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A Comparison of Technologist Needs and Training Requirements of the Major Industries Within the State of Utah

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A COMPARISON OF TECHNOLOGIST NEEDS AND TRAINING REQUIREMENTS OF THE MAJOR INDUSTRIES WITHIN THE STATE OF UTAH

by

Gene E. Forsberg

A thesis submitted in partial fulfillment
of the requirements for the degree

of

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in

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Approved:

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Gene E. Forsberg

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ABSTRACT

A Comparison of Technologist Needs and Training Requirements of the Major Industries Within the State of Utah

by

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The technologist needs and training requirements were determined from a selected cross-section of Utah industrial firms.

The larger industries were significantly more aware of the training requirements and capabilities of four-year technologists than were the smaller firms.

A significant difference was found regarding general and specialized training required by each firm. Thirteen of the 16 responding firms indicated specialized training as being most important.

The 10 areas of technical training rated most critical in their order of importance were: electronics, technical writing, electricity, English, mathematics (calculus and above), machine shop, manufacturing processes, physics, and metallurgy and design.

There was no significant difference found between the wages offered by selected Utah industrial firms and the national average of comparable occupations.

(79 pages)

INTRODUCTION

For the past decade significant progress has been made in science and engineering. Great strides have taken place particularly in the areas of aerospace, transportation, and military defense technology. As a result of this expansion, it appears that a gap has grown between the engineer and craftsman in performing the functions necessary in keeping pace with our advancing technology (7).

Many of the industrial firms within the state of Utah are directly or indirectly involved in support of these areas of technology. In an effort to provide the necessary engineering support personnel, several educational programs were initiated in the state of Utah for this purpose. At the present time, there are five four-year technologist programs being offered within the state of Utah. Three of these programs are conducted at Utah State University, one at Weber State College and one at Brigham Young University. Each program is designed to lead to a Bachelor of Science degree and provide the training necessary to qualify each graduate for an engineering support or industrial management position.

Statement of the Problem

A general review of graduate records, for the past 10 years, in the various technical areas indicated that over 75 percent of the graduate technologists are gaining employment outside the state of Utah as evidenced by their current permanent address.

As the result of conversations of the author with several representatives of instate industries, it appeared that two basic factors were involved. First, instate employers seemed unaware of the qualifications and abilities of persons trained as four-year technologists. Second, it appeared that there was not a clear understanding between industry and the schools involved as to the degree of general or specialized training required to adequately fit graduating students in the technical positions available within the state. This study was designed to determine if such problems and deficiencies existed between the instate industries and schools involved, resulting in fewer employment possibilities for persons graduating from the technologist programs.

Objectives

Specifically, this study attempted to answer the following questions:

1. Do the major Utah industrial firms and service agencies understand the qualifications and abilities of a technologist?

2. What level of specialization or general background training is desired or required by these employers for placement of persons in technologist positions within their organization?

3. How many technologists in the areas of aeronautical, automotive, and welding technology are practicing in the state of Utah?

4. How many and what type of technologist positions are available in the major industries within the state?

5. Do the existing curriculums offered by the schools support industrial needs within the state in the area of technologist training?

Review of Literature

A review of current literature revealed there has been no study concerning the needs and training requirements of technologists conducted within the state of Utah.

The term "technologist" is relatively new as it relates to a designated area of work. In the Dictionary of Occupational Titles the term is mentioned in only three occupations: biochemistry, bacteriology, and medicine. With regards to the area of industrial technology, as the term is used in this study, reference is made in the Dictionary of Occupational Titles only to the technician.

Although little has been written concerning industrial technologists, three reports were located that were indirectly related to the present study. The first, conducted by the New York Engineering Manpower Commission during 1967-1968 and entitled Degrees in Engineering and Industrial Technology, revealed that during the two-year time interval, 1967-1968, there were 843 Bachelor of Science degrees conferred in the combined areas of engineering technology. Also, during this time, 943 Bachelor of Science degrees were conferred in the field of Industrial Technology. This represented the total number of degrees reported on a nation-wide basis and involved 415 educational institutions. The most active areas of engineering technology were mechanical, civil, and

electrical engineering. Preferences in the areas of industrial technology were not stated in this report. One basic conclusion of this study was that an extensive analysis of the report and extended research would be necessary to draw any firm conclusions as to a nation-wide status of the technologist in the labor force.

A second study, conducted by the University of Illinois and entitled Technician Need Study: Vermilion County, Illinois, was designed to determine the needs and training requirements of various technician occupations within a single county of the state of Illinois. Although this report did not relate directly to the objectives of this study, it provided valuable information concerning the possible future demands of the technologist.

The report included the following statement concerning the present and future statistics in relation to the growth within the fields of technology:

> The fastest growing of all occupational groups during the decade from 1950 to 1960 was the professional and technical group. This trend of growth is expected to continue at an accelerated rate: by 1970 projected figures show a 43% increase in this occupational group, and by 1975 a 65% increase. . . .
>
> Rates of increase in certain areas of technical work have been reported at a phenomenal figure of more than 600%. The underlying cause of this high rate of increase is the rapid change of the social order in the United States to a society dependent upon science and technology. (7, p. 2)

With such rapid development within the fields of technology, it seems appropriate to assume that the need for a highly trained technologist will become more apparent in direct proportion to the future advancement made in the various areas of technology.

It was found that at present there are 96 universities and colleges throughout the United States who are offering industrial technology programs. (See Appendix D.)

A third study, conducted for the California State Colleges, entitled Industrial Arts and Industrial Technology, February, 1970, revealed several important facts relating specifically to the industrial training needs of the state of California. These results may have some nation-wide implications with relation to future trends in technologist curriculum planning.

In the section of this report entitled "The Need for Technologists," reference is made to a report given by Eckhart Jacobsen called "A Survey of Technical Needs for Industry and Implications for Curriculum Development" in which he made the following estimate:

> . . . for every two technicians employed in 1967, three will be needed by 1972, and at least one-fifth of them will be required to have a baccalaureate or higher degree. This represents at least a doubling of the need for technicians with the bachelor's degree from 1967 to 1972. . . . (2, p. 32)

In support of the above information and since California is one of the leading states in technical employment, reference was also made to the article entitled "California Manpower Needs to 1975," in which the following prediction was made:

> . . . [There will be] nearly 2.7 million more job opportunities for 1975 than existed in 1968. Over one-half million or 18% of these will be in the "Professional, Technical, and Kindred" category and another 293,000 in the "Managers, Officials, and Proprietors" category, where career preparation usually involves several years of college training. Employment of technicians in California increased from about 58,000 in 1960 to about 96,000 in 1968, and will increase to 132,000 in 1975, creating more than 45,000 new job opportunities.

> The aerospace group of manufacturing industries, particularly electrical machinery and aircraft manufacturing, are cited as the major source of job opportunities, followed closely by construction, miscellaneous business services, government, and other industries, in lesser numbers. (2, p. 32)

Expanding this thought to a national basis, Jesse J. DeFore reported the results of a survey in which he contacted 122 employers and asked them to estimate a projected increase in employees in three major areas. In his report he made the following comment:

> The data suggest that the greatest proportionate need for engineering manpower in the United States is for the individual trained at the technologist level. In fact, the proportion by which employers included in the sample surveyed anticipated increasing their staffs during the period 1966-1975 was 27% for engineers, 182% for engineering technologists, and 35% for engineering technicians. (2, p. 25)

From the foregoing statements, it seems proper to assume that technology and possibly the technologist is currently becoming the fastest growing occupation today.

Again with reference to the California State Colleges report, Industrial Arts and Industrial Technology, it is made clear that the responsibility for proper and successful training of technologist personnel is a two-way Street in which industry and education share equal involvement.

