SKILLS AND KNOWLEDGE REQUIRED OF EMPLOYEES IN THE
STEEL FABRICATION INDUSTRY IN THE GREATER
FORT WORTH METROPOLITAN AREA

THESIS

Presented to the Graduate Council of the
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For the Degree of

MASTER OF SCIENCE

By

W. Dennis McPeak, B. S.

Denton, Texas

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This study was designed to determine the employment opportunities in the steel fabrication industry of the Greater Fort Worth Metropolitan Area, and to ascertain what skills and knowledge were required of the prospective employee and which of these skills were being taught in the Industrial Arts metalworking laboratories.

The Machine Metalworking I & II curriculum was established and related to information gained through a questionnaire sent to participating steel fabrication firms.

The study was used to determine present and anticipated employment opportunities in the steel fabrication industry and aid in evaluating the curriculum of Machine Metalworking I & II as it relates to the employment requirements of the steel fabrication industry.
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CHAPTER I

INTRODUCTION

Steel fabrication is an important aspect of the steel industry and might be called the very backbone of the construction trade. New construction techniques and metallurgical findings, coupled with new construction, have produced a great demand for steel fabrication employees, especially in the areas of "layout" and "fit-up." A study by the Fort Worth Chamber of Commerce in 1971 indicated that the number of employees in the fabricated metals industry rose 92.0 per cent between 1961 and 1971 (3, p. 5). A year-end study by the Chamber of Commerce showed a growth of 23.5 per cent between 1970 and 1974 to a total number of 6,917 employees (4, p. 19).

Industrial arts metalworking courses are designed to give students the opportunity to learn the characteristics of metals and develop basic skills and techniques necessary to work with them successfully. Since industrial arts courses include work with the tools, and processes and materials of industry, the experience gained from industrial arts classes
should be of value to the prospective employee entering the steel fabrication industry.

Statement of the Problem

This study was designed to determine the employment opportunities in the steel fabrication industry of the Greater Fort Worth Metropolitan Area, what skills and knowledge are required of prospective employees, and which of these skills were being taught in the industrial arts metalworking laboratories.

More specifically, the study sought to answer the following questions:

1. What is the curriculum of Machine Metalworking I & II?

2. Would basic knowledge and skills taught in Machine Metalworking I and Machine Metalworking II courses be desirable for the prospective employee in the steel fabrication industry to possess?

3. Is previous experience or skills required of the prospective employee in the steel fabrication industry?

4. What are the educational requirements of prospective employees in the steel fabrication industry?

5. Are training programs available to the employee?

6. What types of entrance examinations are required of the prospective employee?

7. What are the employment opportunities for the future?
**Purpose**

This study should provide concrete information that will be used to determine present and future employment opportunities in the steel fabrication industry in the Greater Fort Worth Metropolitan Area and aid in evaluation of the curriculum of Industrial Arts Machine Metalworking I & II courses.

**Delimitations of the Study**

This study was limited to nine completed and returned questionnaires from the participating firms in the Fort Worth Metropolitan Area (2, p. 183, 202, 294, 334). Further limitations were job classifications as found in the Dictionary of Occupational Titles that relate to the structural steel fabrication industry (12, p. 285, 415). It was also limited to the knowledge, skills and training required of employees in the steel fabrication industry in the Greater Fort Worth Metropolitan Area.

**Procedure**

A list of twenty-two steel fabrication firms that met the specifications required by the study was compiled (3). A letter of inquiry (Appendix A and Appendix B), accompanied by a reply post card, was used to determine the steel fabrication firms in the Greater Fort Worth Metropolitan Area willing to
participate in the study (Appendix C). A questionnaire designed to seek answers to the questions asked in the statement of the problem was then sent to those firms which had agreed to participate in the study (Appendix C). When the questionnaires were returned, the data were tabulated and are presented in Chapter II and III.

Sources of Data

Data were collected from returned and completed questionnaires from the participating firms. Previous studies, books, articles, and other printed materials, as listed in the bibliography, were also used to obtain data for the study.

Definition of Terms

For the purposes of this study certain terms were defined as follows:

"Industrial Arts" as related to this study refers to that phase of general education that deals with the materials, tools, and processes of industry.

"Standard Metropolitan Statistical Area" as used in this study refers to a county with one or more cities of at least 50,000 population plus any adjacent counties that are metropolitan in character and economically integrated with the central county (2, p. 183).
"Greater Fort Worth Metropolitan Area" as used in this study will be referred to as the Fort Worth, Texas, area as found in Tarrant and Johnson counties (2, p. 183).

"Structural Steel Lay-out Man" as used in this study refers to an employee who lays out reference points on structural shapes and plates for fabricating, welding, and assembling into framework for such structures as conveyors, cranes, buildings, and bridges: traces layout marks from template and applies knowledge of trigonometry, structural design, effects of heat, and allowances for thickness of metal to project location of holes, cuts, and bends from blueprints.

"Fitter" as used in this study refers to an employee who lays out, positions, aligns, and fits together fabricated parts of structural metal products in a shop according to blueprints and lay-out specifications preparatory to welding or riveting (12, p. 285).

"Skills and knowledge" as related to this study refers to proficiency in the use of concepts and principles of steel fabricating techniques, tools, and machinery as they apply to the steel fabricating industry and as they are taught in the high school metalworking laboratories.
"Participating firms" refers to the nine firms of the original sampling that returned questionnaires completed in such a manner that make them usable for the purposes of this study.

Related Studies

Several studies were found that related directly to this study:

In 1972, Teague (10) conducted a study of the housing adequacies of industrial arts metalworking laboratories in the state of Texas and to what extent the physical facilities for these laboratories met current standards. Two of Teague's conclusions were that the essential items for operation and instruction in the metalworking laboratories were present in most schools, and that there was a need for a universally adopted standard for industrial arts facilities to be followed when renovating existing facilities or constructing new facilities.

