# IDENTIFYING PROJECTS FOR A MANUFACTURING CLASS ATTENTIVE TO ALL STUDENTS AT GRAFTON HIGH SCHOOL

by

Michael J. Dodge

A Research Paper
Submitted in Partial Fulfillment of the
Requirements for the
Master of Science Degree
in

Industrial/Technology Education

Approved: 2 Semester Credits

Dr. Kenneth Welty

The Graduate School

University of Wisconsin-Stout

August, 2006

**The Graduate School**
**University of Wisconsin-Stout**
**Menomonie, WI**

**Author:** **Dodge, Michael J.**

**Title:** ***Identifying projects for a Manufacturing Class Attentive to All Students at Grafton High School***

**Graduate Degree/ Major: MS Industrial Technology Education**

**Research Adviser:** **Kenneth Welty, Ph.D.**

**Month/Year:** **August, 2006**

**Number of Pages:** **86**

**Style Manual Used:** **American Psychological Association, 5th edition**

ABSTRACT

Manufacturing classes at Grafton High School utilizes projects to teach craftsmanship and skills. To increase enrollment, this study examined factors that would make selected projects (i.e., key ring, desk set, yard sign) more attractive to a larger population of students.

Three hundred and fifty one male and female students completed a survey that asked them to select features that would make illustrated projects more attractive. The results of the study suggested student preferences depended on the project in question. In every case, a majority of the respondents indicated a preference toward making projects that allowed them to add a personal touch. With some projects, but not all, a majority of the respondents indicated a desire to work alone, fulfill a course requirement, solve a problem, and make something that can be given as a gift. The idea of following a set of plans or developing skills received far less support.

These findings suggest projects need to be vehicles for personal expression by accommodating the students' desires to make something that reflects their own work and includes a unique contribution to its design. Therefore, projects need to account for affective considerations as well as cognitive and psychomotor development.

The Graduate School

University of Wisconsin-Stout

Menomonie, WI

## Acknowledgements

The author would like to express his sincere gratitude to his wife, family, and friends that supported him during this project. He would also like to acknowledge Dr. Kenneth Welty for providing the challenges needed to expand his knowledge of the science that will inform his teaching. Lastly, the author would like to express his appreciation to the faculty and students of Grafton High School for their participation in this study.

TABLE OF CONTENTS

Page

ABSTRACT ii

List of Tables vi

Chapter I: Introduction 1

*Statement of the Problem* 2

*Purpose of the Study* 2

*Research Questions* 2

*Definition of Terms* 3

Chapter II: Literature Review 4

Chapter III: Methodology 11

*Purpose of the Study* 11

*Research Design* 11

*Subject Selection and Description* 11

*Instrumentation* 12

*Data Collection* 13

*Data Analysis* 14

Chapter IV: Results 15

*Purpose of the Study* 15

*Rate of Response* 15

*Demographics* 15

Chapter V: Discussion ..... 36

*Introduction* ..... 36

*Problem Statement* ..... 36

*Methodology* ..... 37

*Findings* ..... 38

*Conclusions* ..... 40

*Recommendations* ..... 41

References ..... 43

Bibliography ..... 44

Appendix A: Student Survey ..... 49

Appendix B: Letter of Consent ..... 52

Appendix C: PowerPoint Presentation ..... 55

List of Tables

Table 1: Sample Demographics ..... 16

Table 2: Enrolled in Tech Ed Versus Not Enrolled in Tech Ed ..... 16

Table 3: Enrolled in Researchers class Versus Not Enrolled in Tech Ed ..... 17

Table 4: Enrolled in Researchers class Versus Enrolled in other Tech Ed ..... 18

Table 5: Total in Researchers Classes Versus Total in other Tech Ed ..... 18

Table 6: Key Ring Project: Together Versus Alone ..... 19

Table 7: Key Ring Project: Together Problem Versus Course Requirement ..... 20

Table 8: Key Ring Project: Personal Touch Versus Set of Plans ..... 21

Table 9: Key Ring Project: Develop Skills Versus Gift You Made ..... 22

Table 10: Desk Set Project: Together Versus Alone ..... 23

Table 11: Desk Set Project: Together Problem Versus Course Requirement ..... 24

Table 12: Desk Set Project: Personal Touch Versus Set of Plans ..... 24

Table 13: Desk Set Project: Develop Skills Versus Gift You Made ..... 25

Table 14: Yard Sign Project: Together Versus Alone ..... 26

Table 15: Yard Sign Project: Together Problem Versus Course Requirement ..... 27

Table 16: Yard Sign Project: Personal Touch Versus Set of Plans ..... 28

Table 17: Yard Sign Project: Develop Skills Versus Gift You Made ..... 29

Table 18: Yard Sign Project: Clustered Responses ..... 30

Table 19: Desk Set Project: Clustered Responses ..... 32

Table 20: Key Ring Project: Clustered Responses ..... 34

# Chapter I: Introduction

The curriculum for Grafton High School (GHS) manufacturing classes dates back to the early 1970's. The focus of Grafton High School's technology education program has been on craftsmanship and skill development. It dates back to the days of Industrial Arts with an emphasis on providing the necessary skills for students to pursue careers in one of a few technical fields.

The curriculum is articulated with skills needed for advanced placement at local technical colleges and to meet the needs of the local businesses. The area is filled with several manufacturing companies that produce products ranging from springs to the castings and dies used in the production of Harley Davidson motorcycles. Project materials and instructional information have been provided upon request and need with the expectation that students will be groomed to become future employees.

The classroom is well equipped and divided into areas that model on a small scale the processes and procedures used in area businesses. The areas include: foundry, lathe, mill, drill press, band saw, tabletop CNC, and welding areas. A few years ago much of the shop was updated through a referendum, leaving only a few antiquities at the current time. The environment and nature of the classroom favor the success of the male student.

As of late, the enrollment and needs of today's students have changed. The most important change to be noted is the continuous push by parents for their children to attend a four-year college. Many of the students enrolled in GHS's manufacturing classes have no plans to pursue it as a career. They have plans to attend a four-year college or technical college in a different field. Many of them want to develop certain skills and apply them to current jobs in the

automotive industry, fix problems for their parents, or apply it to a current hobby. Over the past four years only two students have gone on to receive a degree in precision machining (the main focus of GHS's manufacturing classes). GHS's manufacturing courses are currently developed to serve the male student population. The goal of the researcher is to identify and integrate projects important to all members of the student population.

*Problem Statement*

The current enrollment in the manufacturing classes at Grafton High School is low. GHS's manufacturing courses have been developed by males and currently serve the male population of the student body. The researcher must identify projects to be integrated into the courses to better serve the needs of all students at Grafton High School.

*Purpose of the Study*

The purpose of the study is to identify project features that incorporate technical and practical problem solving skills to meet the needs of all students of Grafton High School. The researcher will attempt to identify project offerings that are attentive to solving the problems of everyday life.

*Research Questions*

1. To what extent would allowing students to work together to produce a lot of the same project versus allowing students to work alone to complete the entire project make GHS's manufacturing classes more or less attractive to all students?
2. To what extent would manufacturing a product in the context of solving an everyday problem versus fulfilling a course requirement make GHS's manufacturing classes more or less attractive to all students?

3. To what extent would adding a personal touch to a project versus following a set of plans make GHS's manufacturing classes more or less attractive to all students?
4. To what extent would completing a project to develop a set of skills versus using the project as a gift for someone make GHS manufacturing classes more or less attractive to all students?

Definition of Terms:

In order to proceed with the study, the researcher must define the terms relevant to understanding the nature of the problem. The following terms are key ingredients for the development of a solution.

Technology Education: A group of elective courses that utilizes a hands-on approach to develop core academic skills in a manufacturing laboratory.

Design: The creation of a solution to a problem based on a set of criteria framed in the context of everyday life.

Problem Solving Skills: The required skills and knowledge needed to develop a solution to a problem related to everyday life.

Projects: The final solution to a problem developed through the application of knowledge and technical skill.

# Chapter II: Literature Review

## *Purpose of the Study*

The purpose of the study is to identify project features that incorporate technical and practical problem solving skills to meet the needs of all students of Grafton High School. The researcher will attempt to identify project offerings through the discussion of three topics: (a) technology education, (b) enrollment factors in technology education, and (c) enterprise, aesthetics, and problem solving.

## *Technology Education*

The history of technology education is quite complex as a result of the changing needs of society. The leaders of the profession have been instrumental in making the changes that have shaped technology education, as we know it today. The first major push began with manual training, which emphasized teaching hand skills through the completion of a series of exercises involving wood or metal (Phillips, 1985). Manual training evolved into manual arts due to the rapid industrial changes taking place in society at the time (Bennett, 1917). Manual arts was developed in schools, because the current methods for training skilled labor could not keep up with industrial demands (Bennett, 1917). The third movement towards technology education came in the form of industrial arts. This movement concentrated on providing students with the opportunity to study and use tools, materials, and processes of industrial-technical fields (AIAA, 1963). The final movement is the transition from industrial arts to technology education.

Technology education provides opportunities for problem-based learning that utilizes math, science, and technology principles. The standards for technological literacy define technology education as: a study of technology, which provides an opportunity for students to

learn about the processes and knowledge related to technology that are needed to solve problems and extend human capabilities (ITEA, 2000). Technology education takes many forms in today's high school. Courses in this subject area are based on four core areas of study that include: manufacturing, construction, communications, and transportation. The goal of technology education is technological literacy. Technological literacy is the ability to use, manage, assess, and understand technology. A technologically literate person understands Technology is the modification of the natural environment in order to satisfy perceived human needs and wants (ITEA, 2000).

*Enrollment Factors in Technology Education*

Society has long influenced the development of children through the use of stereotypes and cultural norms (Welty & Puck, 2001). These influences can be identified by the examination of clothing, toys, and activities used by parents while raising their children. Society, parents, teachers, and guidance counselors play an important role in the selection of technology education courses. Although a number of females may be positively influenced by many of the adults in their life to explore technology education, the vast majority of females fail to see the importance of technological studies in their daily life (Silverman & Pritchard, 1994). The attitudes and opinions expressed by their fellow students play another important roll in the selection of technology education courses. Due to these influences, students have already been exposed to a set group of ideas shaping their perceptions on technology education before they enter the classroom.

