THE JOB ENTRY COMPETENCIES OF STOUGHTON HIGH SCHOOL GRADUATES AS PERCEIVED BY LOCAL METAL MANUFACTURING INDUSTRIES AND BUSINESSES

By

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ABSTRACT

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The purpose of this study was to determine if the current curricular content of the introductory metals manufacturing course reflects the needs of local businesses and industry in the city of Stoughton. The objectives of the study were to identify the entry-level metal manufacturing job/occupations available to high school graduates, identify the most important entry level personal characteristics, metalworking techniques and skills and processes. The study also set out to compare the current metals manufacturing course with the results of the study. The study was conducted by sending a survey to 24 heads of personnel at metal manufacturing related businesses and industries in the city of Stoughton. The list of subjects was obtained in an on-line yellow pages directory. The list of contact persons represented a cross section of the metal manufacturing sector. The subjects ranged from small welding businesses to large metal manufacturing companies.

The results of the study determined that eighteen entry-level positions are available for Stoughton High School graduates in the metals manufacturing area. The study also showed that some entry-level personal characteristics, metalworking techniques and metalworking processes and skills are more important than others. Finally, the results indicated that the current metals manufacturing program is meeting the needs of local metalworking businesses and industries.

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I would like to dedicate this paper to my kids, Gustav and Ila, who for their love of learning gave me the inspiration to finish this endeavor.

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CHAPTER 1

Introduction

Background of the Problem

The Stoughton Area School District is located in the town of Stoughton, Wisconsin. It is a rural district with a population of 12,000. Stoughton is growing with sub-divisions popping up on the outskirts of the town. Growth is taking place at a rapid pace and business and industry are establishing a solid foothold in the community at the same pace as the residential property. The Stoughton Area School District has three elementary schools, Kegonsa, Fox Prairie, and Yahara, each with kindergarten though fourth grade. The district has one fifth and sixth grade school, Sandhill, and one seventh and eighth grade school, River Bluff, and lastly the 9th through 12-grade high school. Stoughton High School is in the Badger Conference and has a total enrollment ranging from 1,100 to 1,300 students.

The Stoughton High School Technology Education Department has four members who teach: communications, construction, transportation, and manufacturing. "Technology in communication, construction, manufacturing, and transportation will continue to change at a rapid pace… If this is the plan of American industry, technology education teachers must plan to make changes. They must plan to make the curriculum reflect society today" (Bjorklund, 1988, p. 121). The courses are elective and each high school student is required to take a single course from the applied academics area, which besides technology education includes art, music, business and family consumer education, and agriculture.

The delivery of information in the Technology Education Department involves both lecture and application of knowledge in a lab setting. Activity helps make explicit to the learner how knowledge is generated, communicated, and used to analyze and solve technical problems (Herschbach, 1995). The application of technological skills is vital in the Technology Education Department for the demonstration of knowledge. "There is a need to keep up with technological advances because skills are key to retention. Workers changed jobs more often, and were often required to regularly update their skills" (Sterry & Hendricks, 1999, p. 19). Students involved in technology education courses at Stoughton High School are evaluated based on four employability skills: responsibility, motivation, organization, and compatibility. The employability skills are an attempt to reinforce what employers look for in future employees.

The Stoughton High School Metals Manufacturing program is based on making weld examples, testing, evaluating, and discarding them. Making weld examples and testing them is a good way to develop skill and put theory into action. The students also experience activities that relate to other professions in manufacturing. High schools must educate rather than train career-bound students. An educational system that uses the content of an industry, business, or trade can teach broad-based technical skills and motivate students to acquire more complex academic knowledge (Bottoms, 1993). Students also need a broad approach to other skills in the manipulation and fabrication of metal materials. If instruction is based on specific skills and is not broad enough to incorporate general familiarities among manufacturing entities, students will be given an inaccurate perception of the workplace. Frey (1989) observed, for example, that "a highly skilled welder 'knows' how to weld but very likely cannot articulate exactly how welding

is accomplished" (p. 29). Students in an introductory manufacturing class should have experiences that allow them to gain knowledge and skills that can apply to a wide range of jobs. These types of experiences are often called employability skills or life skills. In classroom partnerships, business leaders and volunteers from the community improve the learning environment by either bringing business or occupational expertise directly into the classroom for students and teachers, or by bringing the classroom to the workplace for on-site visits, job shadowing, apprenticeships, or other school-to-careers programs (Dykman, 1996).

At this time, the welding industry of Stoughton is influencing what is taught at the high school level. Stoughton Trailers and Zaulk Joesephs Fabricators have donated machines, equipment, and materials. "Education through occupation advocates argue that a broad-based design is best for teaching academic subjects and all aspects of industry" (Grubb, 1997, p. 78). It is unclear if the present program at Stoughton High School is currently applying a broad-based design.

An articulation agreement for advanced standing in welding has been established with Madison Area Technical College and Stoughton High School Welding/Metals Manufacturing classes. Very few students are taking advantage of the agreement for advanced standing while attending Stoughton High School. The program is designed to give students advanced placement for competencies that they complete in the high school setting. The student satisfies the individual competency and the instructor signs and dates when the skill has been successfully completed. The student has 27 months following graduation from high school to take advantage of the agreement and get advanced standing in the technical school welding program. Area industries look to the technical

schools for trained welders and fabricators, plumbers, heating ventilation and air conditioning repairpersons, and machinists.

In most situations employers prefer to train new employees on the job or in house schooling such as welding schools. The employers prefer this method because the employee can be trained in the work environment and be familiarized with the company's approach to production. This practice eliminates the need to retrain employees after they may have picked up bad or undesirable skills in the high school or technical school setting. Many employers look to the high school to train individuals in the job-entry skills before they come and work for them. Traditional and Tech Prep advocates also argue for broad-based programs because they believe that students' employment opportunities are maximized in today's labor market, not by depth, but by having entry-level skills in a variety of related occupations that permit them to compete for a greater number of jobs (Pautler, 1999). The most popular way to learn these job entry skills at Stoughton High School is to have students participate in a School-to-Work or work release program. Also the state recommended standards for technology education, give students a range of experiences that will help with the transition to work.

Four standards/objectives for technology education have been developed and instructors are incorporating them into the high school curriculum. One objective is to prepare students to understand the nature of technology in relation to an extension of human capability. The second objective is to prepare students to recognize the individual components of systems and how each component affects the operation of the system and its relationship to other systems. The third objective prepares students to be able to define problems, gather information, explore options, devise a solution, evaluate the outcome,

and communicate the results. The fourth objective prepares students to understand that technology affects society and the environment in ways that are both planned and unplanned and desirable and undesirable (*Wisconsin State Technology Education Standards*1998). The state standards are a guide for instructors to implement the study of technology in their classrooms, workshop, or lab. Students need to have access to the knowledge and skills described in the standards. Students can access the standards if the:

- Local curriculum is based on standards.
- Concepts and skills based on the standards are woven throughout the grades to provide an opportunity to develop increasing levels of sophistication and understanding over time.
- Content is accurate and is updated as new information emerges.
- Units of study are current and coordinated within the school (e.g., across classrooms and grade levels) and beyond the school (e.g., within the supervisory union, school-to-work region).(Carr & Harris, 2001)

The new technology education standards, along with changing competencies in the metals manufacturing industry, affect the present technology education curriculum. The Technology Education Department is one of the places in schools where students can demonstrate the use of technology in hands on experiences.