A study by Slaughter (8) in 1970 focused on the knowledge and skills required of welders in the Dallas-Fort Worth area. Three of this conclusions were,

1. Young men who take welding courses in high school have a better understanding of industry and should be better satisfied with the jobs.
2. The basic welding curriculum offered in the public schools can be of benefit to many young men in an introduction to a possible vocation upon graduation from high school.

3. An employee who has taken welding courses will probably spend less time in in-service training and will qualify for a job requiring more skill.

Slaughter recommended that data presented in his study be used for revising course content in basic welding courses offered in the public schools in the Dallas-Fort Worth area and that programs designed to explore welding should include some degree of emphasis on working from blueprints. He further recommended that the high schools should foster an awareness of the opportunities in the metal and welding industry for young men.

A 1970 study by Mosby (7) centered around the knowledge and skills required of machinists in the Dallas-Fort Worth area. Mosby concluded that persons who take machine metalworking in high school have a better understanding of industry and should be better satisfied with their jobs. He also concluded that the basic metalworking curriculum offered in the public schools of Texas can be of benefit to young persons as an introduction to a possible vocation and that employees who have taken machine metalworking courses will probably spend less time in in-service training and will qualify for a job requiring more skills.
Mosby recommended an emphasis on the reading of working blueprints and an understanding of precision measuring instruments. He further recommended an awareness program in the high school which acquainted the students with opportunities for employment in the metal industry.

Several additional studies were found which were indirectly related to this study.

In 1971, Wied (13) conducted a study centered around the job prerequisites for female employees in the electronics industry in the Dallas area. The data presented by Wied indicated that employment opportunities for female employees in electronics were increasing more rapidly than the number of workers being trained for positions. He recommended that young women should be encouraged to take electricity-electronics courses in high school.

Craghead (1) conducted a study of the knowledge and skills required of draftsmen in the manufacturing and non-manufacturing firms in the Dallas-Fort Worth, Texas area. This study indicated that most of the draftsmen at some time participated in the actual design of a product. It further indicated that employment demands for trained draftsmen were steadily increasing.
A 1973 study by Mack (5) sought to determine the skills and knowledge required of plastics employees in the Dallas Metropolitan area. Data from his study indicated that the educational requirements for employees in the plastics industry varied in the specific job sites. Further indications were that persons who had taken plastics courses in high school appeared to be preferred for employment but that some type of in-service training program was utilized by all of the participating firms.

Mack concluded that the participating firms preferred high school graduates due to the broad range of job skills they are capable of being trained to perform. He also found that industrial arts courses, as a part of general education, were unable to meet the exact requirements of the various areas of the industrial market.

Two recommendations from Mack's study were that industrial arts plastics curriculums be updated at least every three years to keep abreast of changes in the plastics industry, and that employment opportunities in the plastic industry should be stressed in the schools and community.

A 1969 study conducted by Morrow (6) focused on safety practices used by industrial arts instructors in the Dallas Independent School District. Findings from that study indicated
that the development of an effective accident prevention program was considered of prime importance by the instructors and that safety was being incorporated into everyday laboratory experience rather than being taught as a separate unit.

All of these studies sought answers to questions and problems of industrial arts or industry. This study seeks answers to the relationship between the industrial arts metalworking curriculum and the employment requirements of the steel fabrication industry.
CHAPTER BIBLIOGRAPHY


3. Fort Worth Chamber of Commerce, verbal list of Structural Steel Fabricating Firms in the Greater Fort Worth Metropolitan Area, November, 1972.


CHAPTER II

GENERAL QUALIFICATIONS AND DUTIES OF
EMPLOYEES IN PARTICIPATING FIRMS

The general qualifications and duties of steel fabrication employees are presented in this chapter. The information was provided by steel fabrication firms in the Greater Fort Worth Metropolitan Area through the use of an instrument (Appendix D) which was designed to obtain information from the participating firms concerning job qualifications for their respective employees. Data were obtained pertaining to previous industrial work experience, minimum and maximum age requirements, entrance examinations, educational requirements, in-service training programs, and skills and knowledge of shop procedures and use of shop machinery.

The instrument was sent to the eleven firms in the steel fabrication industry agreeing to participate in the study. Nine, or 82 per cent, of these firms responded by returning the completed instrument. These firms ranged in size from the smallest, which employed six persons, to the largest, which employed 300. It was believed that the study should be made because there was a total of over 800 persons employed by these firms.
Previous Work Experience

Eight, or 89 per cent, of the participants indicated that previous work experience was important when considering the qualifications of prospective employees. Only one, or 11 per cent, considered previous work experience unimportant; this might be attributed to the specialized nature of the steel fabricated products made by this firm. Due to the specialized nature of the products made by this firm, it conducted an in-service training program for new employees.

General welding experience was mentioned as desirable by five, or 56 per cent, of the participants as a specific area of desirable previous work experience. Layout experience was considered important by two, or 22 per cent, of the participants, while only one of each of the participants listed shear operator, general sheet metal work, press brake operator, drilling, and finishing as desirable previous work experience.

Age Requirements

All of the participants considered eighteen years to be the minimum age that could be considered for a prospective employee. Only one respondent indicated a maximum age for prospective employees. This was specified as being sixty-five. The responses to a preferred age for prospective employees
varied greatly. Three participants indicated no preference as to a preferred age while one indicated ages twenty-five to sixty as desirable, one indicated ages thirty to fifty as desirable, one indicated ages twenty-two to thirty-five as desirable, one indicated ages twenty-five to fifty as desirable, and one indicated thirty to forty-five as desirable.

Entrance Examination

Information concerning entrance examination requirements is presented in Table I. All percentages are rounded to the nearest whole number.

