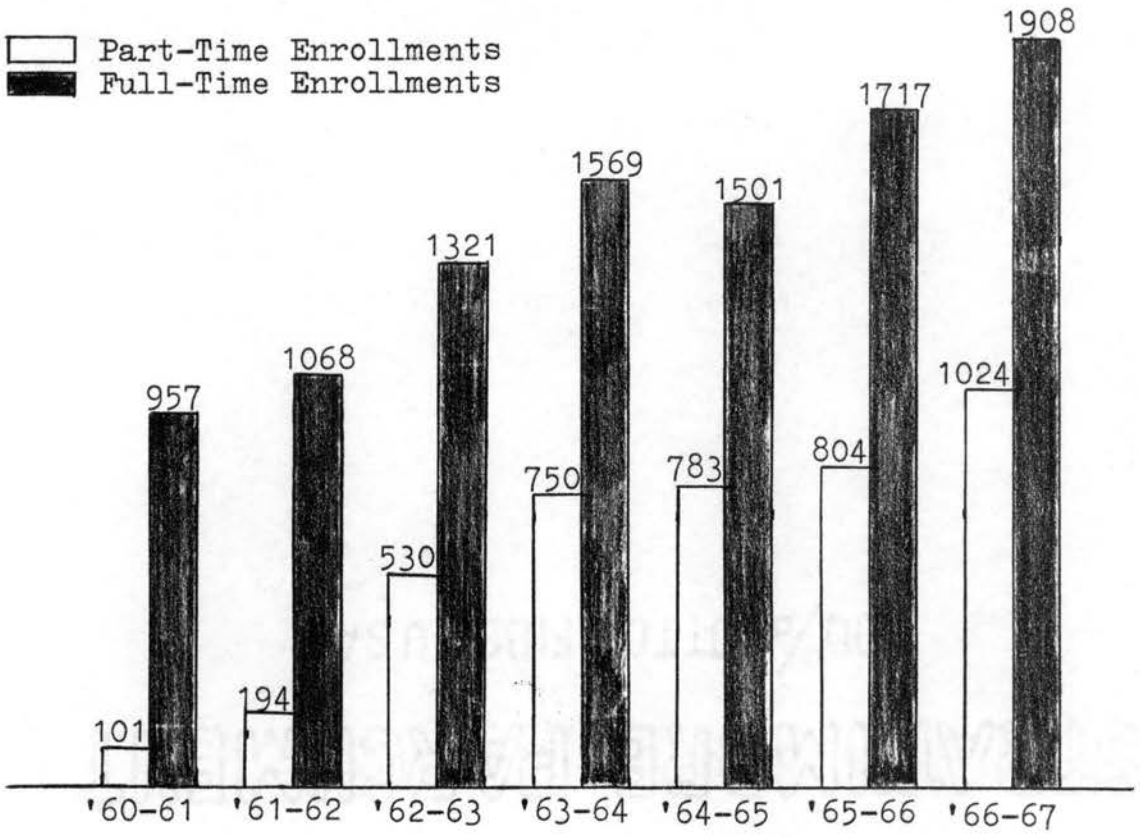

Figure 6. A Comparison of Full and Part-Time Post-High School Technical Program Enrollments in Oklahoma from 1960-61 to 1966-67.

CHAPTER V

SUMMARY AND CONCLUSIONS

The following conclusions, serving to answer briefly the seven questions raised on pages 3 and 4, are numbered (1) through (7) in correspondence to those questions:

(1) Several high schools and Area Vocational-Technical schools in the state offer introductory programs in engineering and physical science-related technology at less than the associate-degree level. The 12 public schools, however, offering engineering and physical science-related technologies of full associate-degree level are:

Sayre Junior College--Sayre
Altus Junior College--Altus
Cameron State College--Lawton
O.S.U. Technical Institute--Oklahoma City
Murray State College--Tishomingo
Eastern Oklahoma State College--Wilburton
Connors State College--Warner
Oklahoma State Tech--Okmulgee
Langston University--Langston
O.S.U. Technical Institute--Stillwater
Northern Oklahoma College--Tonkawa
Northeastern Oklahoma A & M College--Miami

(2) Some privately-supported and federally-supported schools in Oklahoma train technicians at an academic level equivalent to that used to define the technicians considered in this study. Notably, Spartan School of Aeronautics in Tulsa and the Federal Aviation Academy in Oklahoma City have been involved in this type of training. These schools,

however, offer coursework which, though intensive, is short-term and aimed at more narrow occupational objectives than the technician training programs included in this study. Other than these two programs, all the other state accredited nonstate-supported technical programs in the state are aimed at the "industrial technician" training which requires less intensive study in math and science than does the engineering and physical science-related technical program.