Statement of the Problem

Metals manufacturing is an entry level course offered to students at Stoughton High School who have an interest in learning about welding and related processes. Research was needed to determine if the curriculum was meeting the needs of local industries and businesses in the city of Stoughton. The study was needed to find

deficiencies in preparation of students in the basic skills that apply to the variety of entry-level positions at area metal manufacturing businesses and industries. There has been no research done in the related metal fabrication areas in terms of job entry competencies.

Purpose of the Study

The purpose of this study was to see if the current curricular content of the metals manufacturing course reflects the needs of local businesses and industry in the city of Stoughton. The results of this study could be used to modify the current curriculum to meet the needs of other areas of metal fabrication besides welding and cutting operations. The study can inform students of the businesses and industry needs that are impacted by cutting, joining and manipulation of metal products. The study results can also be used to improve the transition into school-to-work and work release programs. The information will be used to make curricular modifications to improve the knowledge and skills students possess as they make informed decisions for future career choices.

Research Objectives

In order to determine if the Stoughton High School's Metals Manufacturing curriculum needs revision, the following research objectives were addressed:

1. What are the entry-level metal manufacturing jobs/occupations available in Stoughton?
2. What are the common entry-level skills/competencies that metals manufacturing employers look for?
3. How does the current metals manufacturing curriculum compare to the results of this study?

Significance of the Study

1. The significance of the study was to determine if there is a need to change the current curriculum in the entry-level Metals Manufacturing course.

2. With this information the Stoughton Technology Education Department can address similar curriculum decisions in communications, construction, and transportation. The same techniques used in this study can apply directly to the other curricular areas.

3. Data will be used to support the needs of business and industry in the Stoughton area. A working relationship can be fostered between the Technology Education Department and the area industries and businesses.

4. This study could also be used by other school districts to assist in relating curriculum to area businesses and industry. Other districts could conduct similar studies to ensure that their curriculum reflects the needs of the community.

Limitations of the Study

The limitations of the study are as follows:

1. The content of the study was limited to entry level metals manufacturing course curriculum at Stoughton High School.

2. The research only relates to employers who have a related occupational descriptive as the entry level Metals Manufacturing class at Stoughton High School.

3. The data was based on information collected in the spring semester of 2003 from Stoughton area metal manufacturing businesses and industries.

4. The data was derived from job entry competencies that students from the metals manufacturing course need when they interview or from actual job performance.

5. The research was limited to metals manufacturing employers in the city of Stoughton.

Definition of Terms

The following terms are defined for clarity of understanding regarding this study:

Articulation agreement- A written understanding between a secondary school district and a post-secondary educational institution identifying which credits earned by secondary students are eligible to be counted toward the course requirements for specific post-secondary level program and/or course identified by the post-secondary institution.

Career choices- Options students have as they make decisions for future employment.

Compatibility- Term used in Stoughton Technology Education classes to classify the ability to get along and work well with others.

Curriculum- Course of study in a school.

Entry-level competencies- Skills individuals possess as they make the transition to the world of work.

Machining- Shaping material to the desired shape or contour by using a sharp bit composed of harder metal than the part being machined.

Mentorship program- Program established between Stoughton Schools and area business and industry for training in professional growth development.

Metal products- Items produced with ferrous and nonferrous materials.

Motivation- Term used in Stoughton Technology Education classes to classify the eagerness to work and accept new procedures.

Organization- Term used in Stoughton Technology Education classes to classify the ability to keep accurate records, plans, and journals. This also refers to a student's ability to maintain a safe and orderly working environment.

Responsibility- Term used in Stoughton Technology Education classes to classify the ability to get to class on time, have no absences or at least very few, and following class policies.

School-to-work- Program at Stoughton High School, which allows students to receive credit while working at area business and industry.

Welding- Joining of material by the means of melting or fusing their adjoining surfaces.

Weld example- Multiple pieces of metal joined together to demonstrate skill.

CHAPTER 2

Review of Literature

Introduction

A review of literature is needed in order to determine which metal manufacturing job entry competencies are needed to meet the needs of businesses and industries in the city of Stoughton. This review accomplishes two objectives. First, it provides the project with a list(s) of entry level competencies that business and industry are looking for and, second, it provides the researcher information about the needs of employers for a survey that will be sent to area businesses and industries.

The Studies

Many studies have been conducted to identify the skills that are needed when making the transition to the work place. Most of the studies look at the workplace in general terms such as the Department of Labor (Secretary's Commission on Achieving Necessary Skills, 1991) and the American Society for Training and Development (Koffel, 1994), but there are a few that are specific to an area of interest (De Leon & Borchers, 1998). The message that these studies send is that high school graduates should possess academic and vocational skills that will provide employment and ensure success in an ever changing technical work place. Unfortunately, most secondary and post secondary institutions have not been successful in instilling these skills in their students. A disparity exists between educators who emphasize the study of ideas, discussion of concept and thoughts, and the business community and employers who emphasize skills. Educators spend much time discussing theories, sharing knowledge, experimenting and searching for concepts, while employers who hire students who graduate from our educational

system want to see results and want their employees to be able to do something with their knowledge (Koffel, 1994). The U.S. Department of Labor conducted a study on the skills employees need for entry-level positions, principles of learning them, and trends effecting employment.

DOL Study

The U.S. Department of Labor's Secretary's Commission on Achieving Necessary Skills (Secretary's Commission on Achieving Necessary Skills, 1991) has proclaimed that "good jobs depend on people who can put knowledge to work." At present, high school students lack sufficient opportunity to learn in the context of real problem solving. SCANS suggested three principles from cognitive science:

1. Students do not need to learn basic skills before they learn problem-solving skills. The two go together. They are sequential but mutually reinforcing.
2. Learning should be reoriented away from mere mastery of information and toward encouraging students to recognize and solve problems.
3. Real know-how foundation and competencies-cannot be taught in isolation; students need practice in the application of these skills. (Stern, Raby, and Dayton, 1992, p. 8)

Another study looked at the educational goals for students as they approach graduation from high school. The American Society for Training and Development (ASTD) went as far as identifying skills that can be addressed at the high school level that are necessary for entry-level working positions.