Silverman and Pritchard's (1994) research in Connecticut suggests several reasons for current trends in technology education. A majority of students participate in technology education because they enjoy the hands on aspect of the courses fostered by the technology

education laboratory. Their research also discovered that many students are influenced by relatives or friends outside of the school setting to enroll in technology education courses. Females currently enrolled in technology education want to challenge stereotypes about females and technology. In many cases traditional stereotypes about girls and technology education tend to be rejected by students of both genders. However, the fact that few females work in technological careers seems to play a major part in a girl's choice to enroll in technology education courses. Furthermore, knowledge about technological careers has very little effect on decisions regarding the enrollment in technology education courses (Silverman & Pritchard, 1994, p 9). In regards to middle school technology education, (Silverman & Pritchard, 1994) show participation at the middle school level to carry no weight in the selection of high school courses. The difference in the scope and sequence offered between the two levels doesn't allow students to make adequate comparisons for class selection. This led to girls being uninformed about the selection of courses being offered in technology education. In addition, guidance counselors seemed to provide little information to students about technology education, often having a negative impact on female enrollment in the subject matter The results of Silverman and Pritchard's research show students have limited knowledge of career choices, as well as the impact of those choices on their financial success as adults. "Many Students lack a sense of economic realities which could inform them of careers and help them make reasonable plans for further education and training after high school (p9-10)."

The Classroom environment can be a major factor affecting the enrollment of students in technology education (Welty & Puck, 2001). The design, layout, and cleanliness of the traditional technology education lab can be very intimidating to female students. Attitudes of instructors need to be modified to meet the needs of female students in an ever-changing

technological society. Verbal and Non-verbal language should be gender neutral, and sexist remarks should be eliminated from the learning environment. Instructors must alter their teaching styles to divide the attention given to all students of both genders equally. "It is easy for girls and young women to feel that their presence, contributions, and perspectives are not valued when they do not receive as much attention as male students (Welty & Puck, 2001 p.11)."

Projects and activities offered in the technology courses are also a major factor affecting student enrollment. A review of current literature uncovered several distinctions in learning styles between the two genders. Using the results of Gurian's (2001) research, the researcher can develop coursework balanced around the needs of all learners. For example, use of language between genders during the learning process is quite different. Female students tend to use a lot of words and males tend to use very little throughout the learning process. Instructors can use these distinctions to develop projects and activities requiring both written and verbal communication. The development of a balanced coursework allows students to successfully utilize skills in their strength areas and develop weaker skills throughout the learning process. Another major distinction listed by Gurian is the amount of space and movement required during the learning process. Coursework should be a balanced mixture of written and laboratory activities requiring students to develop the basic skills of learning as well as the hands on skills needed to apply technological theories to real life situations.

*Enterprise, Aesthetics, and Problem solving*

The researcher has identified enterprise, aesthetics, and problem solving as variables important to identifying projects capable of meeting the needs of all students. The following discussion supports the use of these variables in the research instrument developed for this study.

The general purpose of enterprise education is to allow students to make connections between school and everyday life. "Twiddle and Watt (1995) utilize the following rationales for enterprise education: learning about enterprise, learning through enterprise, learning for enterprise. The focus of this rationale is providing students with the knowledge, skills, and attitude needed to be successful contributors to the economy (as cited in Deuchar, 2004, p. 225)." International names for enterprise education vary by country; however, the goal to educate students about the social, business, and economic aspects of modern life by establishing partnerships with business remains the same.

Enterprise education brings relevancy to this study by providing students with opportunities to manufacture and market a product. The marketing process provides students with the consumer skills needed to function in our economy, as well as developing the leadership and teamwork skills necessary to run a successful business. Through the process of enterprise education students develop and refine skills related to communication, teamwork, creativity, problem solving, decision-making, risk taking, and employment (Deuchar, 2004).

Current literature suggests aesthetics to be a very individualized subject, based on personal preference or opinion. A person's aesthetic response is the result of their interactions with an object, and relating how they feel about the appearance of the object.

Hutchinson and Karsnitz state: "Aesthetics refers to the appearance of an object with form scale, color, and so on. An object with good aesthetics is pleasing to look at (Hutchinson and Karsnitz, 1994, p.286)."

Liu (2003) states aesthetic experiences and responses are multidimensional in the sense that overall aesthetic response is the joint outcome of a multitude of factors. The issues of debate

among philosophers, art critics, and designers are what these factors are and how they contribute to aesthetic response, either positively or negatively.

A consumer's aesthetic response to a product will most likely be in two areas. The first is in response to the color, shape, and overall appearance of the object. The second being how difficult the object is to operate (Liu, 2003).

Problem solving has long been a focus of technology education. McCade (1990) stated, "Few concepts which fall within the scope of technology education have received as much attention as 'problem solving' (p. 1)." He went on to state *The Technology Teacher* featured contained seven articles about problem solving between 1985 and 1989. McCade also divides technological problem solving into three categories: design, troubleshooting, and technology assessment (impact evaluation). "Regardless of which of the three types of technical problem solving are taught, three basic concepts should be attended to. These concepts are: (a) a model for problem solving, (b) systems to subsystems approach, and (c) necessary prerequisite knowledge (McCade, 1990, p 3)."

A review of the ITEA Standards for Technological Literacy reveals design to be the main problem solving process. ITEA standards for grades nine through twelve indicate: "The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results (ITEA, 2000, p.97)." ITEA recognizes troubleshooting, research and development, invention and innovation, and experimentation as problem solving processes.

A review of textbooks currently being used in technology education confirms these findings. Hutchinson and Karsnitz provide the following process for design: (1) Identifying problems and opportunity, (2) Framing a design brief, (3) Investigation and research, (4) Generating alternative solutions, (5) Choosing a solution, (6) Developmental work, (7) Modeling and prototyping, (8) testing and evaluating, and (9) Redesigning and Improving (Hutchinson & Karsnitz, 1994).

*Summary*

The main goal of Technology Education is to produce students who have the knowledge and skills to become productive members of our increasingly technological society. A review of current literature revealed several factors affecting student enrollment in technology education. Stereotypes, lack of information, classroom conditions, adult influence, and limited knowledge of technology related careers have influenced the number of students enrolling in technology education classes. Project offerings in technology education classes have also been biased towards male students, greatly decreasing the number of females enrolling in technology education courses. The development of non-biased projects is possible through the incorporation of enterprise, aesthetics, and problem solving. The incorporation of enterprise into technology education classes allows students to gain a broad understanding of the manufacturing process. Incorporating aesthetics into projects allows the instructor to reduce gender-bias by providing students with the opportunity to personalize each project. Utilization of the design process gives students the experience needed to solve problems related to becoming active consumers in our ever-changing society. The knowledge gained from the review of literature will allow the researcher to identify project features that will meet the needs of all students at Grafton High School.

# Chapter III: Methodology

## *Purpose of the Study*

The purpose of the study is to identify project features that incorporate technical and practical problem solving skills to meet the needs of all students of Grafton High School. The researcher will attempt to identify project offerings through the discussion of three topics: (a) technology education, (b) enrollment factors in technology education, and (c) enterprise, aesthetics, and problem solving. This chapter will discuss the research methodology used to perform the study.

## *Research Design*

The research design for this study was a survey focused on identifying project features appealing to all students. As students completed the survey, a PowerPoint presentation displayed pictures of the projects designed to aid in the response to each question. The review of literature uncovered three key areas to identify project features that could be used to meet the needs of all students at Grafton High School. These areas include: a) enterprise, b) aesthetics, c) problem solving and were used to develop the survey for this study. In concrete terms, the survey addressed the notion of working alone or in a group, fulfilling a course requirement or solving a problem, adding a personal touch or following a set of plans, and developing a set of skills or giving someone a gift.

## *Subject Selection and Description*

Grafton High School has a mixed population of 750 male and female students in grades 9-12. The survey was administered to a sample population consisting of a mixed group of three hundred and fifty-one students. The researcher surveyed approximately 207 males and 144

female students. The subjects of the study were chosen from the general population to decrease the amount of bias towards technology education by students who are currently enrolled in technology education classes. The researcher used his preparation period to administer the survey to a selected group of general education first hour classes at Grafton High School, in Grafton, Wisconsin.

*Instrumentation*

The researcher developed a PowerPoint survey for the purpose of this research project (See Appendix C). The PowerPoint presentation corresponded with the survey allowing the subjects of the study to get a visual idea of the projects being discussed (See Appendix B).

Questions one, five, and nine were designed to address the first research question, "To what extent would allowing students to work together to produce a lot of the same project versus allowing students to work alone to complete the entire project make GHS's Manufacturing classes more or less attractive to all students?" The survey measured this by asking students to select one of the following scenarios: A) working together to make a lot of the same project by having classmates specialize in one step of the problem or B) working alone to make one project by completing all steps of the process.

Questions two, six, and 10 were designed to address the second research question, "To what extent would manufacturing a product in the context of solving an everyday problem versus fulfilling a course requirement make GHS's Manufacturing classes more or less attractive to all students?" The survey measured this by asking students to select one of the following scenarios: A) making the project to solve an everyday problem or B) making the project to fulfill a course requirement?

Questions three, seven, and 11 were designed to address the third research question, "To what extent would adding a personal touch to a project versus following a set of plans make GHS's Manufacturing classes more or less attractive to all students?" The survey measured this by asking students to select one of the following scenarios: A) would it be more appealing to add features to it in order to give it a personal touch or B) would it be more appealing to follow a set of plans to make it exactly like the one in the picture?

