ADVANCED AGRICULTURAL MECHANICS: FABRICATION
AND PROJECT CONSTRUCTION CURRICULUM

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A Project
Presented
to the Faculty of
California State University, Chico

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In Partial Fulfillment
of the Requirements for the Degree
Master of Science
in
Agricultural Education

__________

by
Bryan Dodson
Spring 2014
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AND PROJECT CONSTRUCTION CURRICULUM

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The purpose of this project is to create curriculum that provides secondary students enrolled in agricultural mechanics courses at Liberty Ranch High School with the practical and real-world opportunities to apply their skills and knowledge. Current curriculum in the agricultural mechanics discipline provide ample opportunities to build and develop skills in welding technique, however it does not equip students with valuable application experience within the fabrication and construction skill areas. Through the use of a student-completed needs assessment and literature review of research and trade industry-related publications, it is evident that both welding technique and fabrication knowledge are essential competencies desired by employers in the metal fabrication industry. This project began with the review of the agriculture mechanics section of the
California Content Standards. As with all curriculum creation, standards provide the foundation for curricular objectives and creation. The initial step within the methods was to create the instrument. Once the instrument was created and administered, the results, coupled with the California Content Standards and a review of other program’s curriculum, were used to craft the course learning objectives. The course learning objectives were then organized within units to create a complete course unit plan. Once the unit plan was created, a course syllabus was generated, which includes a course description, course procedures, and grading policy. Once these steps were completed, each unit was created, adding specific activity sequences, assessment, and material lists, which finalized the curriculum.
CHAPTER I

INTRODUCTION

Purpose of the Project

Purpose

The purpose of this project is to provide students enrolled in agricultural mechanics courses at Liberty Ranch High School educational training in the areas of metal fabrication and project construction. Our current program does an exceptional job in equipping students with knowledge and training in welding technique. In fact, it is one of the few institutions in California that provides welding certification through the California Industrial and Technology Education Association (CITEA). With that being said, there is room for improvement, specifically in the area of design, fabrication, and construction. It is in that vein of improvement that this curriculum was designed and created. My interest in welding and metal fabrication began during my high school experience, during which I had the opportunity to be a part of a program that focused on welding technique and fabrication. I believe it is crucial that students are challenged to apply skills and knowledge in real-world applications. This curriculum allows students to comprehensively understand welding and fabrication through methodically building. It is my hope that one day this curriculum will be implemented in our program and district.
Scope of Project

This project consists of four primary components: student-completed needs assessment; course syllabus; unit outline; and unit plan. Over 100 Liberty ranch High School students completed the Student Needs Assessment designed to gauge the attitudes towards an agricultural fabrication course. A number of resources were used to create this curriculum, including the California Content Standards, instructional texts, and current curriculum in use at other schools. The goal is to integrate this curriculum into the Liberty Ranch Agriculture Mechanics Pathway.

Significance of Project

This curriculum will better prepare students in our program for a wider breadth of careers in construction-related industries, especially those closely tied to metal fabrication. The course learning outcomes differ from the current course, adding objectives focused on fabrication concepts including layout, metallurgy, design, technical drawing interpretation, and project planning. With the addition of these learning objectives, students will be better prepared to design projects and/or interpret technical plans, formulate precise materials list, generate accurate cut list, design a logical task sequence, demonstrate accurate layout procedure, utilize effective weld placement procedures, and determine appropriate finishing procedures. These skills and competencies would improve the comprehensive knowledge and ability of our student and expand employability. In addition, this
course while provide service to our community, who have expressed the need for this type of curriculum.

Definition of Terms

Arc

The physical gap between the end of the electrode and the base metal. The physical gap causes heat due to resistance of current flow and arc rays.

Design

The use of geometry, physics, and understanding of construction to create an object or structure.

Flux Cored Arc Welding (FCAW)

An arc welding process which melts and joins metals by heating them with an arc between a continuous, consumable electrode wire and the work. Shielding is obtained from a flux contained within the electrode core. Added shielding may or may not be provided from externally supplied gas or gas mixture.

Gas Metal Arc Welding

An arc welding process, which joins metals by heating them with an arc. The arc is between a continuously fed filler metal (consumable) electrode and the work piece. Externally supplied gas or gas mixtures provide shielding. Common MIG welding is also referred to as short circuit transfer. Metal is deposited only when the wire actually touches the work. No metal is transferred across the arc. Another method of MIG welding, spray transfer moves a stream of tiny molten droplets across the arc from the electrode to the weld puddle.
Gas Tungsten Arc Welding

Often called TIG welding (Tungsten Inert Gas), this welding process joins metals by heating them with a tungsten electrode which should not become part of the completed weld. Filler metal is sometimes used and argon inert gas or inert gas mixtures are used for shielding.

Layout

The transfer of a design onto a work-piece.

Metallurgy

The science and technology of metals and their alloys.

Metal Fabrication

An industrial term refers to building metal structures by cutting, bending, and assembling through welding and use of various fasteners.