This report documents well the critical need for well trained technologist personnel as part of the engineering team, but it also indicates that technology will gain equal prestige and success with other areas of

educational endeavor only when it involves a free flowing interchange of ideas and suggestions between industry and related educational institutions.

Definition of Terms as Used in This Study

Technician--a person skilled in a particular area of technology. Generally, two years training at a trade or technical school is required. Specifically, as used in this study, training is of a duration less than that required for a bachelors degree (2, p. 20).

Technologist--a person who has completed four years of college training and has received a Bachelor of Science degree in a field of technology such as aeronautics, welding, or automotive technology. The technologist is required, in addition to technician classes, to take courses that give additional training in the theory of the applied sciences and design. This training does not go into the depth required for engineers in such areas as mathematics, theoretical analysis, etc. (2, p. 20).

Engineer--one who is involved in the economic application of the laws, forces, and materials of nature to the design, construction, and operation of engineering structures and projects (11, p. 136).

Curriculum--an orderly, predetermined series of educational experiences designed to assist a student in the fulfillment of an educational goal (4, p. 15).

Craftsman--one who practices some trade or manual occupation.

He is actually engaged in producing physical goods and usually receives training and develops his skill by means of on-the-job training (6, p. 236).

Industries--those organizations engaged in the extraction, refining, processing, fabrication, or assembly of saleable goods. These organizations also provide inspection, maintenance, and support functions for various forms of transportation. (Author's definition as used in this study.)

Aeronautical technology--a program providing a skill foundation coupled with knowledge of structure, power plants, and systems, followed by advanced courses in theory, design, management, and planning. A major in aeronautics technology requires four years of study (13, p. 30).

Automotive technology--a program going beyond the usual trade training for craftsmanship levels into more of the functional and scientific aspects of the mechanisms that make up automotive and diesel machines (13, p. 30).

Welding technology--the study of how the science and art of metal joining is used in the production of material objects. The welding technologist uses welding skills and sciences in solving problems of manufacturing, sales, and maintenance (10, p. 1).

Service organizations--those organizations who perform maintenance, repair, servicing, and scheduling of vehicles used for private and commercial conveyance of consumer goods and personnel. (Author's definition as used in this study.)

Seniority--the status secured by length of service for a company to which certain rights, as promotion, attach (6, p. 770).

Industrial technologist--an individual who uses tools, instruments, and devices to design, fabricate, maintain, and operate objects, materials, or equipment (2, p. 19).

Industrial technology--trade-technical education specifically designed to equip students for employment in trade, service, and technical occupations in industry (2, p. 1).

METHODS OF PROCEDURE

Industrial Firm Selection

The objective of this study was to evaluate the present status and employability of industrial technologists within the state of Utah. The first step taken in the evaluation was to develop a list of industries whose organizational function was of such a nature as to enable them to employ technologist personnel. Thirty of the largest instate employers were selected from a list published by the Utah Office of Employment Security. From this list, 20 industrial firms and service agencies were chosen for actual contact. The total number of firms (20) was used so as to limit the study to firms to have a large enough organizational structure which would enable them to employ four-year technologists. Several large employers, such as school districts, utility organizations, and nonrelated service agencies, were eliminated from the final selection, because their function was of such a nature as to not include the hiring of technologist personnel.

During the selection of firms, an attempt was made to gain equal representation of industries which could be involved in employing persons graduating from the technologist programs within the state. It should be noted that contact was made with several large electronics firms in an effort to gain some insight into the part technology may play in future curriculum planning in the area of electronics.

Firms actually contacted during the study were located in the area known as Utah's Wasatch front. This area is considered the heart of Utah's industrial complex and includes the four major cities of the state: Provo, Salt Lake City, Ogden, and Brigham City.

Development of Interview Form and Schedule

An interview form (Appendix A), of which the general section being adapted from the Illinois study, was developed with questions designed to determine the understanding and opinions of each firm representative contacted, concerning the following three areas as they related to their present organizational function:

1. Number and status of industrial technologists presently employed by each firm.

2. The quality and amount of interaction and communication between industrial firms and educational institutions within the state.

3. The current training requirements desired or required by each firm.

Contact was then made with Mr. Robert Halladay, Executive Vice President of the Utah Manufacturers Association. Mr. Halladay provided a letter of introduction for the author (Appendix A) to those industrial firms which were involved in the study.

The first phase of developing the interview schedule was to arrange the industrial firms and service agencies in groups of three, according to their nearest geographical proximity. Allowing for adequate travel time

between interviews, each firm was assigned a two-hour block of time on a specific date in which they were asked to arrange for a 30-minute interview. Letters to this effect (Appendix A) were then sent to the employment or personnel representative of each organization. Included in each letter was an appointment confirmation card (Appendix A) upon which they were asked to confirm a time during the assigned period which was most convenient for them.

Interviews

During each interview, care was taken to explore each question shown on the interview form. Their reaction to each question was recorded on the interview form by the author. Each person interviewed was asked to personally fill out the education requirement check sheet and to rate each item as it related directly to the function of his organization. They were encouraged, through a discussion of their needs and past interaction with the schools, to give their candid opinions and observations concerning educational deficiencies that may exist and future employment possibilities of the industrial technologist.

Method of Analysis

Since this study was designed to obtain actual numerical values and trends relating to education verses industry, the information was presented as total number of responses in cases where applicable and as

percentages where a specific trend was to be identified. Salary schedules were calculated on the basis of an 8-hour day and 40-hour work week in cases where respondents reported an hourly wage rather than a monthly salary schedule.

RESULTS AND DISCUSSION

During the interview the remarks of each representative were recorded on the interview form by the author.

The general information section of the interview form was used in this study in order to establish a link of communications with each industry, should additional follow-up information be desired.

Generally, the interview appointment confirmation letter was mailed to the employment representative or personnel manager of each firm. However, in several cases, the interview was established with someone else in the firm, thus, resulting in the largest number of persons contacted being listed in category nine. This category was used to indicate positions other than those specifically listed on the form. Included in these contacts were shop foremen, maintenance managers, plant managers, and college relations personnel.

In relation to the organizational function of each firm, it was revealed that, of the 16 responding firms, 11, or 68.7 percent, were actually engaged in the production of consumer goods from raw materials or in the design and development of goods for the consumer. The type of goods produced included copper, electronics equipment, steel pipe and tubing, steel structures, and defense and space vehicle propellants. The remaining five firms (31.3 percent) were engaged in providing maintenance, service, and scheduling of commercial and private vehicles of

conveyance. Included in this group were airlines, automotive, and heavy equipment service agencies.

It should be noted that due to the broad classifications used in the study that there may be some overlapping between the functions of the various firms involved.

Section I of the interview form was designed to evaluate the present status and actual number of technologists currently employed with industries in the state of Utah.

Nine responding firms indicated that their operation was of high complexity and was rated nearer to the pure engineering function. The remaining seven indicated a function in the medium level, indicating a closer relationship with the technical area or use of technically oriented personnel. Of the firms interviewed, none indicated a low functional classification or that related to the use of craftsman personnel only.

Table 1 tabulates the results of the question designed to determine the number of technologists presently employed with selected industries within the state and the type of work that they are performing.

It should be noted that nine firms stated that they do not employ four-year technologists and, thus, marked the column indicating none were used.

Comments were made by several larger employers (Appendix C) indicating that the position of technologist has now been defined within their organizational structure and that an increased number of positions will be available in the future. These comments were restricted to firms

Table 1. The number of technologists employed with selected employers within the state of Utah and the level of work being performed as indicated by Section I-II and I-III of the interview form

Technical area	Number employed in each area	Level of work		
		Engineer	Technician	Craftsman
Automotive	7	1	4	2
Aeronautics	5	5	0	0
Welding	2	1	1	0
Other	5	1	4	0
Total	19	8	9	2

engaged in processing raw materials and steel fabrication. The positions mentioned were also generally related to the area of welding technology.