Questions four, eight, and twelve were designed to address the fourth research question, "To what extent would completing a project to develop a set of skills versus using the project as a gift for someone make GHS Manufacturing classes more or less attractive to all students?" The survey measured this by asking students to select one of the following scenarios: A) would it be more appealing to use this project to develop a set of skills needed for a future career or B) would it be more appealing to use this project to give someone a gift that you made?

Data Collection Procedures:

The researcher developed a PowerPoint survey to identify projects for a manufacturing class attentive to all students attending Grafton High School in the spring semester of 2006. Parents of all Grafton High School students received a letter of consent describing the research project (See Appendix A). The researcher verbally asked a group of first hour general education teachers for permission to administer the survey during their classes. The survey occurred over a three-week period and involved one to two survey groups per day. During each of the survey sessions, the researcher gave an oral introduction to the research project and handed out consent forms to the students. Upon collection of the consent forms, the researcher utilized a laptop and overhead projector to administer the survey through the use of a PowerPoint presentation.

Data Analysis:

The results of the survey were analyzed based on frequencies and percentages. A binomial-test was used to determine the significance of the difference among respondent selections. Furthermore, a cluster analysis (SPSS) was used to group students based on patterns within their responses and to identify how they responded to one question as opposed to other questions on the survey instrument.

# Chapter IV: Results

## *Purpose of the Study*

The purpose of the study is to identify project features that incorporate technical and practical problem solving skills to meet the needs of all students of Grafton High School. The researcher used a PowerPoint survey to gather student input about project features centered around enterprise, aesthetics, and problem solving. Insight gained from the study will be used to identify project features that incorporate technical and practical problem solving skills to meet the needs of all students of Grafton High School.

## *Rate of Response*

A letter of parental consent was delivered to parents of all students attending Grafton High School. Parents were asked to contact the researcher if they did not grant parental consent for their child to participate in the survey. Before administering the survey, students were asked to sign a permission slip stating their participation in the study was completely voluntary. The researcher administered 351 surveys to a select group of general education classes during first period.

## *Demographic Information*

Table one describes the demographic information of the respondents who took part in the study. The researcher consulted each first period teacher for the number of male and female students in each class. A total of 351 respondents participated in the study, 207 (58.97%) of the respondents were identified as male, and 144 (41.03%) were identified as female. The data displayed in table one shows a conscious effort by the researcher try and select a demographic population equally composed of male and female students.

Table 1

Sample Demographics

| | Frequency | Percent |
|---|---|---|
| Males | 207 | 58.97% |
| Females | 144 | 41.03% |
| Total Students | 351 | 100% |

Table two describes the number of respondents currently enrolled in technology education courses versus the number of respondents not enrolled in the technology education classes. Of the 351 respondents, 296 (84.33%) of the respondents were not enrolled in technology education classes, and 55 (15.66%) of the respondents were enrolled in technology education classes.

Table 2

Students Surveyed: Enrolled in Tech Ed Versus Not Enrolled in Tech Ed

| | Frequency | Percent |
|---|---|---|
| Not Enrolled in Tech Ed | 296 | 84.33% |
| Enrolled in Tech Ed | 55 | 15.66% |
| Total Students | 351 | 100% |

The data displayed in table two shows a demographic of students not enrolled in technology education. By surveying a population not currently enrolled in technology education classes, the researcher tried to eliminate student bias towards technology education classes.

Table three describes the number of respondents currently enrolled in the researcher's courses versus the number of respondents not enrolled in the technology education classes. Of

the 351 respondents, 308 (87.74%) of the respondents were not enrolled in technology education classes, and 43 (12.26%) of the respondents were enrolled in the researcher's classes.

Table 3

Students Surveyed: Enrolled in Researchers Class Versus Not Enrolled in Tech Ed

| | Frequency | Percent |
|---|---|---|
| Not Enrolled in Tech Ed | 308 | 87.74% |
| Enrolled in Researcher's Class | 43 | 12.26% |
| Total Students | 351 | 100% |

The data displayed in table three shows a respondent population containing a majority of students that have never taken the researchers class. The goal of the researcher was to survey a student population new to technology education in order to determine factors to increase student enrollment.

Table four describes the number of respondents currently enrolled in the researcher's courses versus the number of respondents enrolled in the other technology education classes. Of the 55 respondents enrolled in the technology education classes, 43 (78.18%) of the respondents were enrolled in researcher's classes, and 12 (21.81%) of the respondents were enrolled in other technology education classes.

Table 4

Students Surveyed: Enrolled in Researchers Class Versus Enrolled in other Tech Ed

| | Frequency | Percent |
|---|---|---|
| Enrolled in Researcher's Class | 43 | 78.18% |
| Enrolled in other Tech Ed | 12 | 21.81% |
| Total Students | 55 | 100% |

The data displayed in table four reflects a respondent population containing very few students who are currently enrolled in the researchers class. It further reflects a small respondent population containing students currently enrolled in more than one technology education class.

Table five describes the number of students currently enrolled in the researcher's courses versus the number of students enrolled in the other technology education classes. Of the 239 students enrolled in technology education classes, 102 (42.67%) of the respondents were enrolled in researcher's classes, and 137 (57.33%) of the respondents were enrolled in other technology education classes.

Table 5

Total in Researchers Classes Versus Total in Other Tech Ed Classes

| | Frequency | Percent |
|---|---|---|
| Enrolled in Researcher's Class | 102 | 42.67% |
| Enrolled in Other Tech Ed | 137 | 57.33% |
| Total Students in Tech Ed | 239 | 100% |

The data displayed in table five represents the number of student enrolled in technology education at the time of the researchers survey. The only factor not accounted for in table five is

the number of students who are enrolled in multiple technology education classes during the survey period.

*Key Ring Project: Working Together Versus Working Alone*

Respondents were asked to fill out a PowerPoint based survey displaying pictures of three projects. The first project on the survey was a key ring project. Respondents were asked to indicate a preference of working together in a group or working alone to complete the project. Of the respondents in the study many chose to work together in a group, while half of the respondents in the study chose to work alone to complete the project. Table six describes the data collected from this question.

Table 6

Key Ring Project: Together Versus Alone

| | Would it be more appealing to work: | |
|---|---|---|
| | Frequency | Percent |
| A. together? | 160 | 46.1% |
| B. alone? | 187 | 53.9% |
| Totals | 347 | 100% |

The data described in table six shows a slight respondent preference towards working alone to complete the project. However, approximately half of the population chose to work together, while the other half chose to complete the project by working alone. According to the binomial test, the difference between respondents choosing to work alone versus together in a group was not significant.

*Key Ring Project: Solving a Problem Versus Fulfilling a Course Requirement*

Respondents were asked to indicate a preference of completing the project to solve an everyday problem or fulfill a course requirement. Of the respondents in the study half (57.1%) chose to solve an everyday problem, while many (42.9%) of the respondents in the study chose to fulfill a course requirement. Table seven describes the data collected from this question.

Table 7

Key Ring Project: Problem Versus Course Requirement

| | Would it be more appealing to make this project to: | |
|---|---|---|
| | Frequency | Percent |
| A. solve an everyday problem? | 198 | 57.1% |
| B. fulfill a course requirement? | 149 | 42.9% |
| Totals | 347 | 100% |

Note: $\underline{z}$ (346) = 2.575, $p<.010$

The data described in table seven shows a slight respondent preference towards completing the project to solve an everyday problem. However, approximately half of the population chose to solve an everyday problem, while the other half chose to complete the project to fulfill a course requirement. The binomial test indicated the difference was significant at the .010 level.

*Key Ring Project: Give it a Personal Touch Versus Following a Set of Plans*

Respondents were asked to indicate a preference of completing the project by giving it a personal touch or by following a set of plans. Of the respondents in the study most (78.3%)

chose to give it a personal touch, while very few (21.7%) of the respondents in the study chose to follow a set of plans. Table eight describes the data collected from this question.

Table 8

Key Ring Project: Personal Touch Versus Set of Plans

| | Would it be more appealing to: | |
|---|---|---|
| | Frequency | Percent |
| A. give it a personal touch? | 271 | 78.3% |
| B. follow a set of plans? | 75 | 21.7% |
| Totals | 346 | 100% |

Note: $\underline{z}$ (346) = 3.50, $p<.001$

The data described in table eight shows a strong respondent preference towards giving the project a personal touch. A majority of the respondents elected to complete the project by giving it a personal touch. The binomial test indicated the difference was significant at the .001 level.

*Key Ring Project: Develop a Set of Skills Versus Give Someone a Gift You Made*

Respondents were asked to indicate a preference of completing the project to develop a set of skills needed for a future career or give someone a gift that you made. Of the respondents in the study half (52.4%) chose to develop a set of skills, while many of the respondents (47.6%) in the study chose to give a gift you made. Table nine describes the data collected from this question.

Table 9

Key Ring Project: Develop Skills Versus Gift You Made

| | Would it be more appealing to use this project to: | |
|---|---|---|
| | Frequency | Percent |
| A. develop a set of skills? | 182 | 52.4% |
| B. give a gift you made? | 165 | 47.6% |
| Totals | 346 | 100% |

The data described in table nine shows a respondent group that is almost evenly divided as to how to complete the project. The responses recorded in the survey give a slight respondent preference towards completing the project to develop a set of skills. However, no significant difference was found with the binomial test.

*Desk Set Project: Working Together Versus Working Alone*

The second project on the survey was a desk set project. Respondents were asked to indicate a preference of working together in a group or working alone to complete the project. Of the respondents in the study very few (37.2%) chose to work together in a group, while a majority of the respondents (62.8%) in the study chose to work alone to complete the project. Table 10 describes the data collected from this question.

Table 10

Desk Set Project: Together Versus Alone

| | Would it be more appealing to work: | |
|---|---|---|
| | Frequency | Percent |
| A. together? | 129 | 37.2% |
| B. alone? | 218 | 62.8% |
| Totals | 347 | 100% |

Note: $\underline{z}$ (346) = 3.50, p<.001

The data described in table 10 shows a respondent preference to working alone. The change to the Desk Set Project resulted in an increased difference between the respondents choosing to work together versus working alone to complete the project. A review of table six shows no significant difference in respondents' preference toward working alone to complete the key ring project. However, in the case of the desk set project, the binomial test indicated the difference was significant at the .001 level. The respondents preferred to work alone on this project.