Oxy Fuel Cutting

A process, using a different type of gas torch, called a cutting torch. Here the metal is heated until it glows orange (around 1800°F = 982°C), and then a lever on the torch is pressed to pass a stream of oxygen through the work-piece, to burn the steel away where the cut is desired. The iron-oxide product of this combustion process falls to the floor as a dust. Once the process is started properly, there should be no globs of melted steel under the work-piece. No melting should occur.

Oxy Fuel Welding

A joining process that uses a mix of gases to fuel a torch to join two metal parts.
Plasma Arc Cutting

An arc cutting process which severs metal by using a constricted arc to melt a small area of the work. This process can cut all metals that conduct electricity.

Shielded Metal Arc Welding

An arc welding process which melts and joins metals by heating them with an arc, between a covered metal electrode and the work. Shielding gas is obtained from the electrode outer coating, often called flux. Filler metal is primarily obtained from the electrode core. An AC/DC welder is recommended for Stick. For most applications, DC reverse polarity welding offers advantages over AC, including easier starts and out-of-position welding, smoother arc and fewer arc outages and sticking.

Spot Welding

Usually made on materials having some type of overlapping joint design. Can refer to resistance, MIG or TIG spot welding. Resistance spot welds are made from electrodes on both sides of the joint, while TIG and MIG spots are made from one side only.

Task Sequence

The order in which you construct a metal object or structure.

Tack Weld

A joint between two pieces of metal made by welding at isolated points.
Welding

To join (metals) by applying heat, sometimes with pressure and sometimes with an intermediate or filler metal having a high melting point.
CHAPTER II

REVIEW OF LITERATURE

A pragmatic and practical approach to the literature review for this project created three primary objectives; validate the need for this type of curriculum; research the best methods and practices for teaching such a course, and review similar curriculum to help guide the curriculum creation.

Pate Warnick, and Meyers (2012) published a Delphi study in the Career and Technical Education Research journal focusing on the critical skills needed by beginning teachers to teach welding. A panel of agricultural educators identified 49 skills and competencies that all beginning teachers should develop. Included in the before-mentioned skills were a variety of welding process skills, technical drawing interpretation, and project layout.

Through their 2010 study, Rhoades, Irani, Roberts, Snyder, and Brendemuhl studied the use and relationships between three measures of cognitive function: critical thinking disposition, problem solving style, and learning style when participants are encouraged to engage in their natural cognitive tendencies by being placed in an intense environment (Rhoades, Irani, Roberts, Snyder, & Brendemuhl, 2010). Their work validated the importance of integrating real-world problem solving and critical thinking into the curriculum.
Blackburn and Kelsey (2013) facilitated an instrumental case study, which aimed to evaluate the effectiveness of Authentic Assessments in agricultural mechanics. Knowledge construction, self-discipline and recognition of the value of learning are all fundamental themes of authentic learning. Authentic learning tasks aim to prepare students for real-world situations and problem solving, so they are prepared for similar obstacles in the future. Blackburn and Kelsey used individuals who routinely observe teachers to collect data and observe teachers who implement authentic tasks and assessments. After synthesizing the observation data, Blackburn and Kelsey constructed a four-part authentic assessment model, which is as follows; set high and fair expectations for students, implement progressive hierarchy of skills, student knowledge of progress, and teacher commitment to student success.

Anderson and Driskill (2012) focused on the integration of mathematics concepts and competencies in agricultural mechanics courses. This study is of interest due to the fact that many of the fabrication concepts require mathematical skills and knowledge. An electronic survey instrument was used to survey 26 agricultural educators, selected by an expert panel. The mean results indicated that mathematics concepts are integrated into 23% of agricultural mechanics lessons.

Although not focused specifically on technical skills, McLaughlin (1995) offered the single most worthwhile literature to validate the need for this curriculum from an industry perspective. One hundred employers and human resource professionals from a variety of technical trade industries completed questionnaires designed to assess the skills needed to be successful in today’s
workplace. The researchers then synthesized the data from the questionnaires to create an Employability Skills Profile. The THINK category was one significant area of need included in the Employability Skills Profile that was very helpful and strongly validated the curriculum created through this project. Employers strongly expressed the need for potential employees to be able to think critically and act logically to evaluate situations, solve problems and make decisions, understand and solve problems involving mathematics and use the results, use technology, instruments, tools, and information systems effectively, and access and apply specialized knowledge from various fields (McLaughlin, 1995). One of the principal differences between the curriculum created through this project and the curriculum currently taught in our district is that it forces students to think critically, evaluate problems, and apply solutions.