In reference to Table 1, the three technologists checked in the column marked "Other" were employed in the area of electronics technology. Table 1 also indicates that, of the 19 technologists employed, 42.1 percent are working at the engineering level, 47.4 percent in engineer support positions, and 10.5 percent working at the craftsman level.

It was determined during the interview that item 4 on the interview form, regarding the number of engineers who could be replaced by graduate technologists, was not sufficiently defined for use in this study. Reponses ranged from the replacement of all engineers in one case to the replacing of two in another. Thirteen of the responding firms

indicated that they were not interested in replacing any of their engineers with technologist personnel.

One of the objectives of the study was to determine the number of technologist positions currently available with industries within the state of Utah. Table 2 indicates the number reported by the 16 firms involved in the study.

Table 2. Current technologist positions available with industries within the state of Utah

Technical area	Positions available	Type of organization involved
Automotive technologist	1	Copper production
Aeronautical technologist	0	None
Welding technologist	3	Copper production, steel fabrication, and heavy equipment manufacturing
Other	0	None

Several influencing factors should be considered in relation to the positions available within the state. Regarding aeronautical technology, comments were made by several of the large airline companies that in-state hiring is limited because of the seniority and bid system (5, pp. 30-34). In this system employees are generally hired in the larger

cities, and according to seniority are allowed to bid into the area of their choice. This in turn restricts the hiring of persons within the state of Utah to a low percentage.

Second, at the time the study was conducted, there was a cutback in government funds supporting the space and military programs which may have had an effect on the positions available.

It was the author's opinion that salaries offered within the state may have influenced the final selection of employment by the graduating technologists. Table 3 tabulates the current salary offerings of various industries within the state according to their general functional area.

Table 3. Current salaries offered for technologist personnel by major industrial firms within the state of Utah during 1970

Industry segment	Monthly salary schedule		
	Maximum	Minimum	Average
Airlines	$605.00	$605.00	$605.00
Electronics	$730.00	$700.00	$715.00
Aerospace manufacturing	$750.00	$48.00	$615.00
Industrial manufacturing	$850.00	$780.00	$815.00
Automotive service agencies	$760.00	$760.00	$760.00

Several of the salaries were reported on an hourly wage scale and were converted to the monthly total on the basis of a 40-hour week and

a four-week period. Also, as the basis for comparison, the national average wages in the engineering and technical fields are presented in Table 4. These statistics are representative of occupations which are related or are comparable in their training requirements.

Table 4. National average of monthly salaries in the professional, engineering and technical fields as reported in the Handbook of Labor Statistics[a]

Occupation	Grade I	Grade II	Grade III
Accountants	$622.00	$689.00	$781.00
Chemists	$672.00	$744.00	$847.00
Engineers	$750.00	$815.00	$914.00
Engineering technicians	$465.00	$555.00	$632.00
Draftsmen	$510.00	$628.00	$768.00

[a]U. S. Department of Labor, Bureau of Statistics. Handbook of labor statistics. Washington, D. C. 1969.

The average salaries indicated in Table 4 were calculated by dividing the yearly salary total by 12 to determine the monthly total for that particular field or area and are for entrance level positions.

It should be noted that the salaries indicated in Table 4 are for the year 1968 as reported in the 1969 issue of the Handbook of Labor Statistics published by the United States Department of Labor.

The first basic assumption of this study was that there was insufficient interaction between the schools and industries and, thus,

industrial firms were not aware of the qualifications and abilities of the technologist.

Section II of the interview form was designed to evaluate the amount and quality of the information being exchanged. Table 5 tabulates the amount of current information being received by industries from the schools in the areas of interest to them.

Table 5. Response of industries to the amount of information currently being received from the educational institutions

Industry segment	Information received			
	Adequate	Barely adequate	Inadequate	None
Electronics	1	0	0	1
Airlines	0	0	3	1
Aerospace manufacturing	2	1	0	0
Industrial manufacturing	4	0	1	0
Automotive service agencies	1	0	0	1
Total	8	1	4	3

As shown above, 50 percent of the responding firms reported receiving adequate information, whereas the remaining 50 percent reported receiving inadequate information or none at all. The airlines group reported receiving the least amount of information.

In response to the question concerning additional information that

would be of interest to them, it was indicated that, of the 16 responding firms, eight were interested in additional information in the following areas:

Electronics curriculum planning

Aeronautical technologist curriculum

Aircraft and powerplant program (two year)

Welding technologist curriculum

List of potential welding graduates

Of the eight requests, five were made in the area of aeronautics, three in automotive-diesel, and one in electronics.

In addition to the above information, each firm was asked to evaluate the amount of contact that they were having with each school involved in an area of interest to them. They were also asked to report the method of contact used. Table 6 indicates their responses in relation to the amount of contact that they were currently engaged in.

Related to the findings in Table 6 were the methods of contact used. Three firms indicated that they used an advisory committee; three others indicated the use of a firm-school adviser; six used only correspondence, and six others stated that they used other methods which included personal contact, symposiums, and college recruitment. Finally, two firms reported no established form of contact.

Comments were made by several industries in relation to improving industry-school relations. These suggestions included establishment of an advisory committee composed of personnel from education and

Table 6. Evaluation of contacts made by industries with education institutions in technical areas of interest to them

Industry segment	Degree of contact			
	Constant	Occasional	Very little	None
Electronics	0	1	1	0
Airlines	0	0	4	0
Aerospace manufacturing	2	1	0	0
Industrial manufacturing	2	3	0	0
Automotive service agencies	0	0	0	2
Total	4	5	5	2

industry meeting on at least a biannual basis to discuss current trends, curriculum changes, and increased involvement of industrial personnel in speaking assignments at the schools who are teaching in the technical areas of interest to them. (See Appendix C.)

The second basic assumption of this study was that there was not a clear understanding between industry and the schools as to the degree of general or specialized training required to adequately fit graduating technologists in the technical positions available within the state. Section III of the interview form was designed to evaluate the type and degree of training desired by each industrial firm.

In response to the question concerning what type of training they desired, 13 (81.3 percent) indicated that specialized training would best

fit their needs. Of the three remaining firms, one (6.2 percent) indicated interest in broad general training and two (12.5 percent) checked the column indicating another type training. Of these two firms, one was interested in journeyman welders only, while the other indicated no interest in technology training.

Specialized training requested by the responding firms was in the following areas:

Aerospace engineering

Aircraft and powerplant mechanics

Chemical engineering

Diesel-welding technology

Drafting and design

Electronics communications

Electronics technology

Manufacturing engineering

Mechanical engineering

Welding engineering

In relation to the level of training desired by all responding industries, six (37.5 percent) indicated training nearer to that of an engineer; eight (50.0 percent) nearer the technician would be most desirable; two (12.5 percent) expressed no interest in this type of training.

Section III of the interview form was used to evaluate the areas of training that were most critical to the needs of industry. With regards

to this form, a request was made of each employment representative to evaluate each of the knowledge areas, as to their importance and usefulness, in relation to the function of his particular organization.

Table 7 tabulates the number of responses indicated in each educational area. In reference to the rating scale, number 5 indicated a critical need in their organization decreasing to number 1 which indicated an item of little importance or of no use to them.