*Desk Set Project: Solving a Problem Versus Fulfilling a Course Requirement*

Respondents were asked to indicate a preference of completing the project to solve an everyday problem or fulfill a course requirement. Of the respondents in the study many (48.1%) chose to solve an everyday problem, while half of the respondents (51.9%) in the study chose to fulfill a course requirement. Table 11 describes the data collected from this question.

Table 11

Desk Set Project: Problem Versus Course Requirement

| | Would it be more appealing to make this project to: | |
|---|---|---|
| | Frequency | Percent |
| A. solve an everyday problem? | 167 | 48.1% |
| B. fulfill a course requirement? | 180 | 51.9% |
| Totals | 347 | 100% |

The data described in table 11 shows the respondents evenly divided as to how to complete the project. No significant difference was found with the binomial test

*Desk Set Project: Give it a Personal Touch Versus Following a Set of Plans*

Respondents were asked to indicate a preference of completing the project by giving it a personal touch or by following a set of plans. Of the respondents in the study most (80.1%) chose to give it a personal touch, while very few of the respondents (19.9%) in the study chose to follow a set of plans. Table 12 describes the data collected from this question.

Table 12

Desk Set Project: Personal Touch Versus Set of Plans

| | Would it be more appealing to: | |
|---|---|---|
| | Frequency | Percent |
| A. give it a personal touch? | 278 | 80.1% |
| B. follow a set of plans? | 69 | 19.9% |
| Totals | 347 | 100% |

Note: $z$ (346) = 3.50, $p<.001$

The data described in table 12 shows a strong respondent preference towards giving the project a personal touch. A binomial test pointed out the difference was significant at the .001 level. This finding along with that presented in table eight shows a continued preference towards giving the project a personal touch.

*Desk Set Project: Develop a Set of Skills Versus Give Someone a Gift You Made*

Respondents were asked to indicate a preference of completing the project to develop a set of skills needed for a future career or give someone a gift that you made. Of the respondents in the study many (47.0%) chose to develop a set of skills, while half of the respondents (53.0%) in the study chose to give a gift you made. Table 13 describes the data collected from this question.

Table 13

Desk Set Project: Develop Skills Versus Gift You Made

| | Would it be more appealing to use this project to: | |
|---|---|---|
| | Frequency | Percent |
| A. develop a set of skills? | 163 | 47.0% |
| B. give a gift you made? | 183 | 53.0% |
| Totals | 347 | 100% |

The data described in table 13 shows a respondent group that is almost evenly divided as to how to complete the project. Slightly more than half of the population prefers to complete the project as a gift for someone else, while the other half prefers to complete the project to develop a set of skills. The binomial test showed no significant difference was found between those that indicated a preference toward developing skills and those preferring to make a gift.

*Yard Sign Project: Working Together Versus Working Alone*

The final project on the survey was a yard sign project. Respondents were asked to indicate a preference of working together in a group or working alone to complete the project. Of the respondents in the study very few (28.3%) chose to work together in a group, while a majority of the respondents (71.7%) in the study chose to work alone to complete the project. Table 14 describes the data collected from this question.

Table 14

Yard Sign Project: Together Versus Alone

| | Would it be more appealing to work: | |
|---|---|---|
| | Frequency | Percent |
| A. together? | 98 | 28.3% |
| B. alone? | 248 | 71.7% |
| Totals | 346 | 100% |

Note: $\underline{z}$ (346) = 3.50, $p<.001$

The data described in table 14 shows a respondent preference to working alone. A binomial test showed a significant difference at the .001 level. The change to the yard sign project resulted in a strong respondent preference toward completing the project by working alone. A review of table 10 also shows more respondent preference toward working alone to complete the desk set project. Tables 10 and 14 suggest respondents prefer to work alone on these projects.

*Yard Sign Project: Solving a Problem Versus Fulfilling a Course Requirement*

Respondents were asked to indicate a preference of completing the project to solve an everyday problem or fulfill a course requirement. Of the respondents in the study very few (30.6%) chose to solve an everyday problem, while a majority of the respondents (69.4%) in the study chose to fulfill a course requirement. Table 15 describes the data collected from this question.

Table 15

Yard Sign Project: Problem Versus Course Requirement

| | Would it be more appealing to make this project to: | |
|---|---|---|
| | Frequency | Percent |
| A. solve an everyday problem? | 106 | 30.6% |
| B. fulfill a course requirement? | 240 | 69.4% |
| Totals | 346 | 100% |

Note: $\underline{z}$ (346) = 3.50, $p<.001$

The data described in table 15 shows a strong respondent preference towards completing the project to fulfill a course requirement. The difference was significant at the .001 level based on a binomial test. A review of table seven shows a respondent preference towards completing the project to solve an everyday problem, while this finding showed a preference towards completing the project to fulfill a course requirement.

*Yard Sign Project: Give it a Personal Touch Versus Following a Set of Plans*

Respondents were asked to indicate a preference of completing the project to solve an everyday problem or fulfill a course requirement. Of the respondents in the study most (90.2%)

chose to give it a personal touch, while very few of the respondents (9.8%) in the study chose to follow a set of plans. Table 16 describes the data collected from this question.

Table 16

Yard Sign Project: Personal Touch Versus Set of Plans

| | Would it be more appealing to: | |
|---|---|---|
| | Frequency | Percent |
| A. give it a personal touch? | 312 | 90.2% |
| B. follow a set of plans? | 34 | 9.8% |
| Totals | 346 | 100% |

Note: $\underline{z}$ (346) = 3.50, $p<.001$

The data described in table 16 shows a strong respondent preference towards giving the project a personal touch. The binomial test showed this difference to be significant at the .001 level. A review of table 12 also shows a respondent preference towards completing the desk set project by giving it a personal touch. A further review of table eight reveals a respondent preference towards completing the key ring project by giving it a personal touch. The results of the data listed in tables eight, 12, and 16 provide the researcher with strong evidence that respondents prefer to add a personal touch to each project.

*Yard Sign Project: Develop a Set of Skills Versus Give Someone a Gift You Made*

Respondents were asked to indicate a preference of completing the project to develop a set of skills needed for a future career or give someone a gift that you made. Of the respondents in the study very few (17.1%) chose to develop a set of skills, while most of the respondents

(82.9%) in the study chose to give a gift you made. Table 17 describes the data collected from this question.

Table 17

Yard Sign Project: Develop Skills Versus Gift You Made

| | Would it be more appealing to use this project to: | |
|---|---|---|
| | Frequency | Percent |
| A. develop a set of skills? | 59 | 17.1% |
| B. give a gift you made? | 287 | 82.9% |
| Totals | 347 | 100% |

Note: $\underline{z}$ (346) = 3.50, $p<.001$

The data described in table 17 shows a strong respondent preference for using the project to give someone a gift. A binomial test showed a significant difference at the .001 level. A comparison of tables eight and 13 provided the researcher with no conclusive data regarding respondent preference. A further review of all tables related to the survey question reveals the change from the desk set project to the yard sign project contributed to the change in data recorded in table 17.

Table 18

Yard Sign Project: Clustered Responses

| | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5 | n |
|---|---|---|---|---|---|---|
| It would be more appealing to work… | | | | | | |
| together. | 0 (0%) | 15 (15.3%) | 0 (0%) | 0 (0%) | 83 (84.7%) | 98 |
| work alone. | 127 (51.2%) | 19 (7.7%) | 37 (14.9%) | 65 (26.2%) | 0 (0%) | 248 |
| Be more appealing to make this to… | | | | | | |
| solve a problem. | 0 (0%) | 5 (4.7%) | 14 (13.2%) | 65 (61.3%) | 22 (20.8%) | 106 |
| fulfill a requirement. | 127 (52.9%) | 29 (12.1%) | 23 (9.6%) | 0 (0%) | 61 (25.4%) | 240 |
| Would it be more appealing to… | | | | | | |
| add a personal touch. | 127 (40.7%) | 0 (0%) | 37(11.9%) | 65 (20.8%) | 83 (26.6%) | 312 |
| follow a set of plans. | 0 (0%) | 34 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 34 |
| Be more appealing to use this project to… | | | | | | |
| develop skills. | 0 (0%) | 6 (10.2%) | 37 (62.7%) | 0 (0%) | 16 (27.1%) | 59 |
| give as a gift. | 127 (44.3%) | 28 (9.8%) | 0 (0%) | 65 (22.6%) | 67 (23.3%) | 287 |
| Totals | 127 (36.6%) | 34 (9.8%) | 37 (10.7%) | 65 (18.7%) | 83 (23.9%) | 347 |

*Cluster Analysis*

A cluster analysis of the yard sign project data was performed to uncover patterns related to response to the survey. The data displayed in table 18 describes the results of a cluster analysis for the data related to the yard sign project. Cluster one represents a decisive group of students. All of the students in cluster one were interested in completing the yard sign by working alone, to develop a set of skills by following a set of plans while completing the project to fulfill a course requirement. An examination of cluster two reveals all of the students are interested in following a set of plans. Respondents in this cluster were also interested in completing the project to fulfill a course requirement by giving it a personal touch, but were divided on whether they wanted to work together or alone. The data displayed under cluster three represents a group of respondents interested in completing the process by working alone to develop a set of skills while adding a personal touch to the project. However, the respondents in cluster 3 were divided as to whether they wanted to complete the project to solve a problem or fulfill a course requirement. Cluster four represents another decisive group of students interested in completing the project by: working alone, solving a problem, adding a personal touch, and as a gift for someone else. In cluster five, all of the students were interested in working together and adding a personal touch to the project. A majority of the students in this cluster were also interested in completing the project as a gift and fulfilling a course requirement.