<table>
<thead>
<tr>
<th>Type of Examination</th>
<th>Number of Firms</th>
<th>Per Cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>4</td>
<td>44</td>
</tr>
<tr>
<td>Skill Test</td>
<td>5</td>
<td>56</td>
</tr>
<tr>
<td>Practical</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>Standardized</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Oral</td>
<td>4</td>
<td>44</td>
</tr>
<tr>
<td>None</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. 30 day performance evaluation</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>b. Welding certification</td>
<td>1</td>
<td>11</td>
</tr>
</tbody>
</table>

Skill testing was used as an entrance examination by more participants than any other type of examination. Oral
and physical examinations were the next most widely used type of entrance examination. All of the participants used some type of entrance examination; however, none of them used any type of standardized examinations.

Educational Requirements

Minimum educational requirements indicated by the participating firms varied greatly. The information not only indicated a wide variety of educational requirements by the individual firms but was further broken down by some to indicate differences in general job classifications.

Three participants indicated no preference as to minimum educational requirements. Three indicated a minimum requirement of some high school, with preference for a high school diploma. One participant indicated that a high school or a General Education Diploma (GED) was acceptable. One firm showed a preference for college work; this may be attributed to the custom fabrication in which the company was involved.

One large firm indicated that elementary school was acceptable as a minimum educational requirement for prospective employees, which might be indicative of the fact that this firm had a large number of employment opportunities in the unskilled labor classifications.
Specific subject areas of general education were not considered important by four, or 44 per cent, of the participants. Three participants considered mathematics important as a specific subject area. Two mentioned industrial arts courses, and one indicated art as a desirable subject area.

Only three participants indicated their firms had specialized jobs requiring employees to have an education beyond a high school degree. One firm reported that their engineering department required college graduates, another stated that drafting, layout, fit-up, and welding were areas requiring additional training, and one stated that some training was necessary regardless of educational achievements. It was noted that two firms mentioned experience as the only requirement for their specialized jobs. Four, or 44 per cent, of the participants stated that the specialized jobs in their firms did not require additional education.

None of the participating firms had any requirements for training new employees other than a brief, informal adaptation period. Only one reported that it hired employees based on experience only and did not train new employees.
CHAPTER III

JOB OPPORTUNITIES FOR PERSONS SEEKING EMPLOYMENT

IN THE STEEL FABRICATION INDUSTRY

Growth figures for the steel fabrication industry are cited in Chapter III. If the percentage growth rate of the industry remains fairly constant with the percentage rate between 1970 and 1974, the total number of employees in the steel fabrication industry is anticipated to be in excess of 8,500 people in the Greater Fort Worth Metropolitan Area.

Anticipated Growth

Six, or 67 per cent, of the participants indicated that they anticipated a need for a greater number of employees within the next five years. Table II presents information concerning specific job classifications in which growth is expected.

Welding was specified as an anticipated high-growth job classification by four, or 44 per cent, of the participants. Fitters and layout workers are job classifications mentioned by three, or 33 per cent, of the participants.
General shop workers were mentioned by three, or 33 per cent. Detailers, cutting torch operators, sheet metal workers, custom fabrication, drafting, and management were specific areas of growth anticipated by one each of the participants. Only two, or 22 per cent, of the participants indicated they would experience a general over-all growth in all areas.

### TABLE II

SPECIFIC JOB CLASSIFICATIONS IN WHICH GROWTH IS EXPECTED IN THE STEEL FABRICATION INDUSTRY

<table>
<thead>
<tr>
<th>Job Classification</th>
<th>Number of Firms</th>
<th>Per Cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welders</td>
<td>4</td>
<td>44</td>
</tr>
<tr>
<td>Fitters</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>Layout Men.</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>Shop Workers.</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>Detailers</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Burners (Cutting Torch Operators)</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Sheet Metal Workers</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Custom Fabrication.</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Draftsmen</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Management.</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>All Areas</td>
<td>2</td>
<td>22</td>
</tr>
</tbody>
</table>

The largest growth is expected in the skilled job classifications, with only one exception, that being the unskilled classification of general shop workers. It would be expected that as skilled job classifications increase in number, so would the unskilled classifications.
In-Service Training and Additional Educational Requirements

In-service training was available for the new employee in five, or 56 per cent, of the participating firms. This training took the form of on-the-job training in four, or 44 per cent, of the firms and a limited apprenticeship program in one, or eleven per cent, of the firms. One participant used classroom instruction in conjunction with on-the-job training.

Only one, or 11 per cent, of the participants did not encourage its employees to further their education. Table III presents information concerning the areas in which further education was encouraged by the remaining eight, or 89 per cent, of the participants.

TABLE III
SUBJECT AREAS IN WHICH FURTHER EDUCATION WAS ENCOURAGED

<table>
<thead>
<tr>
<th>Subject Areas</th>
<th>Number of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue Print Reading</td>
<td>2</td>
</tr>
<tr>
<td>Drafting</td>
<td>2</td>
</tr>
<tr>
<td>Trade School or Technical School</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics</td>
<td>1</td>
</tr>
<tr>
<td>Engineering</td>
<td>1</td>
</tr>
<tr>
<td>College</td>
<td>1</td>
</tr>
<tr>
<td>GED</td>
<td>1</td>
</tr>
</tbody>
</table>
Two of the areas mentioned, drafting and blue print reading, were very closely related. Drafting is called the language of industry and blue print reading might well be called the interpretation of drafting. Trade school education was mentioned by two, or 22 per cent, of the participants, which might indicate that an education in which specific salable skills were learned was of most importance to these firms. Furthering education in general was indicated to be acceptable by the remaining participants, with mathematics and engineering being specifically mentioned by one each of the participants. Only one participant stated that additional education did not improve the opportunities for employee advancement within the firm. Of the remaining eight participants (discounting one who did not respond to the question), all indicated that additional education did improve the opportunities for advancement of the employee. One participant did state that this education should be directly applicable to his firm's business and one stated that trade school education was not of interest to his firm.
CHAPTER IV