Table 7. Critical evaluation of educational areas required for employment with industrial firms within the state of Utah

Knowledge area	Rating scale				
	5	4	3	2	1
English	0	7	4	1	0
Speech	0	4	2	5	1
Technical writing or reporting	2	5	5	0	0
Mathematics (calculus and above)	3	3	3	2	1
Physics	0	3	5	4	0
Chemistry	0	1	4	7	0
Electricity	4	3	3	1	1
Electronics	5	3	2	1	1
Drafting	1	1	5	4	1
Design	0	5	2	4	1
Metallurgy	2	4	0	3	3
Structural testing	0	6	2	1	3
Machine shop	2	5	2	2	1
Business training	0	2	3	7	0
Industrial relations	1	2	3	4	2
Psychology, human relations	0	2	5	5	0
Manufacturing processes	2	2	6	2	0

It should be noted that 12 firms responded to the educational evaluation form. Of those not completing this form, three indicated that they were satisfied with present technologist curriculums, and one indicated that they were interested only in engineering personnel.

In reference to Table 7, each firm was asked to indicate areas of training requiring additional emphasis relative to the needs of their organization. Table 8 summarizes the numerical standing (from most needed to least needed) of each knowledge area and percent of total responses in each area.

Table 8. Numerical standing and percent of total responses of each knowledge area as reported by Utah industrial firms

Knowledge area numerical standing	Percent of responses per rating				
	5	4	3	2	1
1. Electronics	41.6	25.0	16.7	8.3	8.3
2. Technical writing	16.6	41.7	41.7	0	0
3. Electricity	33.4	25.0	25.0	8.3	8.3
4. English	0	58.3	33.4	8.3	0
5. Mathematics (calculus and above)	25.0	25.0	25.0	16.7	8.3
6. Machine shop	16.7	41.6	16.7	16.7	8.3
7. Manufacturing processes	16.7	16.7	50.0	16.6	0
8. Physics	0	25.0	41.6	33.4	0
9. Metallurgy	16.6	33.4	0	25.0	25.0
10. Design	0	41.6	16.7	33.4	8.3
11. Structural testing	0	50.0	16.7	8.3	25.0
12. Drafting	8.3	8.3	41.6	33.4	8.3
13. Psychology	0	16.7	41.6	41.6	0
14. Speech	0	33.4	16.7	41.6	8.3
15. Industrial relations	8.3	16.7	25.0	33.4	16.7
16. Business training	0	16.7	25.0	58.3	0
17. Chemistry	0	8.3	33.4	58.3	0

The numerical standing in Table 8 was determined by multiplying the number of responses by the rating factor, each rating factor first being multiplied by 10, to give a total point standing.

Those subjects related nearer to engineering appear in the upper part of the rating table, whereas those subjects generally considered in the industrial management area fall near the lower end of the table.

Instate Technologist Programs

The fifth objective of this study was to determine if the present technologist programs, within the state, are supporting the needs of industry.

Presently within the state of Utah there are five Bachelor degree technology programs being offered in the following areas: automotive (12, p. 229), aeronautics (12, pp. 228-229), welding (12, p. 230), manufacturing engineering (14, pp. 286-288), and manufacturing technology (1, p. 334).

The courses offered in these five areas are presented to establish a base upon which a comparison can be made between the findings of this study and the existing curriculums offered by each educational institution within the state. Table 9 indicates the courses offered within each area in comparison with the other areas of technology.

Table 9. Course offerings as they relate to five specific areas of technology offered by educational institutions within the state of Utah

Course offerings	Technical programs instate				
	Aeronautical Tech.	Automotive Tech.	Welding Technology	Mfg. Eng. Tech.	Mfg. Technology
Basic communications	x	x	x	x	x
Introduction to college algebra	x	x	x	x	x
College algebra	x	x	x	x	x
Geometry				x	
Trigonometry	x	x	x	x	x
Introduction to calculus					x
Calculus				x	x
Steering correction		x			
Automotive engine		x			
Driving mechanisms		x			
Orientation	x	x	x		
Technical drawing I	x	x	x	x	x
Technical drawing II	x	x	x	x	x
Oxyacetylene welding	x	x	x	x	
Electric arc welding		x	x	x	
Direct current electricity	x	x	x	x	
Alternating current electricity			x	x	
Vacuum tubes and transistors			x	x	
Automotive fuel systems		x			
Automotive electrics		x			
Motor tune up		x			
General chemistry	x	x	x	x	
Principles of biology		x	x		
Sociology		x			
Economics	x	x	x	x	
Automotive diesel engines		x			
Body and fender repair		x			
Machine shop operation	x	x	x	x	x

Table 9. Continued

Course offerings	Technical programs instate				
	Aeronautical Tech.	Automotive Tech.	Welding Technology	Mfg. Eng. Tech.	Mfg. Technology
Basic slide rule	x	x	x		
Carburetion		x			
Motors, generators, and magnetos		x			
Metal refinishing		x			
General physics and associated labs	x	x	x	x	x
Industrial safety education		x	x		
Personnel relations	x	x	x		
Heat engines	x	x			
Humanities	x	x	x	x	x
Electives	x	x	x	x	x
Management concepts		x			
Internal combustion engines		x			
Automatic transmissions		x			
Engineering reporting	x	x	x	x	
Technical and professional speaking	x	x	x		
Engineering metallurgy	x	x	x	x	x
Manufacturing processes	x	x	x	x	x
Engine testing procedures		x			
Fuel injection systems		x			
Frame, suspension, and sterring systems		x			
Trade unionism and collective bargining					
Health education				x	x
Composit aircraft structure	x				
All metal aircraft structures	x				
Aircraft maintenance	x				
Aircraft powerplants	x				
Aircraft powerplant accessories	x				
Aircraft powerplant maintenance	x				
Fundamentals of turbojet propulsion	x				
Advanced turbojet and gas turbines	x				
Aircraft electrical systems	x				

Table 9. Continued

Course offerings	Technical programs instate				
	Aeronautical Tech.	Automotive Tech.	Welding Technology	Mfg. Eng. Tech.	Mfg. Technology
Aerospace vehicle weight analysis	x				
Aircraft hydraulics and servo's	x				
Airworthiness procedures	x				
Aircraft materials	x				
Flight engineering	x				
Airline maintenance and fixed base operation	x				
Aeronautics seminar	x				
Airport planning	x				
Elementary aircraft design	x				
Aircraft design and construction	x				
Motion and time study	x				
American foreign policy	x				
International political relations	x				
Inspection methods				x	
Jig and fixture construction			x		
Work simplification and layout			x		
Introduction to the Book of Mormon					x
The American heritage					x
Working drawing problems				x	
Welding estimating			x		
Computer programming				x	
Numerical control programming				x	
Applied mechanics--statics				x	
Applied mechanics--dynamics				x	
Weldability of metals			x		
Heat treatment of metals			x		
Advanced welding processes			x		
Tool design I, II				x	
Nondestructive testing					x
Methods engineering plant planning				x	
Industrial electronics			x		

Table 9. Continued

Course offerings	Technical programs instate: Aeronautical Tech.	Automotive Tech.	Welding Technology	Mfg. Eng. Tech.	Mfg. Technology
Materials handling				x	
Applied descriptive geometry				x	
Introductory computing					x
Materials science					x
Foundry processes					x
Applied hydraulics and pneumatics				x	
Electric and electronic controls					x
Production planning					x
Machine tool performance					x
Basic fluid power					x
Welding estimating lab			x		
Process analysis				x	
Metrology					x
General education					x
Devotional assembly					x
Cost estimating				x	
Production management				x	
Production and inventory control				x	
Heat treatment and metals lab			x		
Applied welding technology			x		
Automation in manufacturing					x
Tool design					x
Statistical quality control				x	
Manufacturing research laboratory					x
Seminar				x	
Welding metallurgy--nonferrous			x		
Resistance welding			x		
Numerical control in manufacturing				x	
Supervision principles				x	

Table 9. Continued

Course offerings	Technical programs instate				
	Aeronautical Tech.	Automotive Tech.	Welding Technology	Mfg. Eng. Tech.	Mfg. Technology
Manufacturing planning I, II				x	
Manufacturing systems analysis					x
Welding inspection methods			x		
Kinematics				x	
Basic computer-assisted part programming					x

SUMMARY

A review of graduate records in the areas of technology conducted at Utah State University revealed that over 75 percent of the graduate technologists were gaining employment outside the state of Utah.