Table 19

Desk Set Project: Clustered Responses

| | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5 | n |
|---|---|---|---|---|---|---|
| It would be more appealing to work… | | | | | | |
| together. | 88 (68.2%) | 41 (31.8%) | 0 (0%) | 0 (0%) | 0 (0%) | 129 |
| work alone. | 98 (45.0%) | 120 (55.0%) | 0 (0%) | 0 (0%) | 0 (0%) | 218 |
| Be more appealing to make this to… | | | | | | |
| solve a problem. | 86(51.5%) | 81(48.5%) | 0 (0%) | 0 (0%) | 0 (0%) | 167 |
| fulfill a requirement. | 100 (55.6%) | 80 (12.1%) | 0 (0%) | 0 (0%) | 0 (0%) | 180 |
| Would it be more appealing to… | | | | | | |
| add a personal touch. | 117(42.1%) | 161 (57,9%) | 0 (0%) | 0 (0%) | 0 (0%) | 278 |
| follow a set of plans. | 69 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 69 |
| Be more appealing to use this project to… | | | | | | |
| develop skills. | 163 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 163 |
| give as a gift. | 23 (12.5%) | 161 (87.5%) | 0 (0%) | 0 (0%) | 0 (0%) | 184 |
| Totals | 186 (53.6%) | 161 (46.4%) | 0 (0%) | 0 (0%) | 0 (0%) | 347 |

A cluster analysis of the desk set project data was performed to uncover patterns related to response to the survey. The data displayed in table 19 describes the results of a cluster analysis for the data related to the desk set project. Cluster one represents a student population mainly concerned with completing the project by adding a personal touch and developing a set of skills. The students of cluster one are almost equally divided on the following issues: completing the project by working together versus working alone, and completing the project to solve a problem versus fulfilling a curse requirement. The data represented in cluster two describes a student population interested in: working alone, adding a personal touch, and giving the completed project as a gift. The students of cluster two are evenly divided as to completing the project to solve a problem versus fulfilling a course requirement.

A cluster analysis of the key ring project data was performed to uncover patterns related to response to the survey. The data displayed in table 20 describes the results of a cluster analysis for the data related to the key ring project. Cluster one represents another decisive group of students. All of the students in cluster one were interested in completing the key ring by: working alone, developing a set of skills, and adding a personal touch to the project. However, the respondents in cluster one were divided as to whether they wanted to complete the project to solve a problem or fulfill a course requirement. An examination of cluster two reveals a very divided respondent population. The respondents of cluster two are best represented by the interest in following a set of plans, but are divided on all other variables in the survey. The data displayed under cluster three represents a group of respondents interested in completing the project: to fulfill a requirement, personalizing the project, and to give the

Table 20

Key Ring Project: Clustered Responses

| | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5 | n |
|---|---|---|---|---|---|---|
| It would be more appealing to work… | | | | | | |
| together. | 0 (0%) | 41 (25.6%) | 29 (18.1%) | 36 (22.5%) | 54 (33.8%) | 160 |
| work alone. | 79 (42.5%) | 34(18.3%) | 28 (15.1%) | 45 (24.2%) | 0 (0%) | 186 |
| Be more appealing to make this to… | | | | | | |
| solve a problem. | 45 (22.7%) | 45 (22.7%) | 0 (0%) | 81 (40.9%) | 27 (13.6%) | 198 |
| fulfill a requirement. | 34 (23.0%) | 30 (20.3%) | 57 (38.5%) | 0 (0%) | 27 (18.2%) | 148 |
| Would it be more appealing to… | | | | | | |
| add a personal touch. | 79 (29.2%) | 0 (0%) | 57(21.0%) | 81 (29.9%) | 54 (19.9%) | 271 |
| follow a set of plans. | 0 (0%) | 75 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 75 |
| Be more appealing to use this project to… | | | | | | |
| develop skills. | 79 (43.4%) | 49 (26.9%) | 0 (0%) | 0 (0%) | 54 (29.7%) | 182 |
| give as a gift. | 0 (0%) | 26 (15.9%) | 57 (34.8%) | 81 (49.4%) | 0 (0%) | 164 |
| Totals | 79 (22.8%) | 75(21.7%) | 57 (16.5%) | 81 (23.4%) | 54(15.6%) | 346 |

project as a gift . However, the respondents in cluster three were divided as to whether they wanted to complete the project by working together or alone. Cluster four represents another decisive group of students interested in completing the project to: solve a problem, adding a personal touch, and as a gift for someone else. The respondents of cluster four were also divided between choosing to complete the project by working together or alone. An analysis of cluster five uncovers a decisive group of student interested in completing the project: by working together, by adding a personal touch, and to develop a set of skills. The students in cluster five are equally divided as to whether they should complete the project to solve a problem or fulfill a course requirement.

# Chapter V: Discussion

## *Introduction*

The curriculum for Grafton High School Manufacturing classes dates back to the early 1970's. The focus of Grafton High School's technology education program has been on craftsmanship and skill development. It dates back to the days of industrial arts with an emphasis on providing the necessary skills for students to pursue careers in a one of few technical fields.

As of late the enrollment and needs of today's students have changed. The most important change to be noted is the continuous push by parents for their children to attend a four-year college. Many of the students enrolled in GHS's manufacturing classes have no plans to pursue it as a career. They have plans to attend a four-year college or technical college in a different field. Many of them want to develop certain skills and apply them to current jobs in the automotive industry, fix problems for their parents, or apply it to a current hobby. Over the past four years only two students have gone on to get a degree in precision machining (the main focus of GHS's manufacturing classes). GHS's manufacturing courses are currently developed to serve the male student population. The goal of the researcher is to identify and integrate projects important the general student population.

## *Problem Statement*

The current enrollment in the manufacturing classes at Grafton High School is low. GHS's manufacturing courses have been developed by males and currently serve the male population of the student body. The researcher must identify projects to be

integrated into the courses to better serve the needs of all students at Grafton High School. More Specifically the study attempted to address the following questions

1. To what extent would allowing students to work together to produce a lot of the same project versus allowing students to work alone to complete the entire project make GHS's Manufacturing classes more or less attractive to all students?
2. To what extent would manufacturing a product in the context of solving an everyday problem versus fulfilling a course requirement make GHS's Manufacturing classes more or less attractive to all students?
3. To what extent would adding a personal touch to a project versus following a set of plans make GHS's Manufacturing classes more or less attractive to all students?
4. To what extent would completing a project to develop a set of skills versus using the project as a gift for someone make GHS Manufacturing classes more or less attractive to all students?

*Methodology*

The review of literature helped identify three key areas to identify project features to meet the needs of all students at Grafton High School. The survey used for this study was derived from the following factors: a) enterprise b) aesthetics and c) problem solving. The PowerPoint presentation corresponding with the survey allowed subjects of the study to get a visual idea of the projects being discussed.

The researcher used his preparation period to administer the survey to a selected group of general education first hour classes at Grafton High School, in Grafton

Wisconsin. Grafton High School has a mixed population of 750 male and female students in grades 9-12. The survey was administered to a sample population consisting of a mixed group of three hundred and fifty-one students. The researcher surveyed approximately 207 males and 144 female students. During each of the survey sessions, the researcher gave an oral introduction to the research project and handed out consent forms to the students. Upon collection of the consent forms, the researcher utilized a laptop and overhead projector to administer the survey through the use of a PowerPoint presentation.

*Findings*

The findings of this study reveal several project related factors that could be integrated into GHS manufacturing courses to better serve the needs of all students at Grafton High School. For this research project, respondents were asked to answer the same four questions for three different projects displayed in a PowerPoint presentation. The data analysis revealed the following findings.

1. The first survey question for each project asked students to choose between working together in a group versus working alone to complete each of the projects. Respondents preferred working alone on two out of the three projects. The results of the data analysis showed little interest in working together in a group to complete the projects.
2. The second survey question for each project asked students to choose whether it was more appealing to make each of the three projects to solve an everyday problem or fulfill a course requirement. Respondent response to this question provided the researcher with conflicting data. The data collected for the key

ring project shows a slight respondent preference to solving an everyday problem. Data collected from the desk set project showed equal support for solving an everyday problem and fulfilling a course requirement. The yard sign project supplied the researcher with more definitive data supporting respondent preference to completing the project as a part of a course requirement.

3. The third survey question for each project asked students if it would be more appealing to complete the project by adding a personal touch or following a set of plans. The results of the data analysis related to all three projects in the survey showed an overwhelming support for adding a personal touch to each project. These results were confirmed by the binomial test indicating a significant difference in respondent selections. The ability to personalize a project is very important to high school students.
4. The final survey question for each project asked students to choose whether it was more appealing to use the project to develop a set of skills or give someone a gift that they made. The data collected for the key ring and the desk set project showed equal support for the notion of making a gift and developing a set of skills. The results of the binomial test for both the key ring and yard sign did not show a significant difference in respondent selection. Once again, the yard sign project supplied the researcher with more definitive data supporting respondent preference to completing the project as a gift for someone.

*Conclusions*

Based on the findings of this study, the following conclusions were drawn.

1. The finding suggests making projects has implications for improving self-esteem. This is supported by the expressed desire to make projects that enable them to: work alone, fulfill a course requirement, add personal touches, and make gifts for someone else. The sense of accomplishment that comes from completing all steps of each project appears to be important to students. By working alone, students also gain a sense of achievement as well as an artifact that can be used to gain the approval of their teachers, family members, and friends.
2. Students selected to complete two of the three projects under the auspices of fulfilling a course requirement instead of solving a problem. In order for a project to be perceived as the solution to a problem, students must be able to recognize and appreciate the problem to be solved. If students don't see the problem as being important, completion of the project simply becomes a matter of fulfilling a course requirement. The key ring allowed students to make the connection between the project and the everyday problem of losing your keys. The data for the desk set and the yard sign suggests that students might not have made a connection between these projects and a problem worth solving.
3. The data suggests students were more interested in expressing themselves creatively than they were in developing technical skills. Overwhelmingly students endorsed the notion of personalizing their projects. Allowing students to personalize their own work provides an avenue for creative

expression. This can be directly linked to students' preference to working alone. This is also consistent with the lack of economic knowledge revealed in Silverman & Pritchard's research. Therefore, one reason why the development of skills received so little support might be a lack of knowledge of their applications and value in the labor market.