THE INDUSTRIAL ARTS MACHINE METALWORKING I & II CURRICULUM

AND HOW IT RELATES TO THE EMPLOYMENT REQUIREMENTS

OF THE STEEL FABRICATION INDUSTRY

If an accurate relationship between the employment requirements in the steel fabrication industry and the course work offered in Machine Metalworking I & II is to be established, an accurate definition of the curriculum must be stated. The Texas Industrial Arts Curriculum Guide says,

Industrial Arts is a general education subject area which is designed to prepare youth for effective living in our industrial society. Courses are based on technology; learning experiences include work with common tools and materials and study of industrial processes and problems. Students are taught safe work habits, develop skill and pride in craftsmanship, develop new insights into American industry, and learn to select and use products of industry. Also, they solve a variety of real problems which require application of mathematics and communicative skills as well as natural and social science concepts. Experiences gained in industrial arts provide a foundation for additional technological training (1, p. 140).

Machine Metalworking I & II is offered to students in grades ten through twelve who have had the prerequisite course General Metalworking.

General Metalworking is a study of four or more of the metalworking areas selected from art
metalworking, bench and wrought metalworking, machine metalworking, welding, forging, founding, sheet metalworking and metalspinning (1, p. 154).

Each of these subject areas is taught in such a way as to acquaint the student with the background of the subject area tools and equipment, the skills and knowledge necessary to work in the area, and the safety procedures involved in operating the machinery or tools specifically required in that area.

Machine Metalworking I & II develops a high level of technical skills in operation of basic machine tools and understanding of machine tool design principles (1, p. 155).

Instruction is given on the engine lathe, milling machine, drill press, surface grinding machine, tool grinder, and shaper. Skill is developed by constructing useful projects which require multiple operations on several machines. As skill in machine set-up and operation increases, projects require accurate and precise work and opportunities are afforded to use machinery hand books. Instruction in blue print reading includes interpreting drafting symbols, tolerances, dimensions, conventional representations, interpreting notes, and work orders. Sketching is also taught (1, p. 155).

Related study topics include safety, machine maintenance, cutting speeds, feeds and lubricants, design of machine elements, tool and cutter design, specifications and characteristics of metals, precision and semi-precision measuring tools, jig and fixture design, job analysis, production machines, production planning, occupations in metalworking industries and shop mechanics (1, p. 155).

Of interest in relating the Machine Metalworking I & II curriculum to the employment requirements of the steel
fabrication industry is the area of safety. The first related topic which is mentioned as being taught in Machine Metalworking I & II is safety. Safety is further mentioned numerous times throughout the prerequisite course requirements and the specific subject areas which are described and taught in their respective curriculums.

All of the participating firms stated they posted specific safety regulations which applied to all of their employees. Six, or 67 per cent, of the participants stated that employees with working experience were more safety conscious than those without. Table IV presents information as to specific safety equipment required of employees in the steel fabrication industry.

Gloves were required by seven, or 78 per cent, of the participants, with two of them providing gloves for their employees. Safety-toed shoes were required by six, or 67 per cent, of the participants, with safety glasses and hard hats being required by five, or 56 per cent. Safety glasses were further provided by four, or 44 per cent, of the participants which required them. Hard hats were provided by two, or 22 per cent, of the participants requiring them. Hearing protection and respiratory filters were required by two, or 22 per cent, of the participants respectively. One participant
furnished hearing protection and three participants provided respiratory filters, which indicated that one firm which did not require respiratory protection did have it available to employees to use at their discretion. Protective clothing was required by only one of the participants but was provided by three of them for specific job classifications.

**TABLE IV**

**PARTICIPATING FIRMS REQUIRING EMPLOYEES TO WEAR SPECIFIC SAFETY EQUIPMENT**

<table>
<thead>
<tr>
<th>Safety Equipment</th>
<th>Participating Firms</th>
<th>Equipment Provided By Company</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Safety Glasses</td>
<td>5</td>
<td>56</td>
<td>..</td>
</tr>
<tr>
<td>Hard Hat</td>
<td>5</td>
<td>56</td>
<td>1</td>
</tr>
<tr>
<td>Gloves</td>
<td>7</td>
<td>78</td>
<td>..</td>
</tr>
<tr>
<td>Safety Toe Shoes</td>
<td>6</td>
<td>67</td>
<td>3</td>
</tr>
<tr>
<td>Respiratory Filter</td>
<td>2</td>
<td>22</td>
<td>4</td>
</tr>
<tr>
<td>Hearing</td>
<td>2</td>
<td>22</td>
<td>6</td>
</tr>
<tr>
<td>Clothing (Aprons)</td>
<td>1</td>
<td>11</td>
<td>7</td>
</tr>
</tbody>
</table>

* N, Number; P, Per Cent

**Skills**

The curriculum guidelines mentioned earlier spell out specific skills in which the student should attain some degree of proficiency. Table V presents information concerning some of these specific skills and their relative importance to the participating steel fabrication firms.
TABLE V
CERTAIN METALWORKING SKILLS AND THEIR IMPORTANCE TO STEEL FABRICATION FIRMS

<table>
<thead>
<tr>
<th>Skills</th>
<th>Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very Important</td>
</tr>
<tr>
<td></td>
<td>N  P</td>
</tr>
<tr>
<td>Blue Print Reading</td>
<td>5  56</td>
</tr>
<tr>
<td>Use of Mathematics</td>
<td>4  44</td>
</tr>
<tr>
<td>Ability to Read</td>
<td>6  67</td>
</tr>
<tr>
<td>Interpretation of Drafting</td>
<td>.. ..</td>
</tr>
<tr>
<td>Symbols and Pictorial Representations</td>
<td>2  22</td>
</tr>
<tr>
<td>Interpretation of Welding Symbols as Found on Shop Drawings</td>
<td>5  56</td>
</tr>
<tr>
<td>Maintaining Tolerances</td>
<td>5  56</td>
</tr>
<tr>
<td>In-Shop Drawing (Sketching)</td>
<td>1  11</td>
</tr>
</tbody>
</table>