Preliminary discussion with representatives of several instate industries indicated that two basic problems existed; first, employers seemed unaware of the qualifications and abilities of persons trained as four-year technologists. Second, it appeared that there was not a clear understanding between industry and the schools as to the degree of general or specialized training required to adequately fit graduating technologists in the technical positions within the state.

This study was designed to determine if these conditions generally existed among most industrial employers within the state by attempting to answer the following questions:

1. Do the major Utah industrial firms and service agencies understand the qualifications and abilities of a technologist?

2. What level of specialization or general background training is desired or required by these employers for placement of persons in technologist positions within their organization?

3. How many technologists in the areas of aeronautical, automotive, and welding technology are practicing in the state of Utah?

4. How many and what type of technologist positions are available in the major industries within the state?

5. Do the existing curriculums offered by the schools support industrial needs within the state in the area of technologist training?

A review of literature revealed that there are few occupations in which the term "technologist" is identified or used. However, it was found that during the years 1967-1968 there were 842 Bachelor of Science degrees in engineering technology and 943 Bachelor of Science degrees in industrial technology conferred. This total was representative of 415 educational institutions reporting during that period. It was also reported that technology was one of the fastest growing occupations during the past century.

Personal interviews were conducted, by the author, with 16 industrial firms and service agencies within the state of Utah to determine their current training needs and employment requirements. Response to the interview questions indicated that there were 19 technologists employed by industry. Of this number, 42.1 percent were performing work as engineers; 47.4 percent were in engineering support positions, and 10.5 percent were working at the craftsman level.

Of those selected industries involved in the study, there were four technologist positions available within the state, one in automotive, none in aeronautics, and three in welding technology. It should be noted with regards to aeronautical technology that instate hiring of technologist personnel by the large airline companies is very limited due to the union bid system. This system allows airline personnel, who are

hired at the larger stations, to bid into the Utah area in preference to hiring new personnel from within the state.

In relation to industry-school interaction, aerospace and industrial manufacturers indicated that they were receiving adequate information from the schools, whereas the airlines and automotive service agencies reported inadequate or no information being received. Identical reactions were reported in relation to contacts being made by these industries to the schools. Constant to occasional contacts were being made by companies involved in aerospace and industrial manufacturing. Airlines and automotive service agencies reported few or no contacts being made.

During the latter part of each interview, each firm representative was asked to evaluate various areas of education which they felt were important to their function. Of the 12 responding firms, 81.3 percent indicated that specialized training would be most desirable. Several areas of specialization were requested. Those interested in training nearer the engineer were 37.5 percent, whereas 50 percent requested training nearer that of the technician. Percentage not interested in this type of training was 12.5 percent.

Areas of training receiving the highest rating included electronics, technical writing, electricity, English, and mathematics above calculus. Those receiving least emphasis were psychology, speech, industrial relations, business training, and chemistry.

In comparing the five technologist curriculums offered within the state with the finding of this study, it appears that those best supporting

the needs of the industries involved in the study are the manufacturing engineering technology and welding technology programs. Each of these programs incorporate more of the areas of education rated most critical to industrial needs than do the other three.

It appears that most emphasis within the state, with regards to the larger employing firms, is being placed on a person with a firm background near that of the engineer. The 37.5 percent requesting engineering related training were the larger instate employers.

CONCLUSIONS AND RECOMMENDATIONS

The information obtained in this study indicates that there is considerable variation in the awareness of various Utah industrial firms with regards to the current instate technologist programs.

The following findings, as reported during the interviews, are given as they relate directly to the initial objectives of this study.

First Objective

Do the major Utah industrial firms and service agencies understand the qualifications and abilities of a technologist?

Finding

The larger industrial firms are highly aware of the qualifications of technologist personnel in the areas of interest to them, whereas the smaller firms were not. Those firms employing four-year technologists indicated that they are well satisfied with the training and abilities of the people that they have hired. The area most well understood and accepted was that of welding technology.

Conclusion

The main contributing factor for the above findings was that the organizational structure of the larger firms was of such a nature as to be large enough to employ technologist personnel. Also, the complexity of

their organization has begun to indicate a need for a highly trained technical person to function between engineering and the skilled craftsman. The latter concept has been relatively slow in being accepted within the state. The larger firms indicated that there will be an increasing need in this area within the next decade. These firms have fostered an understanding through active interaction with the schools in areas of interest to them. Several smaller industrial firms and service agencies indicated no interest in the technologist programs. It appeared that in most cases that they were limited in size or that their operation was not compatable with advanced training possessed by a technologist.

Recommendations

In the areas of aeronautics and automotive technology, an increased effort should be made to inform those industries of the advantages of hiring technologist trained personnel. This contact could be made in the form of increased contact of a representative of each educational program to the industries in their specific area. Also, literature related to the technical programs should be sent periodically to them with an invitation for them to suggest ways in which the educational programs could be modified to better serve their needs.

Second Objective

What level of specialization or general background training is desired or required by these employers for placement of persons in technologist positions within their organization?

Finding

Of the 16 firms responding to this question, 13 requested specialized training; one requested broad general training, and two were interested in craftsman personnel only. Ten specific areas of specialization were suggested and, of these, five were the standard engineering curriculums offered within the state.

Conclusion

The specialized training requested by each industrial firm was specifically related to their immediate function and individual needs. When comparing the present training programs with the specialized areas requested by industry, it seems doubtful that each request can be incorporated into the existing technical programs offered within the state.

A high degree of interaction must be established and maintained between industry and the schools, making it possible to adjust current training programs to the areas of specialization desired by the various industries.

Recommendations

An industrial-education coordinating board, composed of representatives of industry and educational curriculum planners, must be established in each area of technology. The function of this board being to closely coordinate the changing needs of industry with the curriculum planning of instate technical programs. State funding should be obtained

to enable them to meet on at least a biannual basis to consider such changes.

Third Objective

How many technologists in the areas of aeronautical, automotive, and welding technology are practicing in the state of Utah?

Finding

A total of 19 technologists were reported currently employed with selected industries within the state. Seven were employed in the automotive field, five in aeronautics, two in welding, and five in electronics technology.

Conclusion

The technologist job title has not been widely understood or accepted by most Utah industrial firms, resulting in few positions being available within the state. Educational institutions need to explain the advantages and promote the use of technologist personnel among instate employers.

It appears that in many cases, graduate engineers are performing job functions that could otherwise be adequately accomplished by competent well trained technologists.

Recommendations

As stated previously, an intensified exchange of information must

be established between industry and each technical education program. This could be incorporated with and in support of the industrial-education coordinating board.

Fourth Objective

How many and what type of technologist positions are available in the major industries within the state of Utah?

Finding

A total of four technologist positions were available within the 16 firms involved in the study. One position was offered in the automotive area and three in welding technology. There were no positions offered in aeronautics or electronics.

Conclusion

As stated earlier, the position of a technologist is not well understood within the state industrial firms. The shortage of positions in the aeronautics field reflects the control of the union hiring agreement between the large airlines and the National Machinists Trade Union. The larger airline companies are starting to hire technologist personnel for maintenance management positions which places them above the level of union control. However, persons hired for these positions are still located in the larger out-of-state cities. It was revealed during the interviews that the most active interaction between the schools and industry was in the area of welding technology. Due to this activity, there is a

more firm understanding by industry of this program and has resulted in more active interest in placing graduates from this program with various industries within the state.