ASTD Study

The American Society for Training and Development (ASTD) conducted a research study with the U.S. Department of Labor in 1988 to find out which skills employers want to see in entry-level employees. ASTD used its 50,000+ membership as a base to conduct an extensive study of employers across the United States. Seven skills categories were identified as being the most valuable to employers: motivation to learn, career development, teamwork, critical thinking, basic skills, communication, and leadership (Koffel, 1994).

The Needs of Employers

The studies in the aforementioned sections addressed workplace skills that could influence future employability success, but very few studies target individual industries such as welding or metal manufacturing. One study, conducted in the state of Texas, attempted to determine current and projected employment trends of high school graduates by Texas manufacturing firms. The study sought to identify specific basic and vocational skills students with only a high school education would need to find employment in Texas manufacturing industries. The survey was comprised of two sections. Section one of the survey requested information from employers concerning the number of current employees and anticipated hires with only a high school diploma. Section two of the survey was comprised of skill statements that addressed academic concerns, as well as personal attitudes and conduct. Each category began with the phrase: "High school graduates employed by this company should have basic skills to:" The statements were grouped into nine skill categories:

1. Reading, writing, and math: Understand common job related words, perform simple math functions, read instruments such as gauges and meters, read the local newspaper, write simple memoranda, read technical manuals, estimate time, weight and speed measurements, understand elementary statistics, read blueprints, understanding geometric principles, perform algebraic equations, and write a technical report.

2. Communications: Follow procedural instructions, speak in clear sentences, give clear directions, listen to formal presentations, understand and/or speak another language, and sketch and dimension an object in multi-view.

3. Critical thinking: Understand problem solving processes, make decisions independently, troubleshoot problems, and formulate a hypothesis.

4. Group interactions: Work well with supervisors, be willing to ask questions, work well with colleagues, work as a team member of a team, respect others' opinions, recognize equality of the sexes, participate in group discussions, and recognize cultural and ethnic diversity.

5. Personal development: Exhibit self-esteem, establish personal goals, desire further education or training, work toward advancement, and recognize career options.

6. Computer skills: Operate a computer keyboard, operate computer-aided drafting software, operate word processing software, operate spreadsheet software, operate database software, understand DOS commands, and operate desktop publishing software.

7. Technical systems: Select the proper tools or equipment, assemble equipment following written directions, knows how technological systems operate (e.g. communications, manufacturing), and calibrate instrumentation.

8. Leadership: Negotiate and resolve conflicts, improve organizational effectiveness, demonstrate leadership qualities, and motivate others.

9. Employability: Demonstrate punctuality, maintain regular work habits, maintain quality standards, take pride in one's work, practice a healthy lifestyle, have a knowledge of the company, and practice in community/civic activities. (De Leon & Borchers, 1998, n.p.)

Job Entry Competencies

Vocational education has a vital role in collaborating with business and industry in high technology training and retaining to upgrade workers with the emerging new occupational skills and to maintain a competitive edge. Vocational education is facing the challenge of producing workers who can manage, operate, manufacture, test, design, program, install, maintain, and repair high technology products and processes (Hassan, 1985).

Definitions for each skill were developed through examples provided by the [National Center on Education and Training for Employment (1992), Harvey and Cohen (1989), the National Academy of Sciences (1984) and Zirkle (1998).

Academic Skills:

- Reading Skills- the ability to comprehend printed materials.
- Writing Skills-the ability to interpret, apply and transmit information in writing.

- Basic Math Computational Skills-the ability to perform addition, subtraction, multiplication and division.
- Advanced Math Computational Skills-the ability to perform algebra, geometry and trigonometry.
- Oral Communication Skills-the ability to listen and speak in an effective manner.

Occupational/Technical Skills:

- Safety and Health Skills-the ability to conduct oneself in a safe manner in the workplace.
- Primary Tool Use Skills-the ability to utilize hand tools specific to the job.
- Basic Machine Operation Skills-the ability to operate equipment that manufactures a product.
- Advanced Machine Operation Skills-the ability to setup and operate equipment that manufactures a product.
- Trade Specific Reading Skills-The ability to comprehend written manuals, procedure sheets and so on.
- Trade Specific Math/Computational Skills-the ability to perform trade-specific mathematical operations.
- Sketching/Drawing Skills-the ability to create illustrations related to trade-specific tasks.
- Quality Assurance Skills-the ability to assume responsibility for the quality of manufacturing products.

- Basic Computer Skills-the ability to work in DOS, Windows and/or MacIntosh operating environments.
- Advanced Computer Skills-familiarity with specific software, e.g., WordPerfect, Lotus 1-2-3.

Employability Skills:

- Decision-making Skills-the ability to make effective choice when presented with alternatives.
- Problem-solving Skills-the ability to identify, analyze and solve a problem situation.
- Creative Thinking Skills-the ability to use different modes of thought to generate new ideas.
- Teamwork Skills-the ability to work cooperatively with a variety of individuals in a job setting.
- Leadership Skills-the ability to guide others in the completion of work-related tasks.
- Negotiation Skills-the ability to work with other individuals to resolve a work-related conflict.
- Self-management skills-the ability to set and achieve personal performance goals. (Zirkle, 1998, n.p.)

As mentioned in chapter one, technology education instructors at Stoughton High School have the opportunity to address and reinforce employability skills in the classroom. As stated before, these four skill areas are: responsibility-(being on time, no absences or at least only a few, and following class and shop policies), organization-

(keeping accurate records, plans, or journal, keeping project pieces in assigned storage area, cleaning up work area, working in an orderly fashion), motivation-(eager to work, finding a job to do rather than waiting to be told, willing to learn new procedures), and compatibility-(getting along and working well with others, treating others and their work respectfully, avoid confrontational situations, personable and friendly). These skills afford the instructor an opportunity to incorporate the skills into the evaluation of student performance for grading purposes. Parents are also interested in knowing how their child is doing in class situations in regard to these aforementioned skills.

Pucel (1992a; 1992b) advanced ten categories of technology education curricular content which include, technological method; common tool usage; common equipment usage; basic technological process; materials; terminology; environmental concerns; social values; scientific principles; and economic factors.

According to Pucel, the first six categories should be the focus of technology education programs, while the latter four categories should be taught in the other areas of the school curriculum (1995, p.62). Much is written about what should be taught in technology education at the high school level. But if any program is going to be successful, a connection has to be made between the school and the institution and the places that hire the students who come out of programs of study. The following is a list of technology education competencies as generated by Pucel's (1992a; 1992b) ten categories of technology education and Gregson's (1991) listing of important work values and attitudes as identified by trade industrial education instructors as valuable competencies for technology education students entering trade and industry programs:

- Being dependable/punctual

- Ability to follow directions
- Showing pride in workmanship
- Being conscientious/honest
- Cooperating with others
- Exhibiting a safety attitude
- Ability to measure
- Identification of common hand tools
- Utilize common hand tools
- Showing concern for the environment
- Knowledge of technical terms
- Operate common equipment
- Knowledge of basic processes
- Identification of common equipment
- Knowledge of basic materials
- Ability to perform basic processes
- Apply scientific principles
- Knowledge of computer applications
- Interpretation of drafting drawings
- Knowledge of scientific principles
- Knowledge of future technologies
- Utilize basic materials
- Knowledge of economic factors
- Construct drafting drawings

- Knowledge of hydraulics/pneumatics
- Knowledge of high-tech applications
- Knowledge of the invention process
- Ability to perform desktop publishing. (Rogers, 1995, p. 65-66)

Students who choose to enter the workforce immediately after high school, instead of going on to further education, need necessary skills to satisfy the entry level positions that are available. The need arises for a technology education curriculum that is broad enough in its delivery that it can cover or address the many skills that are needed in the world of work.