# N, Number; P, Per Cent

The skills considered most important by the participants centered around the area of communications or the interpretations of written or drawn communications. All of the participants considered the ability to read as being very important or important. Blue print reading and the interpretation of welding symbols were considered very important or important.
by all participants, while the interpretation of drafting symbols was considered important or very important by eight of the participants, with one expressing no opinion. Maintaining tolerances was very important or important to eight of the participants, with only one considering this skill area unimportant. Shop drawing (sketching) was the least important area of concern of four, or 44 per cent, of the participants. Three considered sketching very important or important, and two made no response.

General Shop Procedures

As was cited in the beginning of this chapter, industrial arts courses are based on learning experiences which include work with common tools and materials and the study of industrial processes and problems (1, p. 140). These areas of study might well be called general shop procedures. Some specific shop procedures and their importance to the steel fabrication industry are presented in Table VI.

A majority of all the participants considered all of the areas of general shop procedure very important or important. Four, or 44 per cent, of the participants did not consider the characteristics of the metal the employee was working with to be important. Template making and the specifications of
TABLE VI

THE IMPORTANCE OF GENERAL SHOP PROCEDURES IN THE STEEL FABRICATION INDUSTRY

<table>
<thead>
<tr>
<th>Skills</th>
<th>Very Important</th>
<th>Important</th>
<th>Un-Important</th>
<th>No Opinion</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>P</td>
<td>N</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Use of Basic Hand Tools</td>
<td>7</td>
<td>78</td>
<td>2</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Use of Welder (Arc)</td>
<td>5</td>
<td>56</td>
<td>4</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>Use of Cutting Torch</td>
<td>3</td>
<td>33</td>
<td>6</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td>Knowledge of Precision Measurement as Applied to</td>
<td>4</td>
<td>44</td>
<td>3</td>
<td>33</td>
<td>2</td>
</tr>
<tr>
<td>Layout and Fit-up</td>
<td>2</td>
<td>22</td>
<td>4</td>
<td>44</td>
<td>3</td>
</tr>
<tr>
<td>Specifications of Work Materials</td>
<td>1</td>
<td>11</td>
<td>4</td>
<td>44</td>
<td>4</td>
</tr>
<tr>
<td>Characteristics of Metals Being Worked With</td>
<td>3</td>
<td>33</td>
<td>4</td>
<td>44</td>
<td>2</td>
</tr>
<tr>
<td>Effects of Heat on Work Material</td>
<td>1</td>
<td>11</td>
<td>7</td>
<td>78</td>
<td>1</td>
</tr>
<tr>
<td>Allowances for Weld Shrinkage</td>
<td>1</td>
<td>11</td>
<td>4</td>
<td>44</td>
<td>3</td>
</tr>
</tbody>
</table>

* N, Number; P, Per Cent

work material were considered unimportant by three, or 33 per cent, of the participants. The effects of heat on work material and knowledge of precision measurement as applied to lay-out and fit-up were considered unimportant by two,
or 18 per cent, of the participants. Only one, or 11 per cent, considered a knowledge of the allowances for weld shrinkage unimportant.

Use of Equipment and Machinery

Machine Metalworking I & II is designed to afford the student an opportunity to develop some skills in the operation of basic machine tools and equipment. In some cases tools and machinery used extensively in the steel fabrication industry are not common to the industrial arts metalworking lab. Some specific machinery and equipment common to both areas are presented in Table VII.

The information presented in Table VII does not indicate any one piece of machinery or equipment or any type of machinery or equipment to be specifically important to a majority of the participating firms. It was of interest to note the machinery and equipment considered unimportant to the participants and the number of no-response participants. Five, or 56 per cent, of the participants indicated that the power metal saw (hack saw) was an unimportant piece of machinery in their shop. Three, or 33 per cent, of the participants considered the Oxy-acetylene welder and the pedestal grinder unimportant.
TABLE VII
THE USE OF SPECIFIC EQUIPMENT AND MACHINERY AND ITS IMPORTANCE IN THE STEEL FABRICATION INDUSTRY

<table>
<thead>
<tr>
<th>Equipment and Machinery</th>
<th>Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very Important</td>
</tr>
<tr>
<td></td>
<td>N P</td>
</tr>
<tr>
<td>Drill Press</td>
<td>1 11</td>
</tr>
<tr>
<td>A. C. Welder</td>
<td>2 22</td>
</tr>
<tr>
<td>Oxy-Acetylene Welder</td>
<td>2 22</td>
</tr>
<tr>
<td>Grinder-portable</td>
<td>2 22</td>
</tr>
<tr>
<td>Grinder-pedastal</td>
<td>2 22</td>
</tr>
<tr>
<td>Hand Drill</td>
<td>2 22</td>
</tr>
<tr>
<td>Power Metal Saw - Cut-Off</td>
<td>1 11</td>
</tr>
<tr>
<td>Power Metal Saw - Hack Saw</td>
<td>1 11</td>
</tr>
<tr>
<td>Power Metal Saw - Band Saw</td>
<td>1 11</td>
</tr>
</tbody>
</table>

* N, Number; P, Per Cent

Three, or 33 per cent, of the participants made no response to the importance of the drill press and two, or 22 per cent, of the participants did not respond to the importance of the three divisions of the power metal saws. The lack of response, as to the importance of these machines, might be attributed to the fact that these machines were not used in the respective firms; these machines had been replaced
with more sophisticated machines, or the machine operation performed by these machines was being accomplished by another method.