Recommendations

It was suggested by several industrial representatives that if personnel from various areas of their organization were asked to supplement lectures at the schools through speaking assignments that the gap between industry and education in these specific areas could be decreased. These assignments should be arranged for at the most meaningful time in the sequence of each industrial curriculum.

Fifth Objective

Do the existing curriculums offered by the schools support industrial needs within the state in the area of technologist training?

Finding

The 10 areas of technical training rated most critical by Utah industrial firms, in order of their importance, were: electronics, technical writing, electricity, English, mathematics (calculus and above), machine shop, manufacturing processes, physics, metallurgy, and design. A comparison of the five instate technologist training programs with these areas of training reveals that the welding and manufacturing engineering technology programs provide more training in these areas than to the other three.

Conclusion

In considering strictly instate placement of technologist graduates, those programs providing training nearer that of engineering appear most successful. Most of the larger firms involved in the study requested engineering technologist training, whereas the smaller firms favored training nearer that of the technician.

Since the larger firms will be in position first to hire technologist personnel, adjustments in curriculum offerings should be made which best support their needs.

Recommendations

Emphasis in curriculum planning should be stressed in the areas of electricity-electronics, technical writing, and mathematics. In reference to the area of mathematics in courses of analytic geometry and calculus, emphasis should be placed on teaching it on an applied basis rather than a theoretical approach such as used in engineering classes.

Additional Findings and Recommendations

1. It was the opinion of the author that salaries offered within the state as compared to those offered in other areas may have been a factor in the final job selection by graduating technologists. Referring to Tables 3 and 4 of this study, it can be seen that salary offerings suggested by Utah industrial firms were equal to or comparable with related occupations reported for the year 1969 by the U. S. Department of Labor.

It appears consistant with these facts to assume that consideration of salaries was not a great factor in their final occupational selection. One caution might be extended in that Tables 3 and 4 are a comparison of the year 1969 with the year 1970 which may not give an exactly accurate basis of comparison. These figures do indicate, however, that there is not a great gap in current salary schedules.

2. Requests were made by several firms, who currently employ technologist graduates, that a course in union management relations be added to the current technical curriculums. It was stated that too many of these people come in contact with the union without adequate training in the function and purpose of the union-management organizational structure. Many technologists hired by these companies eventually are placed in middle management positions which require dealing directly with the union representatives.

3. A study should be conducted to determine the attitude and/or cooperation of the instate industrial firms concerning part time or sumer employment of instructors engaged in teaching technical subjects.

4. Conduct a study to determine the possibility of obtaining from industry on a permanent or loan basis current technical publications, literature, and equipment that is otherwise not available to the schools.

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APPENDIXES

Appendix A

Survey Forms

TECHNOLOGIST NEED STUDY

INTERVIEW FORM

DATE _____

FIRM NAME _____ ADDRESS _____
_____ _____

NAME OF INTERVIEWED _____ PHONE NO. _____
Position of interviewed: (1) Owner (2) Owner Mgr. (3) Hired Mgr.
(4) Personnel Dir. (5) Sales Mgr. (6) Engineer (7) Service Mgr.
(8) Office Mgr. (9) Other _____

Functions of Firm

(1) incidental (2) significant
(3) major

_____ Job Shop
_____ Mass Prod. Mfg.
_____ Purchasing
_____ Service
_____ Installation
_____ Contracting
_____ Construction
_____ Processing
_____ Retailing
_____ Other

Firm Products or Service

_____
_____
_____
_____

I. Present Technologist Status

1. Complexity of Operation
   High ____ Med. ____ Low ____

2. How many (4-year) technologists do you have employed at the present time in the following areas?
   - Automotive _____
   - Aeronautics _____
   - Welding _____
   - Other _____
   - None _____

3. What function or type of work are they performing?

   Nearest engineer _____
   Nearest technician _____
   Nearest craftsman _____
   Unrelated (explain) _____
   _____

4. _____ Number of graduate engineers who could be replaced by competent well trained (4-year) technologists.

5. Do you have technologist position vacancies in your organization at the present time? (Number and area)
   - Automotive _____
   - Aeronautics _____
   - Welding _____
   - Other _____

6. Approximate salary scale you are offering or could offer a technologist.
   $_____

II. Industry-Education Relations

1. How much information have you received concerning the training and qualifications of four-year technologists?
   - Adequate _____
   - Barely adequate _____
   - Inadequate _____
   - None _____

2. Would additional information be of interest to you?
   Yes _____ No _____
   Specify area:
   - Automotive _____
   - Aeronautics _____
   - Welding _____
   - Other _____

3. What degree of contact do you have with the schools training in technical areas of interest to you?
   - Constant _____
   - Occasional _____
   - Very little _____
   - None _____

4. Method used for contact:
   - Advisory committee _____
   - Firm-school advisor _____
   - Correspondence _____
   - Other (Specify) _____

5. Comments:
   A. Type of information desired: _____
   _____
   _____
   B. Suggestions for improving industry-school relations _____
   _____
   _____

III. 1. If considering hiring a four-year technologist, what type training would you desire?
   - Broad general _____
   - Specialized _____
   - Other (explain) _____

2. If specialized, in what areas
   1. _____
   2. _____

3. Would you be more interested in training nearer to:
   Engineering _____
   Technician _____

Present area of training check sheet!

IV. Comments and Impressions

_____
_____
_____
_____

KNOWLEDGE AND EVALUATION

I. Please evaluate the following knowledge areas as they relate to need and usefulness in your present organizational function by placing a check mark in the appropriate column. Rating scale: Number 5 indicates a critical need decreasing to number 1, indicating no usefulness in your organization.

Knowledge area	Rating scale 5	4	3	2	1
English					
Speech					
Technical Writing or Reporting					
Mathematics (Calculus and above)					
Physics					
Chemistry					
Electricity					
Electronics					
Drafting					
Design					
Metallurgy					
Structural Testing					
Machine Shop					
Business Training					
Industrial Relations					
Psychology, Human Relations					
Manufacturing Processes					
Others (explain)					
1.					
2.					

II. Your comments concerning technologists as they relate to your organization. (Include problems you feel exist in areas such as training, interaction between schools and industry, communications, etc.)

Appendix B

Basic Survey Data

UTAH STATE UNIVERSITY, LOGAN, UTAH 84321

Department of
Industrial and
Technical Education

College of Engineering

March 2, 1970

Mr. Robert Halladay
Executive Vice President
Utah Manufacturers Association
Kearns Building
Salt Lake City, Utah 84101

Dear Mr. Halladay:

I enjoyed talking with you on the phone and would like to thank you for agreeing to write a letter of introduction for this study.

It is our purpose to gain information that will help us adjust our training such that it will more adequately fulfill the needs of the Utah industrial firms.

Enclosed is a short statement of the problem and objective of the study. Through personal contact with each firm, we hope to gain, in addition to factual information, their opinions concerning deficiencies that may exist in our present training programs. Also, we would like to know if there is sufficient interaction between the schools and industries to keep our training current and up-to-date.

I would like to arrange an interview with each firm, at their convenience, during a two-week period beginning March 16, 1970 and extending through April 3, 1970. Appointments will be arranged for by mail, and the interview will only require approximately 30 minutes of their time.

May I thank you again. Should you desire additional information or a copy of the results of the study, I will be very happy to send them to you.