CHAPTER 3

Methodology

Introduction

Research is needed to maintain or improve the quality and/or content of instruction that is given to students in the entry level metals manufacturing classes at Stoughton High School. This chapter describes the selection of subjects, who they are, and where they are from.

As indicated earlier the purpose of the study was to determine if the graduates of Stoughton High School meet the needs of job-entry competencies for metal manufacturing businesses and industries in Stoughton. The objectives of the study were:

1. To determine entry-level jobs/occupations of metal manufacturing employers in Stoughton.
2. To determine what entry-level competencies metals manufacturing employers are looking for and which are more important than others.
3. To determine if there is a need to maintain or improve the quality and/or content of instruction in the entry level metals manufacturing classes at Stoughton High School as compared to the results of this study.

Subject Selection and Description

The subjects consist of 24 (twenty-four) heads of personnel at metal manufacturing related businesses and industries in the city of Stoughton. The list of subjects was obtained by a listing in an on-line yellow pages directory. The list of contact persons represents a cross section of the metal manufacturing sector. The companies

ranged from small welding businesses to large metal manufacturing companies that produce semi trailers and structural components for commercial buildings.

Instrumentation

The instrument used in this study was designed to prioritize specific job-entry competencies at local employers. The survey that each subject completed consisted of a five page document. The first page was a letter that introduced the researcher and explained the purpose of the research study and the benefits it could have on future employees. On page two a space was provided for the respondent to list entry level occupations that are available for high school graduates and a list of fifteen personal characteristics that entry level employees may need to possess. Page three included fifteen metalworking techniques that entry level employees may need to possess. Pages four and five listed twenty-five metalworking processes or skills that entry level employees may need to possess. Employer were asked to list the entry level occupations that are available and rank the importance of each personal characteristic, metalworking technique, and metalworking process or skill for an entry level employee on a scale from one to five, five being the highest. A copy is included in Appendix A.

The statements on the survey were generated from information obtained from the review of literature. The personal characteristics and metal techniques were modified from similar studies done by Zirkle, C. (1998) and De Leon, J. E., & Borchers, R. E. (1998). The twenty five metalworking processes or skills were modified from metalworking occupations found in the Occupations Handbook (1999).

Data Collection

A phone call was made to each company to introduce the researcher, inform them about the survey that was being sent out within the month, and find out to whom specifically it should be addressed. The instrument was mailed to each contact person with a self-addressed stamped envelope in the March of 2003. Information was provided explaining the purpose of the study and all instructions for the completion of the questionnaire. Their participation was completely voluntary and all information collected was kept strictly confidential. The companies were asked to return the questionnaire within five days. The researcher also stated that the companies would not be identified or contacted throughout the length of the study.

Data analysis

There are three research objectives that are at the core of this study. The first objective was to identify the entry-level metal manufacturing jobs/occupations available to high school graduates in Stoughton. When this information was received it was listed in alphabetical order under the heading of "Entry-level metals manufacturing jobs/occupations." A list of the jobs/occupations is provided in Table 1.

The second research objective was to identify the common entry-level skills/competencies that metals manufacturing employers look for. When this data was received, it was tallied and analyzed by recording the level of importance placed on each of the fifteen personal characteristics, fifteen metalworking techniques, and twenty five metalworking processes or skills. The ranking of each individual statement was then summed and averaged by calculating the mean.

The third objective was to compare the current metals manufacturing curriculum with the results of this study. The information obtained from the employers in research objective two was compared to the actual material being taught, to determine the differences between the two. A comparison is provided in Table 5.

CHAPTER 4

Analysis of Findings

Introduction

The purpose of this study was to determine the level of importance metal manufacturing employers in Stoughton placed on entry-level personal characteristics, metalworking techniques and metalworking processes and skills. It also set out to identify jobs/occupations available at the entry level in the metal manufacturing field. Finally, it sought to compare the current metals manufacturing curriculum at Stoughton High School to the results of this study.

Objective One

The first research objective was to identify entry-level metal manufacturing jobs/occupations available in Stoughton. The survey (Appendix A) provided employers with an area to list any entry-level positions that are available with their firm. Twenty four surveys were sent metals manufacturing businesses and industries in Stoughton and ten were returned and tabulated (Table 1-4). From the ten respondents, a list of eighteen entry-level positions was created. See Table 1.

Table 1

List of Entry Level Positions by Respondent

Respondent	Entry Level Positions
1	Welding, Machine Operators, Grinders
2	Assemblers, Welder
3	Laborer
4	HVAC Service Technician & Installer
5	Sandblasting, Painting, Mig Welding
6	Laborer, Apprentice
7	Machine Operator, Machine Assembly, Printed Circuit Board Assembly
8	Majority of Manufacturing Positions
9	HVAC Tech, Sheet Metal Worker
10	General Auto Body Repair, Painters Helper

Objective Two

The second objective was to determine the level of importance that metal manufacturing employers in Stoughton placed on ten entry-level personal characteristic, ten metalworking techniques and twenty-five metalworking processes or skills. The survey (Appendix A) provided employers with a list of ten personal characteristics, ten metalworking techniques, and twenty-five metalworking processes or skills. The employer was asked to circle the number (1-5) that related to the relative importance that

they placed on the individual item (one being less important and five being most important). The results of survey were measured by adding the score of each individual item and dividing by the number of surveys returned (10). As an example, if an item on the survey was scored with a (3) from each respondent, then the average or mean for that item would be (3).

Metals manufacturing employers in Stoughton indicated that some entry-level personal characteristics are more important than others. As the table below demonstrates, the top five average scores for personal characteristics are the ability to follow directions, ability to work cooperatively with a variety of individuals, ability to work well with supervisors, ability to perform addition, subtraction, multiplication and division, and ability to identify, analyze and solve a problem situation. See Table 2.