4. The results of the study suggest most students see different things in different projects. To be appealing to the largest population possible, projects need to accommodate the students' desire to work alone, fulfill course requirements, express themselves creatively, and produce something that is useful (e.g., solves a problem, serves as a gift).

*Recommendations*

Each one of the variables represented by questions in the survey has been researched during the review of literature. The researcher advocates the use of each of the variables at some time during the completion of a project. The following recommendations are a result of the conclusions drawn from this study. Several of the recommendations involve a set of suggested learning activities to be used as flexible guidelines that should be modified throughout the teaching process.

1. Select projects that require students to work under a real-life scenario where the project is clearly a solution to a problem in their life.
2. Do not rely on a single project to address all the needs and interests of a diverse group of students. Instead, select a group of different projects that accommodate the different needs and interests of students while addressing important course objectives.

3. Configure projects so students can add a personal touch to one or more parts of the project. Use the ways in which students personalize their projects to make more informed decisions regarding the selection of future projects.
4. While it is clearly important for students to make a project that gives them a sense of personal accomplishment, there is evidence to suggest that many students value working with their peers. Therefore it might be desirable to have students work in teams, and include features that require collaboration with other students.
5. Survey students to obtain feedback on the projects being used in class. Include questions related to what kinds of projects they would like to make, why they are taking the class, and what they hope to gain from the class. The survey will give students a sense of ownership in their learning experience, by giving them an opportunity to express their opinions and concerns.
6. Develop a list of the skills needed to complete each project. Make students aware of the fact that they will be developing new skills during the course of making each project. Present these skills in a wide range of potential applications within the world of work as well as everyday life.

# References

American Industrial Arts Association. (1963). *Industrial arts education; Purposes, program, facilities, instruction.* Bloomington, IL: Author.

Bennett, C. A. (1917). *The Manual Arts*. Peoria, IL: Manual Arts Press.

Gurian, M. (2001). *Boys and Girls Learn Differently*. San Francisco, CA: Josey-Bass.

Hutchinson, J., & Karsnitz, J. R. (1994). *Design and Problem Solving in Technology.* Albany, NY: Delmar.

International Technology Education Association. (2000). *Standards for technological literacy: Content for the study of technology.* Reston, VA: Author.

Liu, Y. (2003). The aesthetic and the ethic dimensions of human factors and design. *Ergonomics*, *46*(13/14), 1293-1305.

McCade, J. (1990). Problem solving: Much more than just design. *Journal of Technology Education, 2*(1), 1-13.

Phillips, K. (1985). *A progression of technology, in technology education: A perspective of implementation.* Reston, VA: International Technology Education Association.

Silverman, S., & Pritchard, A. M. (1994). *Building their future II: High school girls in technology education in Connecticut.* Hartford, CT: The Vocational Equity Research, and Evaluation Center. (Eric Document Reproduction Service No. ED 376 309)

Welty, K., & Puck, B. (2001). *Modeling Athena: Preparing young women for work and citizenship in a technological society*. Madison, WI: Department of Public Instruction

# Bibliography

American Industrial Arts Association. (1963). *Industrial arts education; Purposes, program, facilities, instruction.* Bloomington, IL: Author.

Bennett, C. A. (1917). *The Manual Arts*. Peoria, IL: Manual Arts Press.

Braundy, M., O'Riley, P., & Petrina, S. (2000). Missing xx chromosomes or gender in/equity in design and technology education? The case of British Columbia. *Journal of Industrial Teacher Education*, *37*(3). Retrieved July 12, 2004,from http://scholar.lib.vt.edu/ejournals/JITE/v37n3/braundy.html

Boser, R.A., Palmer, J.D., & Daugherty, M.K. (1998). Students attitudes towards technology in selected technology education programs. *Journal of Technology Education*, *10*(1), 4-19.

Boudria, T.J. (2002). Implementing a project-based technology program for high school women. *Community College Journal of Research and Practice*, *26*: 709-722.

Burke, M.P., Jr. (1995). Bridge aesthetics: World view. *Journal Of Structural Engineering*, *121*(8), 1252-1257.

Cummings, P.L., Jensen, M., & Todd, R. (1987). Facilities for technology education. *The Technology Teacher*, *46*(7), 7-10.

Dailey, D.W. (1998). Promoting gender equity through technology day camp. *The Journal of Technology Studies*, *24*(1). Retrieved July 12, 2004, from http://scholar.lib.vt.edu/ejournals/JOTS/winter-spring-1998/dailey.html

Davies, I., Fulop, M., Hutchings, M., Ross, A., & Vari-Szilagyi, I. (2001). Enterprising citizens? Perceptions of citizenship education and enterprise education in England and Hungary. *Educational Review*, *53*(3), 262-269.

Deuchar, R. (2004). Changing paradigms- the potential of enterprise education as an adequate vehicle for promoting and enhancing education for active and responsible citizenship: Illustrations from a Scottish perspective. *Oxford Review of Education, 30*(2), 223-239.

Erkkila, K. (1996, July). Enterprise education in the case of Finland. Paper presented at the World Congress of Comparative Education Societies, Sydney, Australia.

Flowers, J. (1998). Problem solving in technology education. *Journal of Technology Education. 10*(1), 20-26.

Flowers, J. (1998). Improving female enrollment in technology education. *The Technology Teacher, 58*(2), 21-25.

Foster, P.N., & Wright, M.D. (2001). How children think and feel about design and technology: Two case studies. *Journal of Industrial Teacher Education, 38*(2). Retrieved July 12, 2004, from http://scholar.lib.vt.edu/ejournals/JITE/v38n2/foster.html

Gloeckner, G.W., & Knowlton, L.K. (1996). Females in technology education: The obligations of a democratic society. *The Technology Teacher, 55,* 47-49.

Gurian, M. (2001). *Boys and Girls Learn Differently.* San Francisco, CA: Josey-Bass.

Haynie, W.J., III. (1999). Cross gender interaction in technology education: A survey. *Journal of Technology Education, 10*(2). Retrieved June 24, 2000, from http://scholar.lib.vt.edu/ejournals/JTE/v10n2/haynie.html

Haynie, W.J., III. (2005). Where the women are: Research findings on gender issues in technology education. *The Technology Teacher, 64*(1) 12-16.

Herschbach, D.R. (1997). From industrial arts to technology education: The eclipse of purpose. *The Journal of Technology Studies*, *23*(2), 20-27.

Huddleson, P., & Oh, S. (2004). The magic roundabout: Work-related learning within the 14-19 curriculum. *Oxford Review of Education*, *30*(1), 83-103.

Hutchinson, J., & Karsnitz, J. R. (1994). *Design and Problem Solving in Technology.* Albany, NY: Delmar.

International Technology Education Association. (2000). *Standards for technological literacy: Content for the study of technology.* Reston, VA: Author.

Kolodner, J.L. (2002). Facilitating the learning of design practices: Lessons learned from an inquiry into science education. *Journal of Industrial Teacher Education*, *39*(3). Retrieved July 12, 2004, from http://scholar.lib.vt.edu/ejournals/JITE/v39n3/kolodner.html

Lewis, T., Petrina, S., & Hill, A. M. (1998). Problem posing: Adding a creative increment to technological problem solving. *Journal of Industrial Teacher Education*, *36*(1). Retrieved July 12, 2004, from http://scholar.lib.vt.edu/ejournals/JITE/v36n1/lewis.html

Liu, Y. (2003). Engineering aesthetic and aesthetic ergonomics: Theoretical foundations and a dual process research methodology. *Ergonomics*, *46*(13/14), 1273-1292.

Liu, Y. (2003). The aesthetic and the ethic dimensions of human factors and design. *Ergonomics*, *46*(13/14), 1293-1305.

McCade, J. (1990). Problem solving: Much more than just design. *Journal of Technology Education, 2*(1), 1-13.

Ndahi, H. (2002). Gender inequity in industrial and technical education in Nigeria: Parent's perspectives in the 21st century. *Journal of Industrial Teacher Education, 39*(2). Retrieved July 12, 2004, from http://scholar.lib.vt.edu/ejournals/JITE/v39n2/ndahi.html

Pannabecker, J.R. (1991). Technological impacts and determinism in technology education: Alternate metaphors from social constructivism. *Journal of Technology Education, 3*(1), 1-11.

Phillips, K. (1985). *A progression of technology, in technology education: A perspective of implementation.* Reston, VA: International Technology Education Association.

Rogers, G. (1998). Concerns about technology education laboratories. *Journal of Industrial Teacher Education, 35*(3), 93-96. Retrieved June 22, 2002, from http://scholar.lib.vt.edu/ejournals/JITE/v35n3/rogers.html

Sanders, M. (2001). New paradigm or old wine? The status of technology education practice in the United States. *Journal of Technology Education, 12*(2), 35-55.

Shacklock, G., Hattam, R., & Smyth, J. (2000). Enterprise education and teacher's work: Exploring the links. *Journal of Education and Work, 13*(1), 41-60.

Silverman, S., & Pritchard, A. M. (1993). *Building their future: Girls in technology education in Connecticut.* Hartford, CT: The Vocational Equity Research, and Evaluation Center. (Eric Document Reproduction Service No. ED 362 650)

Silverman, S., & Pritchard, A. M. (1994). *Building their future II: High school girls in technology education in Connecticut.* Hartford, CT: The Vocational Equity Research, and Evaluation Center. (Eric Document Reproduction Service No. ED 376 309)

Spears, J.D., Dyer, R.A., Frank, S.E., & Montelone, B. A. (2004). Building a network to support girls and women in science, technology, engineering, and mathematics. *Journal of Women and Minorities in Science and Engineering, 10*: 161-177.