Sincerely,

Gene E. Forsberg, Asst. Instructor
Department of Industrial and
Technical Education

UTAH MANUFACTURERS ASSOCIATION

General Offices Kearns Building

Salt Lake City, Utah 84101

March 5, 1970

TO WHOM IT MAY CONCERN:

This letter will introduce Mr. Gene E. Forsberg, Assistant Instructor, Department of Industrial and Technical Education at the Utah State University. He is presently engaged in writing a doctorage thesis preparatory to receiving his degree this spring.

Any help you can give him will be greatly appreciated.

Sincerely,

UTAH MANUFACTURERS ASSOCIATION

Robert E. Halladay
Executive Vice President

REH/o

48-70

UTAH INDUSTRIAL FIRMS AND SERVICE AGENCIES

IDENTIFIED IN TECHNOLOGIST STUDY

1. Hill Air Force Base
   Ogden, Utah
2. Hercules Powder Corporation
   Salt Lake City, Utah
3. Thiokol Chemical Corporation
   Brigham City, Utah
4. Marquart Corporation of Ogden
   Ogden, Utah
5. Sperry Rand--Univac
   Salt Lake City, Utah
6. Litton Industries
   Salt Lake City, Utah
7. Key Airlines
   Salt Lake City, Utah
8. United Airlines
   Salt Lake City, Utah
9. Western Airlines
   Salt Lake City, Utah
10. Frontier Airlines
    Salt Lake City, Utah
11. Kennecott Corporation
    Salt Lake City, Utah
12. Wheelers Equipment Co.
    Salt Lake City, Utah
13. Eimco Corporation
    Salt Lake City, Utah
14. Lelis Transmission Co.
    Salt Lake City, Utah
15. Aamco Transmission Co.
    Salt Lake City, Utah
16. Chicago Bridge and Iron
    Salt Lake City, Utah
17. Mountain States Steel
    Provo, Utah
18. United States Steel Corp.
    Provo, Utah
19. Western Machinery
    Salt Lake City, Utah
20. American Steel
    Salt Lake City, Utah

UTAH STATE UNIVERSITY, LOGAN, UTAH 84321

Department of
Industrial and
Technical Education

College of Engineering

March 25, 1970

Mr. Jim Pendray
Employment Supervisor
Eimco Corporation
P.O. Box 300
545 West 700 South
Salt Lake City, Utah

Dear Mr. Pendray:

During the past few months, increased interest has been shown by leading educators, within the state of Utah, concerning industrial and technical education and its role in fulfilling the needs of the instate industries.

At the present time, Utah State University is training four-year technologists in the areas of aeronautical, automotive, and welding technology. In checking our records we find that many of our technologist graduates gain employment outside the state.

The Department of Industrial and Technical Education is very interested in determining the underlying reasons for their seeking employment elsewhere. You are in an excellent position to provide valuable information which could be used to determine if curriculum or industry-education relations deficiencies exist.

We would like to arrange for a 30 minute interview with you to discuss this matter. If it is convenient, I could plan to be in your office during the morning of Wednesday, April 15, 1970, between 9:00-10:00. If you will advise me of a time that would fit your schedule, I will arrange to be there. Should an interview be impossible, would you furnish the information on a questionnaire that would be sent to you?

Thank you for your consideration. Enclosed is a card upon which we would appreciate your reply. I hope that through this contact with you we can better serve you through education.

Sincerely,

Gene E. Forsberg
Assistant Instructor
Department of Industrial
and Technical Education

GEF:db
Enc.

APPOINTMENT CONFIRMATION

1. ☐ It will be possible to meet with you in my office on:
   Date _____ Time _____

2. ☐ An interview is not convenient, please send me a questionnaire and I will provide the desire information.

Eimco Corporation
545 West 700 South
P.O. Box 300
Salt Lake City, Utah

Name of employment representative _____

TECHNOLOGIST NEED STUDY

INTERVIEW FORM

DATE _____

FIRM NAME _____ ADDRESS _____

_____ _____

NAME OF INTERVIEWED _____ PHONE NO. _____
Position of interviewed: (1) Owner (2) Owner Mgr. (3) Hired Mgr.
(4) Personnel Dir. (5) Sales Mgr. (6) Engineer (7) Service Mgr.
(8) Office Mgr. (9) Other _____

Functions of Firm

(1) incidental (2) significant
(3) major

_____ Job Shop
_____ Mass Prod. Mfg.
_____ Purchasing
_____ Service
_____ Installation
_____ Contracting
_____ Construction
_____ Processing
_____ Retailing
_____ Other

Firm Products or Service

_____

_____

_____

_____

_____

I. Present Technologist Status

1. Complexity of Operation
   High 9 Med. 7 Low 0

2. How many (4-year) technologists do you have employed at the present time in the following areas?
   - Automotive 7
   - Aeronautics 5
   - Welding 2
   - Other 5
   - None 9

3. What function or type of work are they performing?

   Nearest engineer 8
   Nearest technician 10
   Nearest craftsman 1
   Unrelated (explain) 0

   _____

4. 4 Number of graduate engineers who could be replaced by competent well trained (4-year) technologists.

5. Do you have technologist position vacancies in your organization at the present time? (Number and area)
   - Automotive 1
   - Aeronautics 0
   - Welding 3
   - Other 0

6. Approximate salary scale you are offering or could offer a technologist.
   $_____

II. Industry-Education Relations

1. How much information have you received concerning the training and qualifications of four-year technologists?
   - Adequate 8
   - Barely adequate 1
   - Inadequate 4
   - None 3

2. Would additional information be of interest to you?
   Yes 8 No 8
   Specify area:
   - Automotive 0
   - Aeronautics 4
   - Welding 3
   - Other 1

3. What degree of contact do you have with the schools training in technical areas of interest to you?
   - Constant 4
   - Occasional 5
   - Very little 5
   - None 2

4. Method used for contact:
   - Advisory committee 3
   - Firm-school advisor 3
   - Correspondence 6
   - Other (Specify) 4

5. Comments:
   A. Type of information desired: _____
   B. Suggestions for improving industry-school relations _____

III. 1. If considering hiring a four-year technologist, what type training would you desire?
   - Broad general 1
   - Specialized 13
   - Other (explain) 2

2. If specialized, in what areas?
   1. _____
   2. _____

3. Would you be more interested in training nearer to:
   Engineering 6
   Technician 8

Present area of training check sheet!

IV. Comments and Impressions

KNOWLEDGE AND EVALUATION

I. Please evaluate the following knowledge areas as they relate to need and usefulness in your present organizational function by placing a check mark in the appropriate column. Rating scale: Number 5 indicates a critical need decreasing to number 1, indicating no usefulness in your organization.

Knowledge area	Rating scale 5	4	3	2	1
English	0	7	4	1	0
Speech	0	4	2	5	1
Technical Writing or Reporting	2	5	5	0	0
Mathematics (Calculus and above)	3	3	3	2	1
Physics	0	3	5	4	0
Chemistry	0	1	4	7	0
Electricity	4	3	3	1	1
Electronics	5	3	2	1	1
Drafting	1	1	5	4	1
Design	0	5	2	4	1
Metallurgy	2	4	0	3	3
Structural Testing	0	6	2	1	3
Machine Shop	2	5	2	2	1
Business Training	0	2	3	7	0
Industrial Relations	1	2	3	4	2
Psychology, Human Relations	0	2	5	5	0
Manufacturing Processes	2	2	6	2	0
Others (explain)	0	2	0	0	0
1.					
2.					

II. Your comments concerning technologists as they relate to your organization. (Include problems you feel exist in areas such as training, interaction between schools and industry, communications, etc.)

Appendix C

Employer Response Comments

EMPLOYER RESPONSE COMMENTS

1. There is too little interaction between industry and the schools. Periodic meetings of a cross-section of first and second line supervisors from industry and university professors and administration would do much to keep each appraised of the others needs, plans, problems, etc.