Table 2

Mean Scores for Personal Characteristics

Characteristic	Total Score	Mean Score
Ability to comprehend printed materials	40	4.0
Ability to interpret, apply and transmit information in writing	30	3.0
Ability to listen and speak in an effective manner	41	4.1
Ability to follow directions	49	4.9
Ability to identify, analyze and solve a problem situation	43	4.3
Ability to make an effective choice when presented with alternatives	42	4.2
Ability to use different modes of thought to generate new ideas	34	3.4
Ability to work cooperatively with a variety of individuals	48	4.8
Ability to guide others in the completion of work related tasks	31	3.1
Ability to work with other individuals to resolve a conflict	42	4.2
Ability to set and achieve personal goals	38	3.8
Ability to perform addition, subtraction, multiplication and division	46	4.6
Ability to perform algebra, geometry and trigonometry	37	3.7
Ability to work well with supervisors	47	4.7
Ability to motivate others	35	3.5

Metals manufacturing employers also indicated which metalworking technique was more important than others. The ability to conduct oneself in a safe manner in the

workplace, ability to measure, ability to utilize hand tools specific to a job, ability to assemble equipment following written directions, and ability to assume responsibility for the quality of manufactured products were the top five average scores for metalworking techniques. See Table 3.

Table 3

Mean Scores for Metalworking Techniques

Metalworking Technique	Total score	Mean Score
Ability to measure (English)	46	4.6
Ability to measure (Metric)	30	3.0
Ability to conduct oneself in a safe manner in the workplace	47	4.7
Ability to utilize hand tools specific to a job	46	4.6
Ability to operate equipment that manufactures a product	34	3.4
Ability to setup and operate equipment that manufactures a product	31	3.1
Ability to comprehend written manuals, procedure sheets, etc.	39	3.9
Ability to transmit trade-specific information through written materials	31	3.1
Ability to create and perform related trade-specific mathematical operations	38	3.8
Ability to create illustrations related to trade-specific tasks	31	3.1
Ability to assume responsibility for the quality of manufactured products	40	4.0
Ability to work in DOS, Windows and/or MacIntosh operating environments	22	2.2
Familiarity with specific software, e.g., Microsoft Word and Excel	20	2.0
Ability to assemble equipment following written directions	44	4.4
Ability to operate computer-aided drafting	17	1.7

Metal manufacturing employers also indicated which metalworking processes or skills they felt were more important than others. Of the twenty-five processes or skills, ten distinguish themselves from the rest as being most important. The items, work with their hands to make or process products; lay out parts, line up edges, and fit parts together; make, install and repair sheet metal products; operate gas metal arc welding and cutting equipment; cut and thread pipes with a pipe-threading machine; prepare metal parts for welding and riveting; operate oxy-fuel gas welding and cutting equipment; operate gas tungsten arc welding and cutting equipment; operate torch soldering equipment; and set up, adjust and operate machines that grind machine parts, tools and dies top the list of being the processes or skills that Stoughton businesses and industry deem most important. See Table 4.

Table 4

Mean Scores for Metalworking Processes or Skills

Metalworking Processes or Skills	Total Score	Mean Score
Operate flux cored arc welding equipment	16	1.6
Operate forge welding equipment	10	1.0
Operate torch soldering equipment	27	2.7
Operate resistance spot welding equipment	18	1.8
Operate oxy-fuel gas welding and cutting equipment	29	2.9
Operate gas metal arc welding and cutting equipment	31	3.1
Operate gas tungsten arc welding and cutting equipment	29	2.9
Operate plasma arc welding and cutting equipment	23	2.3
Operate shielded metal arc welding and cutting equipment	24	2.4
Operate submerged arc welding equipment	14	1.4
Operate laser beam welding equipment	10	1.0
Write computer programs that instruct machine tools how to make metal or plastic parts	13	1.3
Operate air carbon arc cutting equipment	18	1.8
Install, repair, and service industrial machinery	22	2.2
Put together and install, metal components or ornaments in buildings	20	2.0
Set up and operate machine tools that are controlled by computer programs	16	1.6
Make, install and repair sheet metal products	41	4.1
Cut and thread pipes with a pipe-threading machine	30	3.0

Set up, adjust and operate machines that grind machine parts, tools and dies	26	2.6
Work on machines such as lathes, shapers, milling and boring machines	20	2.0
Prepare structural metal parts for welding and riveting	29	2.9
Produce tools, molds and special guiding and holding devices used to manufacture metal parts	19	1.9
Lay out parts, line up edges, and fit parts together	42	4.2
Set up and operate machines that mold, cast, plate, or heat metals and plastics	15	1.5
Work with their hands to make or process products	47	4.7

Objective Three

The third research object was to compare the current metals manufacturing curriculum with the results of the study. The information obtained from the employers in research objective two was compared to the course content of metals manufacturing at Stoughton High School, to determine the differences between the two. A review of course objectives provided the data used to compare what is being taught and reinforced to the results of the study. See Table 5 and Table 6 in Appendix A.

Table 5

Personal Characteristic, Metalworking Techniques and Processes or Skills Currently Being Taught

Descriptor	Metal Manufacturing Curriculum
Personal Characteristic (Top 5)	
1. Ability to follow directions (4.9)	X
2. Ability to work cooperatively with a variety of individuals (4.8)	X
3. Ability to work well with supervisors (4.7)	X
4. Ability to perform addition, subtraction, multiplication and division (4.6)	X
5. Ability to identify, analyze and solve a problem situation (4.3)	X
Metalworking Technique (Top 5)	
1. Ability to conduct oneself in a safe manner in the workplace (4.7)	X
2. Ability to measure (English) (4.6)	X
3. Ability to utilize hand tools specific to a job (4.6)	X
4. Ability to assemble equipment following written directions (4.4)	X
5. Ability to assume responsibility for the quality of manufactured products (4.0)	X

Metalworking Processes or Skills (Top 10)	
1. Work with their hands to make or process products (4.7)	X
2. Lay out parts, line up edges, and fit parts together (4.2)	X
3. Make, install and repair sheet metal products (4.1)	X
4. Operate gas metal arc welding and cutting equipment (3.1)	X
5. Cut and thread pipes with a pipe-threading machine (3.0)	Not at this time
6. Operate gas tungsten arc welding and cutting equipment (2.9)	X
7. Operate oxy-fuel gas welding and cutting equipment (2.9)	X
8. Prepare structural metal parts for welding and riveting (2.9)	X
9. Operate torch soldering equipment (2.7)	X
10. Set up, adjust and operate machines that grind machine parts, tools and dies (2.6)	Not at this time

At this time the metals manufacturing program matches up rather well with the priorities of local businesses and industries. With the exception of two items, cut and thread pipes with a pipe-threading machine and set up, adjust and operate machines that grind machine parts, tools and dies. It is clear that work needs to be done to incorporate activities that enable students to engage in activities related to these areas.

CHAPTER 5

Summary, Conclusions, and Recommendations

Introduction

This chapter summarizes the study and its impact on those involved. It provides conclusions about the data that was collected and provides recommendations based on those conclusions. Recommendations for future research on this topic will also be suggested.