Topics of Importance in the Steel Fabrication Industry

Machine Metalworking I & II is limited as to the areas of industry which can be taught. Economics, working space, and time are but a few of the limiting factors. The student must develop skills, learn general shop procedures, and become acquainted with the use of shop equipment and machinery. He must become acquainted with some of the processes and problems of industry such as production planning, job analysis, and machine maintenance. Table VIII presents information concerning some of the specific topics of the steel fabrication industry and how they were rated as to their importance by the participants.

Wire welding and A. C. welding were topics considered very important or important by eight, or 89 per cent, of the participants. Gas welding was rated unimportant by five, or 56 per cent, of the participants and very important or important by only three, or 33 per cent. Final assembly and fabrication were the next most important areas, with eight, or 89 per cent, of the participants considering these two topics as important or very important. The characteristics
of tool steel were not considered important by any of the participants.

### TABLE VIII

**THE IMPORTANCE OF SPECIFIC INDUSTRIAL TOPICS AS RATED BY STEEL FABRICATION FIRMS**

<table>
<thead>
<tr>
<th>Industrial Topics</th>
<th>Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very Important</td>
</tr>
<tr>
<td>Welding - Gas</td>
<td>2 22</td>
</tr>
<tr>
<td>Welding - A. C.</td>
<td>3 33</td>
</tr>
<tr>
<td>Welding - Wire</td>
<td>3 33</td>
</tr>
<tr>
<td>Characteristics of Tool Steel</td>
<td>...</td>
</tr>
<tr>
<td>Planning - Layout</td>
<td>3 33</td>
</tr>
<tr>
<td>Planning - Production</td>
<td>4 44</td>
</tr>
<tr>
<td>Fabrication</td>
<td>6 67</td>
</tr>
<tr>
<td>Final Assembly</td>
<td>5 56</td>
</tr>
<tr>
<td>Jig &amp; Fixture Design</td>
<td>2 22</td>
</tr>
<tr>
<td>Machine Maintenance</td>
<td>5 56</td>
</tr>
<tr>
<td>Tool Maintenance</td>
<td>3 33</td>
</tr>
<tr>
<td>Job Analysis</td>
<td>2 22</td>
</tr>
<tr>
<td>Use and/or Design of Production</td>
<td>3 33</td>
</tr>
<tr>
<td>Machines</td>
<td>3 33</td>
</tr>
</tbody>
</table>

* N, Number; P, Per Cent

**Opinions of Machine Metalworking I & II Curriculum As Expressed by the Participating Firms**

When asked their opinion of the individual student project approach to teaching industrial arts metalworking,
four, or 44 per cent, of the participants did not indicate that this method allowed the student to attain the knowledge and skills needed. Three, or 33 per cent, indicated this method was good, and two, or 22 per cent, did not respond. Five, or 56 per cent, of the participants indicated that a group project approach to teaching would provide students with the skills and knowledge they should attain, and four, or 44 per cent, disagreed with this method. A majority of the participants, seven, or 78 per cent, stated that they believed the industrial arts metalworking classes should be organized similar to industrial organizations, with a supervisor, foreman, and workers. Two, or 22 per cent, disagreed with this approach. Information concerning ways in which metalworking courses might aid prospective employees in the steel fabrication industry is presented in Table IX.

All of the participants indicated that high school metalworking courses familiarize the student with the general aspects of the steel fabrication industry. All but one participant indicated that these courses reduced their time spent in in-service training. Only six, or 66 per cent, of the participants indicated that metalworking courses eliminated early termination of jobs, which might be attributed to the great number of variables which may enter into this subject of termination.
TABLE IX

OPINIONS OF STEEL FABRICATION FIRMS AS TO WHETHER THE SPECIFICALLY MENTIONED SUBJECT AREAS WOULD AID PROSPECTIVE EMPLOYEES

<table>
<thead>
<tr>
<th>Subject Areas</th>
<th>Firms</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce time spent in in-service training</td>
<td>Yes</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Familiarize him in the general aspects of the fabrication industry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eliminate early termination of jobs</td>
<td></td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No Response</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

The opinions of the participants were split equally as to whether new employees with high school metalworking experience approached their work in a more organized manner than those without. Three indicated that they did, three did not, and three did not respond. As to whether prospective employees with high school metalworking experience made better employees than those without, four indicated that they did, three did not believe that they did, and two did not respond.
CHAPTER BIBLIOGRAPHY

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The primary purpose of this study was to collect data concerning the skills and knowledge required of employees in the steel fabrication industry in the Greater Fort Worth Metropolitan Area and relate these requirements to the industrial arts Machine Metalworking I & II curriculum as taught in the Fort Worth Independent School District.

Information and data needed for the study were gathered and the study was organized as follows: Chapter I includes an introduction, statement of the problem, delimitations of the study, procedure, sources of data, definition of terms, and a review of seven related studies; Chapter II presents information concerning general qualifications and duties of employees in the participating firms, previous work experience, age requirements, entrance examinations and educational requirements; Chapter III presents data indicating anticipated growth and in-service training and additional educational requirements; Chapter IV includes data defining the curriculum
of Machine Metalworking I & II, safety equipment required of employees in the participating firms, skills, general shop procedures, use of equipment and machinery, and opinions expressed by the participating firms; Chapter V contains a summary, findings, conclusions, and recommendations.

A letter of inquiry was sent to twenty-two steel fabrication firms in the Greater Fort Worth Metropolitan Area asking them to return an included post card indicating whether they would participate in the study. Only eleven firms returned the post card indicating that they would participate in the study by completing and returning a questionnaire. However, only nine of the eleven firms did participate in the study.