Another valuable potion of the Employability Skills Profile offered by McLaughlin’s (1995) research was the *working with others* category. Employers value a potential employees ability to plan and make decisions with others and support the outcomes and lead when appropriate, mobilizing the group for high performance (McLaughlin, 1995). As a part of the Fabrication and Project Construction curriculum, students will collaborate to solve fabrication problem, create projects, and fabricate based on their plans. The research conducted by McLaughlin (1995) reiterated the need for students to have critical thinking skills and the ability to work with others. Both criteria are significant focuses within the fabrication and project construction curriculum.
The fabrication and project construction curriculum utilizes experiential learning as the chief means to equip students with valuable skills and competencies needed in the metal fabrication and construction-related industries. Educational models built on a foundation of learning through process and experience have been widely respected and utilized for decades in education, specifically integrating concepts from Piaget, Dewey and Lewin. Known as an experiential learning innovator and author, Kolb (1984) created a four component experiential learning model that best outlines the most effective model of instruction for this curriculum. Kolb described his learning model, which is comprised of four components; concrete experience; observation; formulation or synthesis of concepts; followed by testing in new situations. One specific example of how this model would be utilized in this curriculum would be the use of fabrication problem scenarios. As a part of the fabrication techniques and practices unit, students are given a specific scenario to address a fabrication problem. Examples could include heat distortion, misalignment, out of square or unintentional tempering. Students will work in groups to develop a solution, implement their solution, observe the result, determine and evaluate the effectiveness of their solution. This process will provide students with concrete concepts, and apply those concepts in other applications.

Brooker and Bulter (1997) studied the effectiveness of on-site learning through apprenticeships. The researchers study apprentices at six separate locations for a four year period. Students spent eight weeks out of the year in formal training and the rest of the year engaged in on-site apprentice training. Apprentices
were asked to rate a group of learning pathways on a scale of one (1) being least helpful and five (5) most helpful. The learning pathways that received the highest rating included: having good points and faults of work pointed out; practice with supervision; looking at professionally-done work; and working on thins with other workers. This information is very helpful, because it shows that learning comes from guided practice in real-world situations.

Marlow (2002) asserted that welding and metal fabrication requires much more knowledge then simply being able to create a perfect welding bead. It requires an understanding of layout, sequence, and fabrication technique. Marlow also points out that some companies provide pre-established sequencing for fabrication and construction, but those already familiar with proper fabrication techniques are that much better prepared.

A complete and thorough review of the current Advanced Agriculture Mechanics curriculum currently being taught in our district was conducted. The current curriculum has some very necessary and beneficial components that I have decided to keep and integrate in the new curriculum. In addition, two examples of curriculum from other district were reviewed to help guide the creation of the curriculum. The before-mentioned curriculum was selected from programs and instructors that have sound fabrication programs. Curriculum from Paso Robles High School and Galt High School were selected and reviewed. This review provided insight on objectives, sequencing, pacing, and course organization. Carefully reviewing these works was probably the single most helpful step in the entire
creation process. The last piece of literature review was to review the California Content Standards for the Agriculture Mechanics area and Foundational Standards. These standards include:

B5.3 Know layout skills.

B7.5 Know basic repair skills using a variety of techniques, including brazing and hard surfacing.

B8.2 Apply gas metal arc welding, shielded metal arc welding, or flux core arc welding processes to fusion-weld mild steel with appropriate welding electrodes and related equipment.

B8.3 Weld a variety of joints in various positions.

B8.4 Know how to read welding symbols and plans, select electrodes, fit-up joints, and control heat and distortion.

B9.1 Understand metallurgy principles, including distortion, hardening, tempering, and annealing.

B9.3 Operate and maintain fabrication tools and equipment safely and appropriately.

B9.5 Understand how to finish a metal project by implementing proper sequencing.

B9.6 Know how to manipulate and finish metal by using a variety of machines and techniques (e.g., lathe, mill, CNC plasma, shears, press break).

B9.7 Construct a welding project (using any electric welding process, appropriate products, joints, and positions), including interpreting a plan,
developing a bill of materials, selecting materials, and developing a clear and concise fabrication contract. In summary, there are several helpful studies that support the effectiveness of experiential and authentic learning, shed light on successful skill and competency progression, and affirm the need for technical skills in the area of fabrication and problem solving skills.
CHAPTER III

METHODOLOGY

The purpose of this project is to create curriculum that provides secondary students enrolled in agricultural mechanics courses at Liberty Ranch High School with the practical and real-world opportunities to apply their skills and knowledge. The following objectives were established; (1) collect data from current students concerning their perception of what purpose an advanced agricultural mechanics course should serve, (2) evaluate data, (3) review literature and similar curricula, (4) craft unit plan, and (5) create course syllabus. Purposeful sampling was used to select the sample group. Students who completed the needs assessment were in the later stages of completing the agricultural mechanics I course, which is the introductory course in the Agriculture Mechanics Pathway at Liberty Ranch High School. The next course in the pathway is agriculture mechanics II, which focuses on basic welding skill and competency. Following completion of agriculture mechanics II, students proceed onto the advanced agriculture mechanics course. The 108 students that comprised the four Agricultural Mechanics I sections at Liberty Ranch High School, completed a needs assessment (see Appendix A). The first step of creating the instrument was to identify the attitude to be measured. The next step was to create a list of statements covering all aspects of the topic. Statements were
reviewed to ensure the correct attitude was measured. The instrument was reviewed for content and face validity. After the statements were finalized, they were formatted to measure intensity. Another methodology improvement would be to run a pilot test.