Summary

The purpose of the study was to determine if the current curricular content of the metals manufacturing course reflects the entry-level needs of local businesses and industry in the city of Stoughton. This information will be used to maintain or improve the present and/or future metals manufacturing curriculum. The first objective of this study was to create a list of entry-level occupations/jobs that are available at Stoughton area businesses and industry. This list can be shared with students in the metals manufacturing classes as to what is available out of high school in the area of employment. The second objective of this study was to identify the common entry-level skills/competencies that metals manufacturing employers are looking for. A review of literature indicated that entry-level competencies can be broken down into three categories: Personal Characteristics, Metalworking Techniques and Metalworking Processes or Skills. These competencies, in three separate lists form the survey, which was mailed to twenty-four metals manufacturing employers in the city of Stoughton. The employers were asked to rank the level of importance for each competency on a scale of one to five. The third objective was to compare the current metals manufacturing

curriculum to the results of the second research objective. This was accomplished by comparing the metals manufacturing objectives with the survey results.

The result of the survey from objective one is that there are opportunities for employment in the metals manufacturing sector in the city of Stoughton. This can be shared with students at Stoughton High School.

The results of objective two indicate that employers place a high value on specific personal characteristics, metalworking techniques and metalworking processes or skills. They also place lower values on these characteristics, techniques and processes or skills.

The results of objective three indicate that the current curriculum meets the needs of local metalworking businesses and industries. The processes or skills that did not match with the current curriculum could very easily be addressed in the future.

Conclusions and Recommendations

Research objective number one was to determine what entry-level occupations are available at metals manufacturing businesses and industries in Stoughton The conclusion, based on the data, is that there are occupations/jobs available for graduates of Stoughton High School. Based on this conclusion, it is recommended that students be informed of the opportunities that are available in the Stoughton area.

Research objective number two was to identify the common entry-level skills/competencies that metals manufacturing employers are looking for in the city of Stoughton. The employers ranked these skills/competencies to determine the level of importance of each item. Based on the data it is concluded that local metals manufacturing employers place more emphasis on certain personal characteristics, metalworking techniques and metalworking processes or skills. The personal

characteristics they ranked most important were: ability to follow directions; ability to work cooperatively with a variety of individuals; ability to work well with supervisors; ability to perform addition, subtraction, multiplication and division; and ability to identify, analyze and solve a problem situation. The metalworking techniques they ranked most important were: ability to conduct oneself in a safe manner in the workplace; ability to measure (English); ability to utilize hand tools specific to a job; ability to assemble equipment following written directions and ability to assume responsibility for the quality of manufactured products. The metalworking processes or skills they ranked most important were: work with their hands to make or process products; lay out parts, line up edges and fit parts together; make, install and repair sheet metal products; operate gas metal arc welding and cutting equipment; cut and thread pipes with a pipe-threading machine; operate oxy-fuel gas welding and cutting equipment; operate gas tungsten arc welding and cutting equipment; prepare structural metal parts for welding and riveting; operate torch soldering equipment and set up, adjust and operate machines that grind machine parts, tools and dies. Based on these conclusions objective number three will be addressed.

Research objective number three was to compare the current metals manufacturing curriculum to the results of research objective two.

Based on these conclusions the current metals manufacturing curriculum for the most part meets the needs of area metals manufacturing businesses and industries. Improvements do need to be made in the area of machine tool and pipe threads.

More information and dialog is needed between local business and industry in order to establish activities that have a direct or close relationship with skills or competencies that are required in this area.

Recommendations for Future Research

This study has provided the researcher with information that can help improve the metals manufacturing curriculum at Stoughton High School. The information gathered is considered critical in understanding the needs of local metalworking businesses and industry. This study is by no means comprehensive or inclusive. The information only relates to metals manufacturing in Stoughton. Similar studies could be conducted in other locations and on other areas of Technology Education. For example, transportation, construction, communication and even other specitic areas of manufacturing could be researched. It is only through this type of research that technology education in local districts can stay current with businesses and industries.

REFERENCES

Alamaki, A. (1999). Technology education in the Finnish primary schools. *Journal of Technology Education, 11*(1) n.p.

Blueprint for high performance. A SCANS Report for America(2000).The Secretary's Commission on achieving necessary skills. Washington, DC: Government Printing Office.

Bjorklund, L. (1988). Interpretation of industry approach. In W. Kemp & A. Schwaller (Eds.), *Instructional strategies for technology education,* (p. 26). Mission Hills, CA: Glencoe.

Bottoms, G. (1993). *Redesigning and refocusing high school vocational studies: Blending academic and vocational education, connecting the school site to the worksite, and linking secondary and postsecondary education.* Atlanta, GA: Southern Regional Education Board.

Branford, J., Sherwood, R., Hasselbring, T., Kinzer, C., & Williams, S. (1990). Anchored instruction: Why we need it and how technology can help. In D. Nix, & R. Spiro (Eds.), *Cognition, education, & multimedia: Exploring ideas in high technology,* (pp. 163-205). Hillsdale, NJ: Lawrence Erlbaum Associates.

Carr, J.F., & Harris, D.E. (2001). *Succeeding with standards: Linking curriculum, assessment, and action planning.* Alexandria, VA: Association for Supervision and Curriculum Development.

Clark, C., & Wenig, R. (1999). Identification of quality characteristics for technology education programs: A North Carolina case study. *Journal of Technology Education, 11*(1), n.p.

De Leon, J. E., & Borchers, R. E. (1998). High school graduate employment trends and the skills graduates need to enter Texas manufacturing industries. *Journal of Vocational and Technical Education, 15* (1), n.p.

Dugger, W.E., Bame, E. A., & Pinder, C.A. (1985). *Standards for technology education programs*. South Holland, IL: Goodheart-Wilcox.

Dykman, A. (1996). *Powerful partnerships: For school to careers success through business and education cooperation*. Alexandria, VA: American Vocational Association.

Dyrenfurth, M., & Kozak, M. (Eds.). (1991). *Technological literacy. 40th yearbook. Council on technology teacher education.* Peoria, Il: Macmillian.

Foriska, T. (1998) *Restructuring around standards: A practitioner's guide to design and implementation.* Thousand Oaks, CA: Corwin Press, Inc.

Frey, R.E. (1989). A philosophical framework for understanding technology. *Journal of Industrial Teacher Education, 27* (1), 23-35.

Gregson, J. A. (1991). Work values and attitudes instruction as viewed by secondary trade and industrial education instructors. *Journal of Industrial Teacher Education, 28* (4), 34-51

Grubb, W.N. (1997). Not there yet: Prospects and problems for "education through occupations". *Journal of Vocational Education Research*, *22*(2) 77-94

Harvey, M.W., & Cohen, L.G. (1989). *An investigation of employers and educators perceptions of entry-level worker skills and employment characteristics*: Implications for programming. Paper presented at the Annual Conference of the

New England Educational Research Organization, Portsmouth, NH. (ERIC Document Reproduction Service No. 323 386)[ed or ej]

Hassan, S.S. (1985). *Education for high-technology jobs* (ERIC Digest No. 37). Retrieved June 19, 2002 from: http://www.ebsco.com

Herschbach, D.R. (1995). Technology as knowledge: Implications for instruction. *Journal of Technology Education, 7*(1) 31-42

Koffel, L. (1994). *Teaching workplace skills: Creative ways to teach students the skills employers want.* Houston, TX: Gulf Publishing Co.