Much of our engineering is of the type that a technologist level engineer (technically, between a technician and an engineer skilled in the more advanced and abstract engineering disciplines) could do and enjoy. Once industry accepts this type of personnel, it is felt there would be a very good demand for them.

2. Our experience with automotive-diesel and welding technologists has been excellent. Our major need is in the automotive-diesel technologist.

3. Our company needs men with a knowledge of union relations because most of the technologists hired are supervising union represented personnel.

4. A three-hour class in union-management relations at the shop level would be helpful to emphasize that there is a third party involved in the shop and that this must be taken into consideration when recommendations of new equipment, new methods, etc., are made. We will be happy to arrange speakers and tours of our company at any time. We are very interested in the technical programs at Utah State University.

5. We would like to suggest that the schools and industry get together twice annually to discuss curriculum and needed changes. Also, we would like permission for our manufacturing people to talk to your welding classes about "state of the art" in welding, opportunities at our company, etc.

6. We would like a person in diesel or welding to have a depth in sales and marketing so that they could sell service for our equipment.

7. There is no lack of information to recruiting and personnel people; however, higher level executives, who determine graduate needs, may not be adequately informed of the curriculum and availability of technologist personnel.

8. We have had two welding technologist graduates with our company and have been well satisfied with both of them.

9. We have a program that provides additional training for the welding technologists that we hire. They are hired and treated as welding engineers. The program includes one year of actual welding work, approximately six months working with codes and specifications, and six months in our company's welding research and metallurgy department. We try to maintain a relationship with Utah State University's welding department and are always looking for graduates whose career plans mesh with our program and organization.

10. Our requirements are normally for manufacturing engineers or mechanical engineers with a manufacturing option.

11. We are not hiring technical personnel at this time because of

defense spending cutback. Most positions for which four-year technologists are qualified for are filled from within the organization.

12. Technologists are not being used as such within our organization. Most supervision positions are filled from within each department. In the aeronautics area, we are looking for either the aeronautical engineer or aircraft mechanic.

13. There is a definite need to increase the interaction between the schools and airline companies. Our company is bound by union rule, and most technologist people come in on bid from the larger cities such as San Francisco, Denver, and Chicago. It does not seem that this system will be changed in the near future, and our hiring of personnel from within the state is highly restricted. There is also increased interest being shown in relation to giving airframe and powerplant mechanics additional training in electricity-electronics and encouraging them to obtain a second class radio license.

Appendix D

Industrial Technology Programs

United States Colleges and Universities Offering
Industrial Technology Programs as of
January 1, 1970

State and Educational Institution	City
Alabama	
Alabama Agricultural and Mechanical College	Normal
Tuskegee Institute	Tuskegee
Arizona	
Arizona State College	Flagstaff
Northern Arizona State University	Tempe
California	
California State College at Long Beach	Long Beach
California State Polytechnic College	San Luis Obispo
Chico State College	Chico
Fresno State College	Fresno
Loma Linda University	Riverside
Pacific Union College	Angwin
San Francisco State College	San Francisco
San Jose State College	San Jose
California State College at Los Angeles	Los Angeles
Florida	
Florida Southern College	Lakeland
University of Western Florida	Pensacola
Florida Agricultural and Mechanical University	Tallahassee
Georgia	
Georgia Southern College	Statesboro
Hawaii	
Church College of Hawaii	Laie Oahu
Idaho	
University of Idaho	Moscow

State and Educational Institution	City
Illinois	
Bradley University	Peoria
Eastern Illinois University	Charleston
Southern Illinois State University	Carbondale
Northern Illinois State University	Dekalb
Chicago State College	Chicago
Illinois State University	Normal
Indiana	
Ball State University	Muncie
Indiana State University	Terre Haute
Iowa	
University of Northern Iowa	Cedar Falls
Kansas	
Kansas State Teachers College	Emporia
Kansas State College of Pittsburg	Pittsburg
Kentucky	
Eastern Kentucky University	Richmond
Western Kentucky University	Bowling Green
Morehead State College	Morehead
Murray State University	Murray
Louisiana	
University of Southwestern Louisiana	Lafayette
Northwestern State College	Natchiteenes
Louisiana State University	Baton Rouge
Southeastern Louisiana College	Hammond
Maine	
Gorham State College	Gorham
Maryland	
University of Maryland	College Park

State and Educational Institution	City
Michigan	
Central Michigan University	Mount Pleasant
Eastern Michigan University	Ypsilanti
Northern Michigan University	Marquette
Western Michigan University	Kalamazoo
Minnesota	
Bemidji State College	Bemidji
Moorhead State College	Moorhead
St. Cloud State College	St. Cloud
Mankato State College	Mankato
University of Minnesota	Duluth
Missouri	
Central Missouri State College	Warrensburg
Southwest Missouri State College	Cape Girardeau
Mississippi	
Mississippi State University	State College
University of Southern Mississippi	Hattisburg
Nebraska	
University of Nebraska at Omaha	Omaha
New Jersey	
Montclair State College	Upper Montclair
Trenton State College	Trenton
New York	
State University College	New York
New Mexico	
Eastern New Mexico University	Portales
Western New Mexico	Silver City

State and Educational Institution	City
North Carolina	
East Carolina State University	Greenville
North Carolina Agricultural and Technical University	Greensboro
North Carolina State University	Raleigh
West Carolina Institute of Technology	Montgomery
Ohio	
Bowling Green University	Bowling Green
Ohio State University	Athens
Central State University	Wilberforce
Miami State University	Oxford
Willmington College	Willmington
Oklahoma	
Northwestern State College	Tankawa
Oklahoma State University	Stillwater
University of Oklahoma	Normal
Southwestern State College	Alva
Oregon	
Oregon Technical Institute	Klamath Falls
Texas	
Texas A&M University	College Station
Eastern Texas State University	East Texas Station
Tennessee	
Tennessee Technical University	Cookeville
Memphis State University	Memphis
Austin-Peay State University	Clarksville
Middle Tennessee State University	Murfreesboro
Eastern Tennessee State University	Johnson City
Utah	
Brigham Young University	Provo
Utah State University	Logan
Weber State College	Ogden

State and Educational Institution	City
Virginia	
Hampton Institute	Hampton
Virginia Commonwealth University	Richmond
Washington	
Central Washington State College	Ellensburg
Eastern Washington State College	Cheney
Western Washington State College	Bellingham
Walla Walla State College	College Place
West Virginia	
Fairmont State College	Fairmont
Marshall	Huntington
West Virginia Institute of Technology	Montgomery
West Virginia State College	Institute
West Liberty State College	West Liberty
Wisconsin	
Stout State University	Menomonie
Wisconsin State University	Platteville

VITA

Gene Ernest Forsberg

Candidate for the Degree of

Master of Science

Thesis: A Comparison of Technologist Needs and Training Requirements of Major Industries Within the State of Utah

Major Field: Industrial Education

Biographical Information:

Personal Data: Born at Logan, Utah, July 15, 1937, son of LeRoy W. and Edna Howell Forsberg; married Gayle Tams June 11, 1965; two children--Brian and Stacey.

Education: Attended elementary school in Paradise, Utah; graduated from South Cache High School in 1955; received a Bachelor of Science degree from Utah State University, with a major in industrial technology and a minor in aeronautical technology in 1966.

Professional Experience: 1970 to present, assistant professor of aerospace science, instructing in aircraft systems and avionics, Metropolitan State College, Denver, Colorado; 1969-70, graduate teaching assistant in electronics and aircraft hydraulic-pneumatic systems, Utah State University; 1968, aircraft maintenance management training, United Air Lines; 1967, instructor, aircraft powerplants and related systems, Utah State University; 1965-66, laboratory assistant for department of aeronautical technology, Utah State University.