The student needs assessment was comprised of ten statements, in which a simple Scale (Likert, 1932) required students to assign a number ranking based on the degree in which agreed with the statement or attitude. Using a five point Likert Scale (Likert, 1932), for each statement, students were asked to assign a ranking based on their level of agreement; 1 being Strongly Disagree, 2 being Somewhat Disagree, 3 being Not Sure, 4 being Agree, and 5 being Strongly Agree. Although the actual project is not intended to create theoretical or scientific results, the results of the student needs assessment were crucial to validating and affirming the need for this project. The Student Needs Assessment can be viewed in Appendix A.

Using the needs assessment, literature review, curriculum standards, and sample curriculum, a unit plan, outlining the focus of each unit and the objectives to be addressed was created (see Appendix B). The goal was to maintain the sound fundamental development concepts currently taught through the current course, but build upon those concepts later in the year through adding units focusing on creating and reading project plans, metallurgy, and fabrication practices. Following completion of the unit plan, a course syllabus outlining the course policies and procedures, including course description, grading, and attendance policy was created (see Appendix C). The final step was to expand the unit plan to include
instructional methods, assessment, and activity sequences. Sample curriculums identified instructional methods used in other districts guided the methods and practices selected for this curriculum project.

Using a five point Likert Scale, for each statement, students were asked to assign a ranking based on their level of agreement; 1 being Strongly Disagree, 2 being Somewhat Disagree, 3 being Not Sure, 4 being Agree, and 5 being Strongly Agree. The results of the Likert Scale are provided in Table 1.

Table 1

_Agricultural Mechanics Pathway Feedback_

<table>
<thead>
<tr>
<th>Student Perceptions of Mechanics Curriculum (n = 108)</th>
<th>Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have or plan to take one or more Agriculture Mechanics courses at Liberty Ranch High School because I enjoy working with my hands.</td>
<td>4.6</td>
</tr>
<tr>
<td>I have or plan to take one or more Agriculture Mechanics courses at Liberty Ranch High School because I enjoy leaning by doing.</td>
<td>4.6</td>
</tr>
<tr>
<td>I have or plan to take one or more Agriculture Mechanics courses at Liberty Ranch High School because I enjoy building things.</td>
<td>4.9</td>
</tr>
<tr>
<td>I have or plan to take one or more Agriculture Mechanics courses at Liberty Ranch High School because I enjoy solving problems and critically thinking.</td>
<td>3.9</td>
</tr>
<tr>
<td>I plan or am thinking about entering a mechanically related field.</td>
<td>4.3</td>
</tr>
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</table>
Table 1 (Continued)

<table>
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<tr>
<th>Student Perceptions of Mechanics Curriculum ($n = 108$)</th>
<th>Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>I believe the ability to apply skills to real-world applications is important.</td>
<td>4.4</td>
</tr>
<tr>
<td>I believe it would be helpful to understand how to build things from start to finish, including reading plans, creating a budget, materials list, and project sequence.</td>
<td>4.7</td>
</tr>
<tr>
<td>I would take great pride in building a project in shop class and exhibiting it at a fair or show.</td>
<td>4.9</td>
</tr>
<tr>
<td>I would be interested in learning how to not only build and fabricate projects, but market them to local business and customers.</td>
<td>3.5</td>
</tr>
<tr>
<td>I believe it is beneficial for those who work in the mechanic or construction fields to understand how to problem solve on real-world applications.</td>
<td>4.2</td>
</tr>
</tbody>
</table>
CHAPTER IV

RESULTS

The results of the student needs assessment were very favorable. Results from question one yielded a mean ranking score of 4.6. These results indicate that many of the students surveyed value a kinesthetic approach to learning and plan to take another course in the Agriculture Mechanics Pathway. Similar to statement one, students responded favorably to statement number two, with a mean ranking of 4.6. This result was encouraging because it indicates students not only recognize the value of experiential learning, but find it to be an effective way to learn. Only three students did not assign a ranking of five, which may suggest their approval of project-based learning. The mean ranking for statement four was a 3.9, suggesting most students agreed that solving problems and thinking critically is valuable. Most adults would likely assert that problem solving and critical thinking skills are invaluable in the work place and life in general. A majority of the students that completed this student needs assessment were in the later stages of their ninth grade year. Ninth grade students may not be prepared to consider their future career goals. However, nearly 80% indicated that they agreed, somewhat agreed, or strongly agreed with statement five. It appears they have given thought to their vocational plans and many of them are considering a career in the mechanics or
construction industries. This suggests teaching fabrication skills are important to prepare students to enter the workforce in these industries. Problem solving, critical thinking, and team working skills implemented though the curriculum would prove vital to their success.