Volk, K., & Holsey, L. (1997). TAP: A gender equity program in high school technology. *The Technology Teacher, 56,* 10-13.

Welty, K. (1999). Looking for the basics through different lenses. *Journal of Industrial Teacher Education, 36*(4). Retrieved July 12, 2004, from http://scholar.lib.vt.edu/ejournals/JITE/v36n4/welty.html

Welty, K., & Puck, B. (2001). *Modeling Athena: Preparing young women for work and citizenship in a technological society*. Madison, WI: Department of Public Instruction

Wicklein, R.C. (2000). Identifying critical issues and problems in technology education using a modified-Delphi technique. *Journal Of Technology Education, 10*(2), 54-71.

Zuga, K. F. (1989). Relating technology education goals to curriculum planning. *Journal of Technology Education, 1*(1), Retrieved July 12, 2004, from http://scholar.lib.vt.edu/ejournals/JTE/v1n1/zuga.jte-v1n1.html

Zuga, K. F., & Bjorkquist, D.C. (1989). The search for excellence in technology education. *Journal of Technology Education, 1*(1), Retrieved July 12, 2004, from http://scholar.lib.vt.edu/ejournals/JTE/v1n1/zugabjor.jte-v1n1.html

Zuga, K. F. (1999). Addressing women's ways of knowing to improve the technology education environment for all students. *Journal of Technology Education, 10*(2), 57-71.

# APPENDIX A

SURVEY INSTRUMENT.

# APPENDIX A

## I Want Your Input Survey.

**Key Ring Project:**

1. **If a class made this project would it be more appealing to work:**

   A. **together to make a lot of them by having classmates specialize in one step of the process?**
   B. **alone to make one for yourself by completing all steps of the process?**

2. **Would it be more appealing to make this project to:**

   A. **solve an everyday problem?**
   B. **fulfill a course requirement?**

3. **Would it be more appealing to:**

   A. **add features to it in order to give it a personal touch?**
   B. **follow a set of plans to make it exactly like the one in the picture?**

4. **Would it be more appealing to use this project to:**

   A. **develop a set of skills needed for a future career?**
   B. **give someone a gift that you made?**

**Desk Set Project:**

5. **If a class made this project would it be more appealing to work:**

   A. **together to make a lot of them by having classmates specialize in one step of the process?**
   B. **alone to make one for yourself by completing all steps of the process?**

6. **Would it be more appealing to make this project to:**

   A. **solve an everyday problem?**
   B. **fulfill a course requirement?**

7. **Would it be more appealing to:**

   A. **add features to it in order to give it a personal touch?**
   B. **follow a set of plans to make it exactly like the one in the picture?**

8. Would it be more appealing to use this project to:

   A. develop a set of skills needed for a future career?
   B. give someone a gift that you made?

**This research has been approved by the UW-Stout IRB as required by the Code of Federal Regulations Title 45 Part 46.**

Yard Sign Project:

9. If a class made this project would it be more appealing to work:

   A. together to make a lot of them by having classmates specialize in one step of the process?
   B. alone to make one for yourself by completing all steps of the process?

10. Would it be more appealing to make this project to:

   A. solve an everyday problem?
   B. fulfill a course requirement?

11. Would it be more appealing to:

   A. add features to it in order to give it a personal touch?
   B. follow a set of plans to make it exactly like the one in the picture?

12. Would it be more appealing to use this project to:

   A. develop a set of skills needed for a future career?
   B. give someone a gift that you made?

# APPENDIX B

## LETTER OF CONSENT

APPENDIX B

**Consent to Participate In UW-Stout Approved Research**

**Title:** Identifying projects for a Manufacturing Class attentive to Males and Females

**Investigator:**
*Michael Dodge*
*Ph: 262-376-5643*
*E-mail: mdodge@grafton.k12.wi.us*
GHS Room C-3

**Research Sponsor:**
Dr. Kenneth Welty
**email:** WeltyK@uwstout.edu
**Office:** 224D Com Tech Bldg
**Phone:** 232-1206

Dear Parent or Guardian:

I teach the manufacturing and machining courses at Grafton High School. I am currently writing a research paper in an effort to earn my master's degree. This paper involves the identification of projects attentive to the learning needs of both male and female students. In order to identify these projects, I will need to complete a study involving your student. The study will involve a survey administered to students through the use of a power point presentation. The presentation will require students to answer questions related to projects shown on the slide.

The only risk to your student is the loss of time needed to fill out the survey. The benefits include: increased awareness of student interest in projects. Improvement and refinement of the current projects offered in manufacturing courses. Important instructor knowledge gained about student interests and perceptions about manufacturing courses offered at GHS.

Students will be asked to complete the ten-minute survey during a class (most likely a study hall) or lunch period. The information contained in the survey will be kept confidential. Students will sign a piece of paper stating they choose to take part in the study, this will be separate from the survey and used for record keeping purposes. Your student participation in the survey is completely voluntary. His or her name will not be included on the survey document, and we do not believe that your student can be identified from any of this information. You may choose to not have your student participate without any adverse consequences to your student. Should your student choose to participate and later wish to withdraw from the study, he/she may discontinue participation at any time without incurring adverse consequences."

This study has been reviewed and approved by The University of Wisconsin-Stout's Institutional Review Board (IRB). The IRB has determined that this study meets the ethical obligations required by federal law and University policies. If you have questions or concerns regarding this study please contact the Investigator or Advisor. If you have any questions, concerns, or reports regarding your rights as a research subject, please contact the IRB Administrator.

**Investigator:**
*Michael Dodge*
*262-376-5643*
Services
*mdodge@grafton.k12.wi.us.*

**Advisor:**
*Dr. Kenneth Welty*
1-715-232-1206
WeltyK@uwstout.edu

**IRB Administrator**
Sue Foxwell, Director, Research

152 Vocational Rehabilitation Bldg.
UW-Stout
Menomonie, WI 54751
715-232-2477
foxwells@uwstout.edu

**Statement of Consent:**
*This section should include the language,* "By signing this consent form you agree to participate in the project entitled, **(Identifying projects for a Manufacturing Class attentive to Males and Females)**

_____
Signature..... Date

_____
Signature of parent or guardian:..... Date
(If minors are involved)

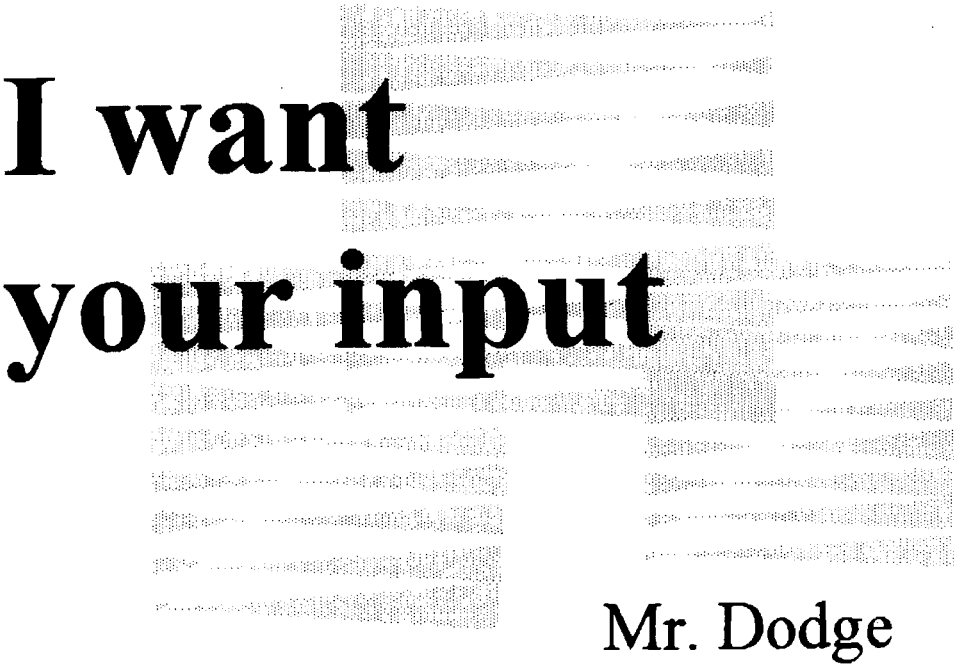
Each student's name will not be included on the survey documents. We do not believe that your student can be identified from any of this information. Your student's participation in this study is entirely voluntary

# APPENDIX C

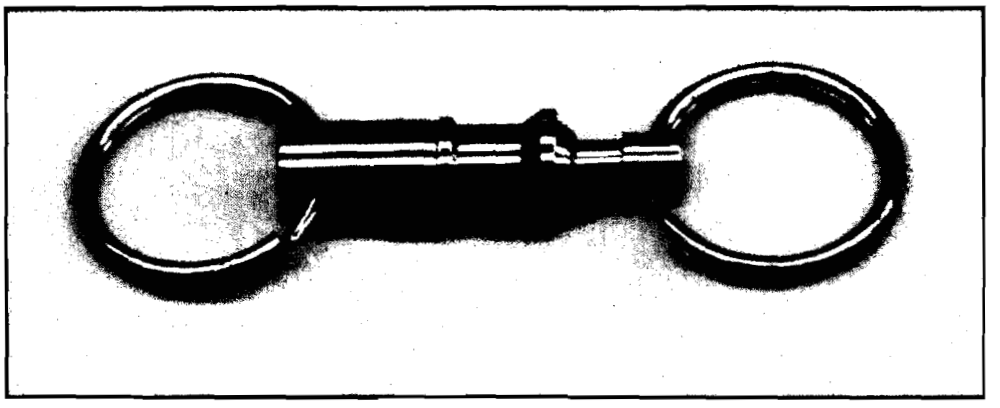
## POWERPOINT SURVEY

APPENDIX C

POWERPOINT SURVEY

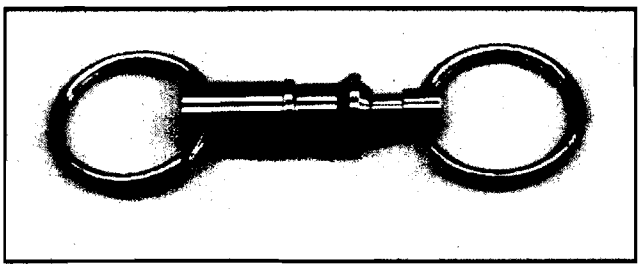


# Key Ring Project



If a class made this project, ...