A questionnaire was designed to gather data concerning specific aspects of the knowledge and skills required of employees in the steel fabrication industry. The personnel directors or an executive of the firms completed the questionnaire, indicating what they considered important as qualifications for employees entering the steel fabrication industry.

This study was limited to data collected by the questionnaires which were returned by representatives of the participants and the responses made by them to the information
which was requested. The study was further limited to the Greater Fort Worth Metropolitan Area and specific job classifications as defined in the Dictionary of Occupational Titles (1).

Findings

The data gathered through the use of the questionnaire revealed some of the basic skills and knowledge required of employees in the steel fabrication industry. The following findings are based on the data.

1. The nine steel fabrication firms in the Greater Fort Worth Metropolitan Area had over 800 employees (one firm did not indicate how many employees it had). The number of employees ranged from six to 300.

2. Six, or 67 per cent, of the participants anticipate an increase in the number of employees during the next five years.

3. The basic skills and knowledge taught in Machine Metalworking I & II were considered desirable for the prospective employee.

4. Eight, or 89 per cent, of the participants considered previous work experience to be important as a part of an employee's background.
5. The educational requirements for the prospective employee in the steel fabrication industry varied as to the particular type job skills.

6. Specific subject areas were not considered important by four, or 44 per cent, of the participants with only three, or 33 per cent, mentioning mathematics and two, or 22 per cent, mentioning Industrial Arts courses as desirable.

7. All participants specified eighteen years as a minimum age for prospective employees. Only one indicated a maximum age, which was specified as sixty-five.

8. In-service training programs were available in five, or 56 per cent, of the participating firms.

9. Entrance examinations were used by each of the participants, with skill testing being the most widely used type of test.

10. The ability to read, blue print reading, and the interpretation of drawings and drawing symbols were considered important as skills for the prospective employee to possess.

11. The Machine Metalworking I & II curriculum as defined and presented in Chapter IV offers a variety of
experiences directly and indirectly related to the steel fabrication industry.

12. The curriculum of Machine Metalworking I & II provides opportunities to learn many of the basic skills and attain knowledge necessary in the steel fabrication industry. This curriculum provides the prospective employee with an excellent base from which to further his skills and knowledge.

13. The employment opportunities in the steel fabrication industry are good. Welders, fitters, and layout men are specific skilled labor classifications which offer opportunities for employment.

Conclusions

The following conclusions are based on a study of the findings.

1. There appear to be opportunities in the steel fabrication industry for a wide variety of age groups and in a variety of job classifications.

2. Young persons who take metalworking in high school should have a better understanding of the metalworking industry.

3. The basic metalworking curriculum offered in the public schools can be of benefit to young persons as an
introduction to a possible vocation in the steel fabrication industry upon graduation from high school.

4. An employee who has taken metalworking will probably spend less time in in-service training and will possibly qualify for a job requiring more skills.

5. Industrial arts courses, like most other courses in general education, cannot fulfill the exact requirements set by the industrial market.

6. If the growth rate of the steel fabrication industry remains the same as for the last four years, the number of employees should increase to over 8,500, in the Greater Fort Worth Metropolitan Area, in the next five years.

Recommendations

The following recommendations are made in view of the findings and conclusions of this study.

1. Young persons who show an interest in the metalworking field should be encouraged to take metalworking courses in high school.

2. Blue print reading and interpreting drafting symbols should be emphasized in metalworking courses.
3. Employment opportunities in the metalworking area should be stressed in the schools and community.

4. On-the-job training in conjunction with education should be encouraged in an effort to provide the student with work experience which is expressed as desirable by a majority of steel fabrication firms.

5. Skill in the use of basic hand tools and metalworking machinery should be a vital part of metalworking courses.

6. Research should be conducted concerning the feasibility of organizing the metalworking laboratories in the same manner as industries are organized - with a supervisor, foreman, and workers.

7. The group project approach to teaching metalworking should be emphasized as a teaching method in metalworking laboratories.

8. Similar studies in other occupational fields should be conducted.

9. Future studies in the metalworking industry of the Greater Fort Worth Metropolitan Area should be conducted in an effort to maintain current and up-to-date information for use in revising and reviewing programs designed to explore the area of steel fabrication.
APPENDIX A

November 10, 1975

Name of Participant

Attention: Director of Personnel

Dear Sir:

In November of 1972 I began a study of employment opportunities in Steel Fabrication plants which are located in the Greater Fort Worth Metropolitan Area. Your company graciously consented to help by answering a questionnaire which I have on file. Due to circumstances beyond my control, I was unable to complete the study and am now working to update and complete the study as a requirement for receiving a Master of Science Degree from North Texas State University.

Since employment requirements for your company may have changed I would like to compile more accurate information with which to complete the study.

Enclosed is a self-addressed, stamped card inquiring whether you would participate in this study by completing and returning a questionnaire that would be mailed to you in the near future. If you do not wish to participate, please return the card and so indicate.

At the end of the study, I will mail you a copy of the summary.

Cordially,

Dennis McPeak
Graduate Student
North Texas State University

44
November 18, 1975

Name of Participant

Dear _____:

I recently mailed your Company a letter requesting participation in a study I am conducting of the employment opportunities in the steel fabrication industry. I received a return post card which stated that you would participate and I sent a questionnaire by return mail. I have not received your questionnaire to date and due to the small number of participants it is very important that the information from your company be included in the study.

For your convenience, I have included another copy of the questionnaire and a self addressed stamped envelope for its return to me.

I will mail you a copy of the summary at the conclusion of the study.