The results from question six provides additional insightful. People may inherently ask themselves at one point in time during their educational career, what is in it for me? Why do I need to know this? When will I ever use this sill/concept? Students assigned statement six an mean score of 4.4, which indicates they long for skills that apply to real life. Equipping students with these skills is the primary motivation for creating the Fabrication and Project Construction curriculum. The mean score for statement number seven was a 4.7, which indicated students recognize the benefits of being able to understand the construction process from a comprehensive perspective. Almost every student assigned a five to question number eight. Students generally take great pride in exhibiting items they build. There is a unique sense of accomplishment associated with such an opportunity, as validated from statement eight. Students were unsure about number nine, which proposed the idea of marketing and advertisement. They assigned a mean score of 3.5 to that statement. The results for statement 10, which synthesized concepts from statements four and six were favorable, with a mean score of 4.2. The results from the Student Needs Assessment certainly validated that students would be interested in such a course and find the course content valuable and applicable. Hopefully this
curriculum will better prepare students to be competitive in the job market and provide them skills that make them valuable assets to the industry.
CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The curriculum is based on the results of the Student Needs Assessment. The results of the needs assessment also proved to be valuable during the formation of the course syllabus. If this curriculum were to be implemented, the needs assessment data would be very helpful when proposing such a curriculum to our school district for approval. These results would also be important to share with our Agricultural Advisory Committee. The curriculum is consistent with the needs of the trade industries and incorporates concepts and content used by other successful programs. The curriculum addresses standards listed in the Agriculture Mechanics and Foundational Standards areas of the California Content Standards. The Student Needs Assessment also called for project-based, hands-on, experiential learning that equips students with skills.

Recommendations

Writing new curriculum, that is relevant, innovative, and needs-based can be challenging. It is important to gauge stakeholders and including them in the process and decision-making. To further validate the need for this curriculum,
facilitating an industry and employer needs assessment would be encouraged. The data from such an instrument would gain feedback from stakeholders, which would potentially help one not only validate the need for curriculum, but help guide the shaping and molding of that curriculum. In addition, the reviewing of other curriculum samples is critically important. Although the goal was to create a curriculum that is unique and different, garnering ideas and concepts from other programs was beneficial. The educational system in the United State is in the midst of significant change, with the transition from standardized testing to Common Core. Those creating curriculum must ensure that their work aligns with state and federal requirements and meets the most current standards for the respective discipline. It is also critical for Career Technical Education curriculum to meet the most current industry trends. In regards to future relate work, state and federal standards and industry feedback must be the driving forces that help shape curriculum projects.
REFERENCES
REFERENCES


Liberty Ranch Agriculture Department

Proposed New Course Needs Assessment

Student Version

Name(optional): ____________________________

Thank you for agreeing to complete this needs assessment for the Liberty Ranch Agriculture Department. The goal of this assessment is to collect valuable information that will help our program better prepare students for today’s careers in agriculture and related fields. We are proposing offering a new course titled Advanced Agriculture Mechanics: Fabrication and Project Construction and greatly value your feedback concerning this proposal. Circle the corresponding number that beset describes your feelings concerning the question. Thank you!

**Ranking Scale**

1  Strongly Disagree
2  Somewhat Disagree
3  Not Sure
3  Agree
4  Strongly Agree

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<tr>
<th>#</th>
<th>QUESTION</th>
<th>RANKING</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>I have or plan to take one or more Agriculture Mechanics courses at Liberty Ranch High School because I enjoy working with my hands.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>2</td>
<td>I have or plan to take one or more Agriculture Mechanics courses at Liberty Ranch High School because I enjoy leaning by doing.</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>
3 I have or plan to take one or more Agriculture Mechanics courses at Liberty Ranch High School because I enjoy building things.

4 I have or plan to take one or more Agriculture Mechanics courses at Liberty Ranch High School because I enjoy solving problems and critically thinking.

5 I plan or am thinking about entering a mechanically related field.

6 I believe the ability to apply skills to real-world applications is important.

7 I believe it would be helpful to understand how to build things from start to finish, including reading plans, creating a budget, materials list, and project sequence.

8 I would take great pride in building a project in shop class and exhibiting it at a fair or show.

9 I would be interested in learning how to not only build and fabricate projects, but market them to local business and customers.

10 I believe it is beneficial for those who work in the mechanic or construction fields to understand how to problem solve on real-world applications.
APPENDIX B
# Liberty Ranch Agriculture Program Unit Plan

**Course:** Advanced Agricultural Mechanics: Fabrication and Project Construction  
**Unit:** Fabrication Techniques & Practices