Merriam-Webster's collegiate dictionary (10th ed.). (1993). Springfield, MA: Merriam-Webster.

McCauley, C.A. (2000). *Forming Hartford Union High School's welding curriculum to meet local industries' needs.* Unpublished masters thesis, University of Wisconsin-Stout, Menomonie.

Mitcham, C. (1994). *Thinking through technology. The path between engineering and philosophy*. Chicago, IL: The University of Chicago Press.

National Academy of Sciences. (1984). *High schools and the changing workplace: The employers view.* Washington, DC: National Academy Press.

Pautler, A. (1999). *Workforce education: Issues for the new century.* Ann Arbor, MI: Prakken Publications, Inc.

Petrina, S. (1998). Multidisciplinary technology education. *International Journal of Technology and Design Education*, *8*(2),103-138.

Postman, N. (1992). *Technopoly.* New York: Vintage.

Pucel, D. J. (1992a). *Technology education: A critical literacy requirement for all students.* Paper presented at the meeting of the Mississippi Valley Industrial Teacher Education Association, Chicago, IL. (ERIC Document Reproduction Service No. 353 399)

Pucel, D.J. (1992b). *Technology education: Its changing role within general education.* Paper presented at the meeting of the American Vocational Association, St. Louis, MO (ERIC DocumentReproduction Service No ED 353 400)

Rogers, G. E. (1995). Technology education curricular content: A trade and industrial perspective. *Journal of Industrial Teacher Education, 32* (3), 59-74.

Secretary's Commission on Achieving Necessary Skills. (1991).*What work requires of schools: A SCANS report for America 2000.* Washington, DC: United States Department of Labor.

Stern, D., Raby, M., & Dayton, C. (1992) *Career academics, partnerships for reconstructing American high schools.* San Francisco, CA: Jossey-Bass Publishers.

Sterry, L., & Hendricks, R. (1999). *Exploring technology.* Menomonie, WI: T & E Publications.

Thompson, J. S. (2000). *The employability of recent Rice Lake high school graduates with major Rice Lake area employers.* Unpublished masters thesis, University of Wisconsin-Stout, Menomonie.

Thompson, S. R. (2001). *The five most important entry-level employability skills employers of the Chippewa valley seek in entry-level job applicants.* Unpublished masters thesis, University of Wisconsin-Stout, Menomonie.

U.S. Department of Labor. (1981). *U.S. Employment service, Selected characteristics of occupations defined in the Dictionary of occupational titles.* Washington, DC: U.S. Government Printing Office.

Wright, R.T. (1992). Building a defensible curriculum base. *Journal of Technology Education, 3*(2), 67-72.

Wicklein, R. (1997). Curriculum focus for technology education. *Journal of Technology Education, 8*(2), 73-80.

Wisconsin Department of Public Instruction. (1998). *Wisconsin's model academic standards for technology education.* Milwaukee, WI: Author.

Zirkle, C. (1998). Perceptions of vocational educators and human resource/training and development professionals regarding skill dimensions of school-to-work transition programs. *Journal of Vocational and Technical Education, 15* (1), n.p.

Zuga, K. F. (1989). Relating technology education goals to curriculum planning. *Journal of Technology Education, 1*(1), 34-58.

APPENDIX A

Instrument

From: Douglas Giese
319 East Washington Street
Stoughton WI 53589
(608) 873-4905

To: Metalworking Employer/Director of Human Resources
Selected Employers of Stoughton

Dear Metalworking Employer:

My name is Douglas Giese and I am a Technology Education instructor at Stoughton High School. I am currently pursuing a Masters Degree from the University of Wisconsin-Stout. I am contacting you in hopes that you can assist me with my thesis project.

My thesis topic investigates the importance of personal characteristics, metalworking techniques, and welding processes. By contacting metalworking employers in the Stoughton area, I hope to determine what entry level jobs/occupations are available and which metalworking techniques and welding processes are most important in hiring entry level employees.

I believe that this is an important study because it will provide valuable information that will be useful to employers and educators. With your help, I will be able to make informed decisions about curriculum changes and improvements. These modifications can only help to improve the level of preparation that future employees possess as they enter the work force.

I am enclosing a self-addressed, stamped envelope in which you can return the survey. It is designed so that it should only take a few minutes to complete, as I realize your time is very valuable. If you have any questions feel free to contact me at the phone number listed above.

Your participation in this survey is voluntary and all responses will be kept strictly confidential. Please complete the survey within two weeks, and thank you in advance for your timeliness and help.

Sincerely,

Douglas J. Giese

Please list the entry level occupations that are in your company for which a high school graduate would be able to apply.

_____

_____

_____

Listed below are 15 personal characteristics that entry level employees may need to possess. Please circle the number that relates to how important the characteristic is to your company.

Level of importance
Most---------Least

5 4 3 2 1	**A**) Ability to comprehend printed materials
5 4 3 2 1	**B**) Ability to interpret, apply and transmit information in writing
5 4 3 2 1	**C**) Ability to listen and speak in an effective manner
5 4 3 2 1	**D**) Ability to follow directions
5 4 3 2 1	**E**) Ability to identify, analyze and solve a problem situation
5 4 3 2 1	**F**) Ability to make an effective choice when presented with alternatives
5 4 3 2 1	**G**) Ability to use different modes of thought to generate new ideas
5 4 3 2 1	**H**) Ability to work cooperatively with a variety of individuals
5 4 3 2 1	**I**) Ability to guide others in the completion of work related tasks
5 4 3 2 1	**J**) Ability to work with other individuals to resolve a conflict
5 4 3 2 1	**K**) Ability to set and achieve personal goals
5 4 3 2 1	**L**) Ability to perform addition, subtraction, multiplication and division
5 4 3 2 1	**M**) Ability to perform algebra, geometry and trigonometry
5 4 3 2 1	**N**) Ability to work well with supervisors
5 4 3 2 1	**O**) Ability to motivate others

Listed below are 15 metal working techniques that entry level employees may need to possess. Please circle the number that relates to how important the skill is to your company.