(3) For a detailed tabulation of the programs offered at each of the institutions included in this study, refer to page 24. Electronics, the most-offered of all the programs, is offered at nine of the 12 institutions. Drafting (or drafting and design) follows, being offered at eight. Data processing is offered at seven. After these three, no other technology is offered at more than three institutions.

(4) For a detailed tabulation of graduates from each program by school year, refer to page 28. Drafting (or drafting and design) has graduated 755 technicians between 1960-61 and 1966-67. Following close to this, electronics has graduated 700 in the same period and the combined group of mechanical and refrigeration-heating technologies has graduated 602. None of the other programs come close to this, the next most prolific program being data processing which has graduated 104 in that period.

(5) Table IV on page 32 is a tabulation of the number of persons enrolled both on a full and part-time basis in each of the technical programs during the seven school years

considered in this study. Figures 4, 5, and 6 further divide these enrollments by the type of institution from which they are reported. Trends emerging show a fairly steady increase in total technical program enrollments in Oklahoma.

The enrollment dip in 1964-65 may well be responsible for the graduate output dip in 1966-67 shown in figure 3 on page 30. The data gathered for this study, however, is incapable of either supporting or rejecting such a contention.

Since 1960, part-time enrollments have comprised a larger and larger share of the total enrollments. In recent years the part-time portion has been roughly one third of the total.

The O.S.U. technical schools have for several years carried at least 60% of the total full-time technical enrollment in the state. The junior colleges, however, have carried more than half of the part-time enrollment until the school year 1965-66. The recent increase in part-time enrollments at the O.S.U. schools has been due almost entirely to the large part-time enrollment at their technical institute branch in Oklahoma City.

(6) Graduates from Oklahoma technical programs during the seven years of this study have been far too few to fill the demand voiced by Oklahoma industry for their services. The growth rate of graduations from these programs during that period has been less than 2.5% annually, while the projected growth rate for the demand for these personnel on a nation-wide basis is about 6% annually. The rate of growth

projected by the Oklahoma Employment Security Commission for technician demand in Oklahoma is about 2.5% annually to the year 1975.

(7) Using projections of the technician output of Oklahoma schools and projections of the demand for these technicians in Oklahoma industry, it appears the demand, having never been completely filled, will be filled less and less in the near future. Present trends show an ever-widening gap between the demand and supply.

CHAPTER VI

RECOMMENDATIONS FOR FURTHER STUDY

It is recommended that the following questions, which have been raised but unanswered by the data gathered for this study, be considered for further study:

(1) Do available demand schedules for engineering and physical science-related technicians reflect a true image of the actual demand for these persons, or is considerable error introduced into the stated and implied demand by a lack of standardization of job title definitions?

(2) Do techniques used in gathering information pertaining to demand for technicians encourage prospective employers to overestimate their needs and ability to employ?

(3) Do techniques used in gathering information pertaining to demand for technicians encourage prospective employers to overstate the technical qualifications necessary to fill their potential job openings? Such a phenomenon could well be one of the major factors in the current migration of highly skilled technicians from Oklahoma to surrounding areas. Employers overstating the qualifications necessary to fill their job openings will often find themselves unable to pay a competitive wage to persons possessing the stated qualifications. The net result is that employers in

answering demand surveys will have contributed to the training of personnel they cannot afford to use.

(4) What was the most probable reason for the sudden technical program enrollment drop in the school year 1964-65? If the drop in enrollment resulted from a particular administrative blunder on the part of technical educators, knowledge of the underlying principles could prevent a recurrence.

(5) What has happened to the graduation and enrollment data supposedly kept by the State Regents and State Department of Vocational and Technical Education? It appears, from the information uncovered in the course of this study, that the loss of records was not through intentional disposal. If the loss was due to administrative turnover or to carelessness and accident, steps should be taken to reduce such losses.

(6) Is a new technical school needed in Tulsa? Limited information gathered in this study indicates the need for opening a technical school in that area. It is recommended that a formal feasability study concerning this possibility be undertaken with the sponsorship of some agency able to act on the findings.

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VITA

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