<table>
<thead>
<tr>
<th>DAY</th>
<th>OBJECTIVES</th>
<th>ACTIVITY SEQUENCE</th>
<th>RESOURCES</th>
</tr>
</thead>
</table>
| 1   | 1. Describe fabrication techniques including layout, tacking, assembly, and fitting.  
     2. Describe how to create project plan. | **Student Project Slideshow**  
Show a series of pictures of projects students have built in an effort to build excitement about building and fabricating.  
**Process Project Slideshow**  
Ask a series of questions after the slideshow:  
1. What planning had to take place to build this project?  
2. What skills were needed to build these projects?  
**Introduce Class Demo Project**  
During this unit, the class will build a project and experience first-hand HOW to properly fabricate a project. This project will be very basic, a portable welding table. Show students project plan.  
**Fabrications Techniques & Practices Notes**  
Discuss steps to project plan:  
1. Materials List  
2. Budget  
3. Cut List  
4. Project Task Sequence | A. Student Project Slideshow PPT  
B. Portable Welding Table project plans  
C. Fabrication Techniques & Practices PPT |
| 2 | 1. Describe how to create project plan. | **Fabrications Techniques & Practices Notes**  
Discuss how to effectively create a Materials List and Budget.  
**Group Work: Materials List and Budget**  
Provide students with a copy of the project plans and price sheet. Instruct students that they will work in groups to create a materials list, and use that materials list and price sheet to create a budget.  
**Groups Share Out**  
Each group will share out their Materials List and Budget  
**Group Discussion**  
Discuss correct Materials List and Budget; point out mistakes made by students. | A. Fabrication Techniques & Practices PPT  
B. Project Plans  
C. Materials Price Sheets |
| 3 | 1. Describe how to create project plan. | **Fabrications Techniques & Practices Notes**  
Discuss how to effectively create a Cut List and Project Task Sequence.  
**Group Work: Cut List and Project Task Sequence**  
Provide students with a copy of the project plans and price sheet. Instruct students that they will work in groups to create a Cut List and Project Task Sequence.  
**Groups Share Out**  
Each group will share out their Cut List and Project Task Sequence.  
**Group Discussion**  
Discuss correct Cut List and Project Task Sequence; point out mistakes made by students. Specifically focus on | A. Fabrication Techniques & Practices PPT  
B. Project Plans |
<p>| | | |</p>
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<tbody>
<tr>
<td></td>
<td>1. Demonstrate how to use common and specialized metal fabrication tools. 2. Describe fabrication techniques including layout, tacking, assembly, and fitting.</td>
<td><strong>Metal Fabrication Tool/Equipment Gallery</strong> Demonstrate how to properly and safely use common and specialized metal fabrication tools. Focus specifically on cutting and shearing equipment including band saw, iron worker, and abrasive cut off saw. <strong>Began Project Construction:</strong> <strong>Assign Cut List tasks</strong> Assign each group or student a specific piece or group of pieces to cut.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>A. Metal Fabrication Tools and equipment</strong>  <strong>B. Project Materials</strong>  <strong>C. Official Cut List</strong></td>
</tr>
<tr>
<td>5</td>
<td>1. Describe fabrication techniques including layout, tacking, assembly, and fitting.</td>
<td><strong>Fabrications Techniques &amp; Practices Notes</strong> Discuss project layout and tacking. <strong>Project Layout/Taking Demo</strong> Chapter 6 Review Questions (Jeffus)</td>
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<td><strong>A. Fabrication Techniques &amp; Practices PPT</strong>  <strong>B. Official Project Task Sequence</strong></td>
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<tr>
<td>6</td>
<td>1. Describe fabrication techniques including layout, tacking, assembly, and fitting.</td>
<td><strong>Project Layout/Taking Demo (cont.)</strong> Continue project lay out and tacking project together.</td>
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<td><strong>A. Official Project Task Sequence</strong></td>
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<tr>
<td>7</td>
<td>1. Describe fabrication techniques including layout, tacking, assembly, and fitting.</td>
<td><strong>Fabrications Techniques &amp; Practices Notes</strong> Discuss project assembly and fitting. <strong>Project Assembly Demo/Lab</strong> Demonstrate and have students help with project assembly. Have students volunteer to complete welds. Focus on proper assembly sequence, checking for warping, and part fitting.</td>
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<td><strong>A. Fabrication Techniques &amp; Practices PPT</strong>  <strong>B. Official Project Task Sequence</strong></td>
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</table>
| 8 | 1. Describe fabrication techniques including layout, tacking, assembly, and fitting. | **Project Assembly Demo/Lab**
Demonstrate and have students help with project assembly. Have students volunteer to complete welds. Focus on proper assembly sequence, checking for warping, and part fitting. | A. Fabrication Techniques & Practices PPT
B. Official Project Task Sequence |
|---|---|---|---|
| 9 | 1. Describe fabrication techniques including layout, tacking, assembly, and fitting. | **Fabrications Techniques & Practices Notes**
Discuss project completion, specifically finish grinding, sanding, cleaning, and painting.
**Project Completion Demo/Lab**
Demonstrate and have students help with completing and finalizing the Project Task Sequence, including finish grinding, sanding, cleaning, and painting. | A. Fabrication Techniques & Practices PPT
B. Official Project Task Sequence |
| 10 | 1. Identify solutions to common welding and fabrication problems. | **Welding Problem Solving Exercise #1**
Break student up into small groups and have them participate in experiential learning labs. Set up lab stations with Welding Problem Scenario Sheets and materials. Students are to identify measures to address problems and carry out plan. Welding problem scenarios taken from *Welding Fabrication and Repair: Questions and Answers* by Frank Marlow, PE
**Process Welding Problem Solving Exercise #1**
Discuss what students did correctly, and what could have been improved. | A. Welding Problem Solving Scenario Sheets
B. Welding Problem Solving Lab Station materials |
|   |   | **Welding Problem Solving Exercises #2**  
| Break student up into small groups and have them participate in experiential learning labs. Set up lab stations with Welding Problem Scenario Sheets and materials. Students are to identify measures to address problems. Students rotate from station to station. Welding problem scenarios taken from *Welding Fabrication and Repair: Questions and Answers* by Frank Marlow, PE  
| **Welding Problem Solving Exercise #3**  
| Discuss what students did correctly, and what could have been improved. |   | A. Welding Problem Solving Scenario Sheets  
| B. Welding Problem Solving Lab Station materials   |   |   |
| 13 | 1. Identify solutions to common welding and fabrication problems. | **Welding Problem Solving Exercises #4**  
Break student up into small groups and have them participate in experiential learning labs. Set up lab stations with Welding Problem Scenario Sheets and materials. Students are to identify measures to address problems. Students rotate from station to station. Welding problem scenarios taken from *Welding Fabrication and Repair: Questions and Answers* by Frank Marlow, PE  
**Process Welding Problem Solving Exercise #4**  
Discuss what students did correctly, and what could have been improved. | A. Welding Problem Solving Scenario Sheets  
B. Welding Problem Solving Lab Station materials |
| 14 | 1. Review key concepts of the unit. | **Unit Study Guide**  
Students use notes and experience to answer review questions.  
**Unit Quiz Review**  
Play review game to prepare students for quiz. | A. Unit Study Guide |
| 15 | 1. Assess student's knowledge of unit concepts. | **Fabrication Techniques & Practices Unit Quiz** | Unit Assessment |
APPENDIX C
Liberty Ranch Agriculture Department