Level of importance
Most---------Least

5 4 3 2 1	**A**) Ability to measure (English)
5 4 3 2 1	**B**) Ability to measure (Metric)
5 4 3 2 1	**C**) Ability to conduct oneself in a safe manner in the workplace
5 4 3 2 1	**D**) Ability to utilize hand tools specific to a job
5 4 3 2 1	**E**) Ability to operate equipment that manufactures a product
5 4 3 2 1	**F**) Ability to setup and operate equipment that manufactures a product
5 4 3 2 1	**G**) Ability to comprehend written manuals, procedure sheets, etc.
5 4 3 2 1	**H**) Ability to transmit trade-specific information through written materials
5 4 3 2 1	**I**) Ability to create perform related trade-specific mathematical operations
5 4 3 2 1	**J**) Ability to create illustrations related to trade-specific tasks
5 4 3 2 1	**K**) Ability to assume responsibility for the quality of manufactured products
5 4 3 2 1	**L**) Ability to work in DOS, Windows and/or MacIntosh operating environments
5 4 3 2 1	**M**) Familiarity with specific software, e.g., Microsoft Word and Excel
5 4 3 2 1	**N**) Ability to assemble equipment following written directions
5 4 3 2 1	**O**) Ability to operate computer-aided drafting

Listed below are 25 metal working processes or skills that entry level employees may need to possess. Please circle the number that relates to how important the processes and skills are to your company.

Level of importance
Most---------Least

5 4 3 2 1	**A**) Operate flux cored arc welding equipment
5 4 3 2 1	B) Operate forge welding equipment
5 4 3 2 1	**C**) Operate torch soldering equipment
5 4 3 2 1	**D**) Operate resistance spot welding equipment
5 4 3 2 1	**E**) Operate oxy-fuel gas welding and cutting equipment
5 4 3 2 1	**F**) Operate gas metal arc welding and cutting equipment
5 4 3 2 1	**G**) Operate gas tungsten arc welding and cutting equipment
5 4 3 2 1	**H**) Operate plasma arc welding and cutting equipment
5 4 3 2 1	**I**) Operate shielded metal arc welding and cutting equipment
5 4 3 2 1	**J**) Operate submerged arc welding equipment
5 4 3 2 1	**K**) Operate laser beam welding equipment
5 4 3 2 1	**L**) Write computer programs that instruct machine tools how to make metal or plastic parts
5 4 3 2 1	**M**) Operate air carbon arc cutting equipment
5 4 3 2 1	**N**) Install, repair, and service industrial machinery
5 4 3 2 1	**O**) Put together and install, metal components or ornaments in buildings.
5 4 3 2 1	**P**) Set up and operate machine tools that are controlled by computer programs
5 4 3 2 1	**Q**) Make, install and repair sheet metal products
5 4 3 2 1	**R**) Cut and thread pipes with a pipe-threading machine

Level of importance
Most---------Least

5	4	3	2	1	**S**) Set up, adjust and operate machines that grind machine parts, tools and dies
5	4	3	2	1	**T**) Work on machines such as lathes, shapers, milling and boring machines
5	4	3	2	1	**U**) Prepare structural metal parts for welding and riveting
5	4	3	2	1	**V**) Produce tools, molds and special guiding and holding devices used to manufacture metal parts.
5	4	3	2	1	**W**) Lay out parts, line up edges, and fit parts together
5	4	3	2	1	**X**) Set up and operate machines that mold, cast, plate, or heat metals and plastics
5	4	3	2	1	**Y**) Work with their hands to make or process products

Thank you very much for completing this survey! Your time is greatly appreciated. Please return the survey to me in the enclosed envelope.

I understand that by returning the survey, I am giving my informed consent as a participating volunteer in this study. I understand the basic nature of the study and agree that any potential risks are exceedingly small. I also understand the potential benefits that might be realized from the successful completion of this study, I am aware that the information is being sought in a specific manner so that only minimal identifiers are necessary and so that confidentiality is guaranteed. I realize that I have the right to refuse to participate and that my right to withdraw from participation at any time during the study will be respected with no coercion or prejudice.

Note: Questions or concerns about the research study should be sent to Douglas Giese, the researcher, at (608) 877-5782, OR Michael Galloy, Research advisor, at (715) 232-2163. Questions about the rights of research subjects can be addressed to Sue Foxwell, Human Protections Administrator, UW-Stout Institutional Review Board for the Protection of Human Subjects in Research, 11 Harvey Hall, Menomonie, WI, 54751, phone (715) 232-1126.

Table 6

Stoughton High School Metals Manufacturing Course Objectives

Personal Characteristics

A) Maintains consistent attendance.

B) Maintains punctuality.

C) Effectively interacts with others.

D) Possesses the ability and willingness to follow directions.

E) Demonstrates personal motivation and positive attitude.

F) Exhibits good listening skills.

G) Illustrates effective communication skills.

H) Demonstrates effective use of technology skills.

I) Demonstrates effective mathematic skills.

J) Possesses basic computer skills.

Metal working Techniques

A) Demonstrates the use of required eye protection for the welding shop.

B) Demonstrates the use of proper dress.

C) Demonstrates the use of proper ear protection.

D) Demonstrates proper bench/hand grinder, drill press, band/chop saw safety.

E) Demonstrates how to measure with a steel rule.

F) Demonstrates how to measure with a micrometer. English, metric and thread pitch.

G) Demonstrates how to measure with a dial caliper.

H) Demonstrates how to sharpen a general purpose drill bit.

I) Demonstrates how to lay out projects to a desired specification.

J) Demonstrates the safe use of hand and power equipment.

Metalworking Processes or Skills

Oxy-Fuel processes:

A) Identify oxy-fuel principles, safety guidelines, terms and limitations, advantages, and applications.

B) Perform flat position welds.

C) Perform oxy-fuel hand cutting and beveling.

Shielded Metal Arc Welding theory and positions:

D) Identify SMAW principles, safety guidelines, terms, limitations, advantages, and applications.

E) Identify and apply AWS joint designs, weld procedures, discontinuities and defects.

F) Demonstrate the knowledge and safe use of basic electricity as applied to welding.

G) Perform flat position welds on the five basic weld joints.

H) Demonstrate the ability to weld in the incline and vertical positions.

Gas Metal Arc Welding Theory and Positions:

I) Identify GMAW principles, safety guidelines, terms, limitations, advantages, and applications.

J) Demonstrate the knowledge and safe use of GMA equipment, electrodes and essential variables.

K) Perform flat position welds on the five basic joints.

L) Perform vertical down fillet welds.

Gas Tungsten Arc Welding Theory and Positions:

M) Demonstrate the knowledge, safe use and proper set up of equipment, electrodes and essential variables.

N) Perform flat position welds with and without filler metal.

Plasma Arc Cutting Theory and Practice:

O) Identify plasma arc cutting principles, safety guidelines, terms, limitations, advantages, and applications.

P) Perform manual cutting freehand and with the aid of a fence.

Resistance Welding Theory and Practice:

Q) Identify resistance welding principles, safety guidelines, terms, limitations, advantages, and applications.

R) Demonstrate proper set up and use of spot welding equipment.

Soldering Theory and Practice:

S) Identify soldering welding principles, safety guidelines, terms, limitations, advantages, and applications.

T) Demonstrate the knowledge and safe use and proper set up of equipment and materials.