Cordially,

Dennis McPeak
Graduate Student
North Texas State University
Company Name______________________________
Company Address______________________________
City________________________________________

This Company is a steel fabrication plant. Yes__No__

This Company employs 25 or more. Yes__No__

If your company meets the above qualifications; We would be willing to participate in this study by completing and returning a questionnaire. Yes__No__

Signature:____________________________________

Title:_________________________________________
APPENDIX D

Name of Firm ________________________________

Address ________________________________

What are the principle products or types of products produced by your firm? ________________________________

How many employees do you employ at this location? ________________________________

Do you anticipate an increase in the number of employees in the next 5 years? Yes _______ No _______

If yes, in what job classification(s)? Please specify. ________________________________

1. Do you consider any type of previous industrial experience to be important as a part of an employee's background? Yes _______ No _______ If yes, what (specify)? ________________________________

2. What minimum age is required of employees? Please specify. ________________________________

What maximum age is required of employees? Please specify. ________________________________

What age do you prefer? Please specify. ________________________________


3. Minimum education requirements of employees. Please indicate the educational requirements for your employees in general. (Check one in each column.)

<table>
<thead>
<tr>
<th>Minimum Education Requirement</th>
<th>Minimum</th>
<th>Prefer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary School</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>Junior High School</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>Some High School</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>High School Graduate</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>GED Test</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>Technical School</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>Some College</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>2 Year Associate Degree</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>College Graduate</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>No Preference</td>
<td>_______</td>
<td>_______</td>
</tr>
</tbody>
</table>

4. Do you consider one specific subject area of education, such as History, Journalism, Industrial Arts, Music, English, Math, Foreign Language, Art, etc. to be important as a part of an employee's background? Yes _______ No _______ If yes, what area(s)? Specify. ________________________________

5. Does your company require any special training period for newly hired employees (other than a brief, informal, adaptation period)? Yes _______ No _______ If yes, specify. ________________________________

6. Do you have specialized jobs which require education other than indicated above? Yes _______ No _______ If yes, specify. ________________________________

<table>
<thead>
<tr>
<th>Job Specification</th>
<th>Educational Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______</td>
<td>_______</td>
</tr>
</tbody>
</table>

7. Are in-service training programs available to your employees? Yes _______ No _______ If yes, what?

a. On the job. _______ b. Apprenticeship. _______ c. Classroom instruction. _______ d. Other (specify) _______

7a. Are employees encouraged to further their education? Yes _______ No _______ If yes, in what specific areas?

7b. Does additional education (post high school) improve opportunities for employee advancement in your company? Yes _______ No _______
8. Please rate the following as they apply to your company and prospective employees.

   a. Skills
      1. Blue Print reading
      2. Use of Mathematics
      3. Ability to read
      4. Interpretation of drafting symbols and pictorial representation
      5. Interpretation of welding symbols as found on shop drawings
      6. Maintaining tolerances
      7. In shop drawing (sketching)

   b. General shop procedures necessary to know.
      1. Use of basic hand tools
      2. Use of welder (Arc)
      3. Use of cutting torch
      4. Knowledge of precision measurement as applied to layout and fit-up
      5. Specifications of work material
      6. Characteristics of metals being worked with
      7. Effects of heat on work material
      8. Allowances for weld shrinkage
      9. Template making
      10. Specify other procedures particular to your company

   c. Use of equipment and machinery.
      1. Drill press
      2. A. C. welder
      3. Oxy-acetylene welder
      4. Grinder - portable
      5. Grinder - pedestal
      6. Hand drill
      7. Power metal saw - Cut off
      8. Power metal saw - Back Saw
      9. Power metal saw - Band Saw

9. Rate the following topics as to their importance in meeting your employee's needs.

   a. Welding - gas
   b. Welding - A. C.
   c. Welding - wire
   d. Characteristics of tool steel
   e. Planning - layout
   f. Planning - production
   g. Fabrication
   h. Final assembly
   i. Jig and fixture design
   j. Machine maintenance
   k. Tool maintenance
   l. Job analysis
   m. Use and/or design of production machines
10. Does your company have specific posted safety regulations which apply to all employees?
Yes \_\_\_ No \_\_\_

10a. Are employees with working experience more safety conscious than those without?
Yes \_\_\_ No \_\_\_

Are employees required to wear any of the following safety equipment? If yes, please indicate which of these items are provided by the company.

<table>
<thead>
<tr>
<th>Item</th>
<th>Yes</th>
<th>No</th>
<th>Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Safety glasses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Hard Hat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Gloves</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Safety toe boots</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Respiratory filters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Hearing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Clothing (Aprons)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10b. In your opinion, are there any areas that would fall under the heading of safety that are not being taught, or that are being taught which need improvements? Yes \_\_\_ No \_\_\_
If yes, please specify.

11. In your opinion, does the individual student project approach to teaching Industrial Arts Metal Working provide the student with the knowledge and skills he should attain in such a course? Yes \_\_\_ No \_\_\_
If no, please comment or make suggestions.

12. In your opinion, would group projects in which a number of students participate in building one project provide the student with the knowledge and skills he should attain in such a course? Yes \_\_\_ No \_\_\_

13. In your opinion, should Industrial Arts Metal Working classes be organized similar to industrial organizations with supervisor, foreman, workers, etc? Yes \_\_\_ No \_\_\_

13a. In your opinion, is there an area of instruction that is not being taught in high school metal working classes that would be of benefit to the prospective employee in your business? Yes \_\_\_ No \_\_\_
If yes, please specify.

14. In your opinion, can high school Metal Working courses aid prospective employees in any of the following ways?

<table>
<thead>
<tr>
<th>Way</th>
<th>Yes</th>
<th>No</th>
<th>Opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Reduce time spent in in-service training.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Familiarize him with general aspects of the fabrication industry.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Eliminate early termination of jobs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Additional comments</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

14a. In your opinion, do new employees with high school metal working experience approach their work in a more organized manner than do those without this experience?

15. In your opinion, do prospective employees with high school metal working experience make better employees than those who do not have such experience? Yes \_\_\_ No \_\_\_.
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