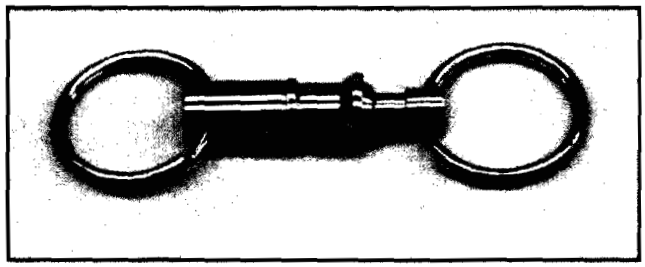
...would it be more appealing to work:



A. together to make a lot of them by having classmates specialize in one step of the process?

B. alone to make one for yourself by completing all steps of the process?

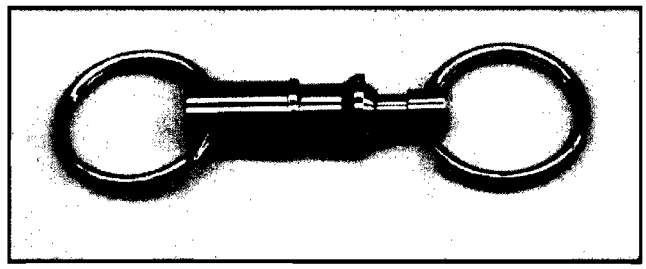
Would it be more appealing to make this project to:



A. solve an everyday problem?

B. fulfill a course requirement?

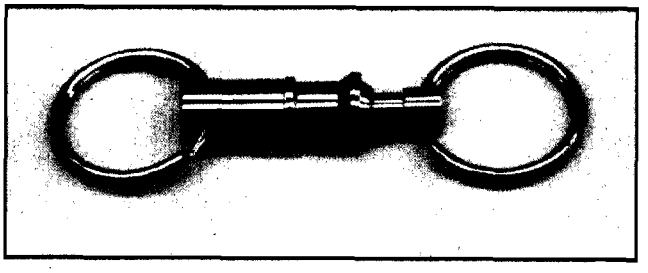
Would it be more appealing to:



A. add features to it in order to give it a personal touch?

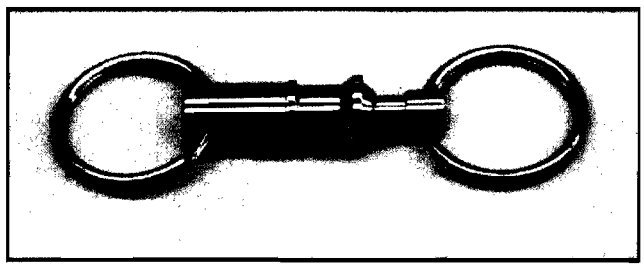
B. follow a set of plans to make it look exactly like the one in the picture?

Would it be more appealing to:



A. add features to it in order to give it a personal touch?
B. follow a set of plans to make it look exactly like the one in the picture?

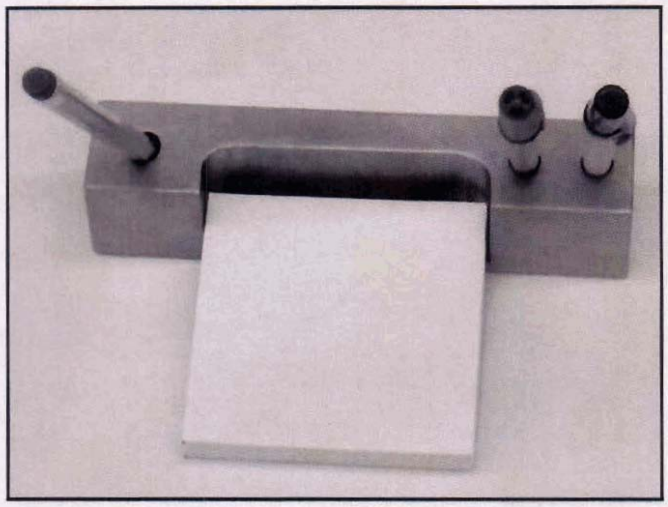
Would it be more appealing to use this project to:



A. develop skills needed for a future career?

B. give someone a gift that you made?

# Desk Set Project

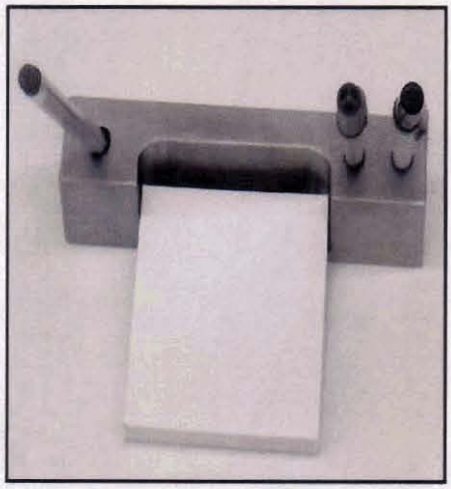


If a class made this project, …

...would it be more appealing to work:

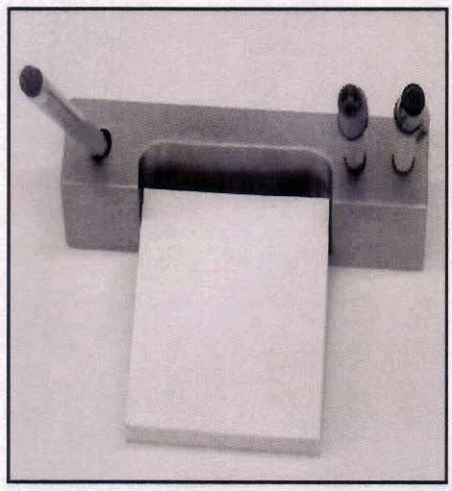
A. together to make a lot of them by having classmates specialize in one step of the process?

B. alone to make one for yourself by completing all steps of the process?



Would it be more appealing to make this project to:

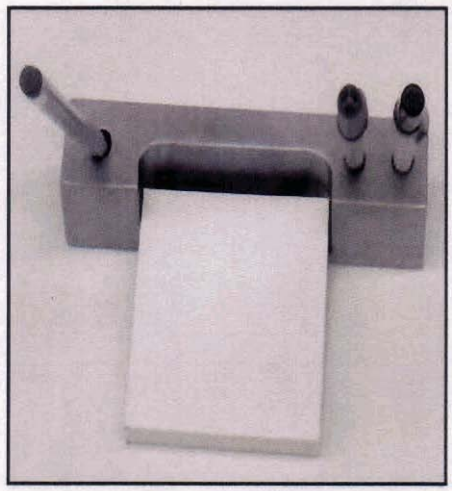
A. solve an everyday problem?
B. fulfill a course requirement?



Would it be more appealing to:

A. be able to add features to give the project a personal touch?

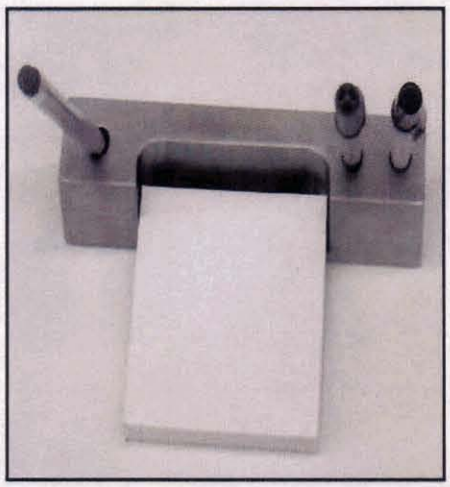
B. follow a set of plans to make it look exactly like the one in the picture?



Would it be more appealing to use this project to:

A. develop skills needed for a future career?

B. give someone a gift that you made?



# Yard Sign Project

If a class made this project, …

If a class made this project, would it be more appealing to work:

A. together to make a lot of them by having classmates specialize in one step of the process?

B. alone to make one for yourself by completing all steps of the process?

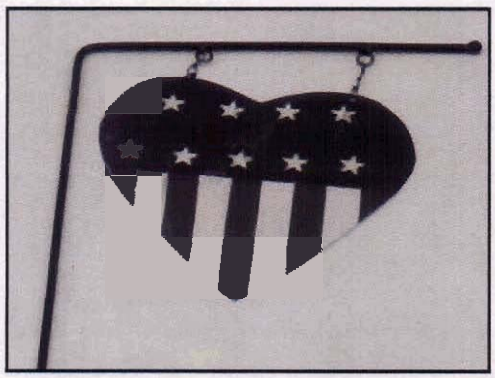
Would it be more appealing to make this project to:

A. solve an everyday problem?
B. fulfill a course requirement?

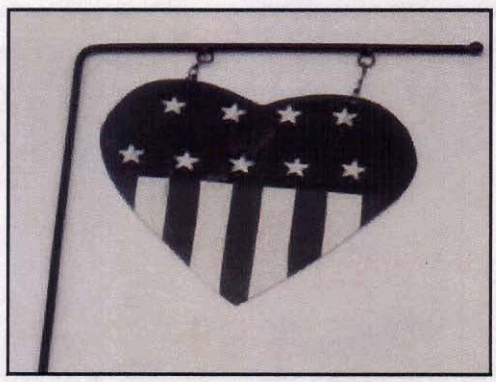
Would it be more appealing to:

A. be able to add features to give the project a personal touch?

B. follow a set of plans to make it look exactly like the one in the picture?



Would it be more appealing to use this project to:

A. develop skills needed for a future career?

B. give someone a gift that you made?