Course: Advanced Agricultural Mechanics: Fabrication and Project Construction

Course Instructor: Mr. Bryan Dodson
(209) 744-4250
bdodson@ghsd.k12.ca.us

Course Length: Year

Course Textbook(s): Welding and Metal Fabrication by Larry Jeffus
Welding Fabrication and Repair: Questions and Answers by Frank Marlow, PE

I. Course Description

The Agricultural Mechanics Fabrication and Project Construction course is a year-long, culminating course in the Agricultural Mechanics pathway at Liberty Ranch High School.

Students will be challenged to utilize and build upon knowledge and skills learned through Agricultural Mechanics I and Agricultural Mechanics II through building and fabrication of projects. As this course is apart of the Agriculture Department, students will be graded upon their FFA and SAE participation.

II. Learning Objectives

Students will be able to:

A. Describe metallurgy principles, including distortion, hardening, tempering, and annealing.

B. Operate and maintain various fabrication tools and equipment safely and appropriately.
C. Demonstrate how to read and design project plans by using mechanical drawing techniques.

D. Demonstrate how to complete project planning by creating a comprehension project plan, including interpreting a plan, developing a bill of materials, selecting materials, and developing a clear and concise fabrication contract.

E. Construct a metal fabrication project.

III. Grading Policy

A. Grading Criteria

**Shop Grade** 10%

Each day the class works in the shop, students earn a shop grade of ten points. Points are deducted for being tardy, truant, off task, and/or operating in an unsafe manner.

**Welding Exercise** 10%

Students will be graded on the quality of welding exercises.

**Unit Review Questions** 5%

Some units will include reading assignments accompanied with review questions.

**Mock Job Interview Project** 5%

Students will participate in a mock job interview to prepare them for acquiring employment later in life.
Unit Quizzes 10%

Upon the completion of each unit, students will be assessed using a unit quiz.

Final Exams 15%

Upon completion of the first and second semester, students will be assessed using final exams.

Fabrication Project and Plan 25%

Every student will be required to complete a agriculturally-related metal fabrication project and exhibit that project at the Sacramento and/or California State Fair. Projects will be graded on quality, completeness, and Fabrication Project Plan presentation.

FFA Participation Grade 10%

FFA participation is an intracurricular part of every secondary agricultural education program. Every student is required to participate in two(2) FFA activities per quarter, which will comprise 10% of that students grade. FFA activities include FFA monthly meetings, FFA committee monthly meetings, fundraisers, CDE competitions, FFA conferences, fair, and banquets.

SAE Participation Grade 10%

Much like FFA participation, Supervised Agricultural Experience (SAE) program participation is intracurricular, and therefore a required component of this course.
B. Grading Standard

90 -100% A

80 - 89% B

70- 79% C

60 – 69% D

59% or lower F

C. Attendance and Tardy Policy

Students are expected to be present and punctual. These traits are critically important to success in this class and therefore, will be used to factor shop grades. Excused absences will not impact student’s grade.

D. Missed and Late Work Policy

Students are expected to submit assignments, take exams, and complete shop work as scheduled. Make-up exams and submission of late assignments will only be permitted when absences are excused. Students are expected to notify the instructor in advance of a potential conflict. Make-up exams/ new due dates will be scheduled immediately. Shop grades may be made up at lunch or after school of announced days and times.
E. Academic Honesty

Academic dishonesty includes such things as cheating, inventing false information or citations, plagiarism, and helping someone else commit an act of academic dishonesty.

Cheating is the act of obtaining or attempting to obtain credit for work by the use of any dishonest, fraudulent, or unauthorized means.

Plagiarism is the act of taking the specific substance of another and offering it as one’s own without giving credit to the source. Students found guilt of academic dishonesty will be assigned an appropriate academic penalty and reported to the administration.

IX. Special Needs

Students with IEPs or 504 Plans, describing disabilities or special needs that may impact your ability to perform and participate in class will be adhered to, however, if you have any other disabilities or special needs that may require special arrangements related to class, please notify the instructor during the first week of school.

X. Classroom Rules

XI. Course Unit Plan
<table>
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<tr>
<th>WEEK</th>
<th>UNIT</th>
<th>OBJECTIVES</th>
<th>ASSIGNMENTS</th>
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</table>
| 1    | Shop Safety               | 1. Explain how to work safely.  
2. Identify each degree of burn and describe how to provide first aid.  
3. Describe the importance of proper ventilation and respiratory protection.  
4. Describe electrical safety. Explain how to safely lift and handle heavy materials and equipment. | Safety Unit Notes  
Safety Quiz |
6 | Bending & Straightening | 1. Demonstrate how to properly bend various materials including flat, angle, channel, pipe, and tubing. 2. Demonstrate how to effectively straighten warped material. | Bending & Straightening Notes Chapter 4 Review Questions (Harlow) Bending Exercises Straightening Exercises Bending & Straightening Unit Quiz SMAW Exercises OFW Exercises

10 | SMAW/OFW | 1. Demonstrate ability to weld with the SMAW process in multiple positions. 2. Demonstrate how to weld with the OFW process in multiple positions. | GMAW Exercises FCAW Exercises GTAW Exercises

13 | GMAW/FCAW/GTAW | 1. Demonstrate how to weld with the GMAW process in multiple positions. 2. Demonstrate how to weld with the FCAW process in multiple positions. 3. Demonstrate how to weld with the GTAW process in multiple positions. | OFC Exercises Plasma Arc Cutting Exercises

16 | OFC/Plasma Arc Cutting | 1. Demonstrate how to cut with the OFC process in multiple positions. 2. Demonstrate how to cut with the Plasma Arc Cutting process in multiple positions. | Final Exam Welding Shop Practices Unit Notes Mock Job Interview Project

18 | Semester One Final Welding Shop Practices | 1. Assess student knowledge of Semester One concepts. 2. Demonstrate basic interview skills. 3. Describe methods of material and consumable conservation. 4. Explain common shop practices including equipment |
operation, hand signals, and outsourcing.

| 21 | Fabrication Techniques & Practices | 1. Describe fabrication techniques including layout, tacking, assembly, and fitting. |
|    |                                 | 2. Describe how to create project plan. |
|    |                                 | 3. Demonstrate how to use common and specialized metal fabrication tools. |
|    |                                 | 4. Identify solutions to common welding and fabrication problems. |

| 24 | Project Construction and Fabrication | 1. Complete comprehension project plan. |
|    |                                  | 2. Fabricate metal project. |

| 36 | Semester Two Final | 1. Assess student knowledge of Semester Two concepts. |

Fabrications Techniques & Practices Notes
Chapter 6 Review Questions (Jeffus)
Chapter 6 Review Questions (Harlow)
Welding Problem Solving Exercises
Fabrication Techniques & Practices Unit Quiz
Project Plan
Project Construction

Semester Two Final
Metal Fabrication Curriculum
Informed Consent

This survey is part of a research project being conducted by Bryan Dodson at California State University, Chico. You are invited to participate in this research project because you are a student in the Agricultural Mechanics Pathway at Liberty Ranch High School. You will be asked to reflect on the level at which metal fabrication, critical thinking, and problem solving skills should be included in the Advanced Agricultural Mechanics curriculum at Liberty Ranch High School.

Your participation in this research study is voluntary. You may choose not to participate. If you decide to participate in this research survey, you may opt out by submitting a blank instrument. If you decide not to participate in this study or if you withdraw from participating at any time, you will not be penalized.

The procedure involves filling a questionnaire that will take approximately 10 minutes. You will be given the survey in person and be asked to complete it using your own perceptions. Your responses will be confidential. To help protect your confidentiality, the surveys will not contain information that will personally identify you. The results of this study will be used for scholarly purposes only and will be released only in summaries where no individual’s answers can be identified. There are no foreseeable risks, discomforts, or repercussions for you as a participant related to this research.

If you have any questions about the research study, research subject’s rights, or in case of research-related injury, please contact Bryan Dodson at bdodson@ghsd.k12.ca.us or (530) 520-8379. This research has been reviewed according to California State University, Chico IRB procedures for research involving human subjects.