

**POWER,
STRUCTURAL AND
TECHNICAL SYSTEMS**
TEACHER RESOURCE GUIDE





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► INTRODUCTION

The SAY Project has developed a National Clearinghouse that shows the alignment of agricultural safety and health curriculum and educational resources to Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards used by agricultural educators.

The purpose of this resource guide is to give an overview of specific curricula provided in the SAY Clearinghouse and suggestions for incorporating the resource within your classroom activities. This teacher resource guide focuses on two curriculum resources that align to the AFNR standard:

- PST.02. *Operate and maintain AFNR mechanical equipment and power systems.*

For each sample curriculum, the Teacher Resource Guide is organized into the following sections:

1. **Overview** • An overview of the sampled curriculums, *AgSafety4U* and *National Safe Tractor & Machinery Operation Program*
2. **Standards Alignment** • How the curriculum aligns to the standards
3. **Sample Objectives** • Sample objectives you can use
4. **Activities** • Descriptions of activities provided in the curriculum
5. **Personalized Sample Activities** • Ideas of additional activities you can utilize
6. **Evaluation** • How students' learning can be evaluated

▶ OVERVIEW OF AGSAFETY4U

AgSafetyU is an online certificate course that provides an overview of the hazards common to farms and rural agricultural businesses. The course offers a general outline of the measures agricultural workers can take to identify and control such hazards.

The online course is designed for youth (ages 16 and up), new and beginning farmers, and for employers and employees of agricultural operations looking to enhance their knowledge and/or to provide professional development with a heavy emphasis on tractor and machinery. Individuals who take this course and pass the online quizzes will be able to print a certificate of completion. The certificate course costs \$10.00 per person.

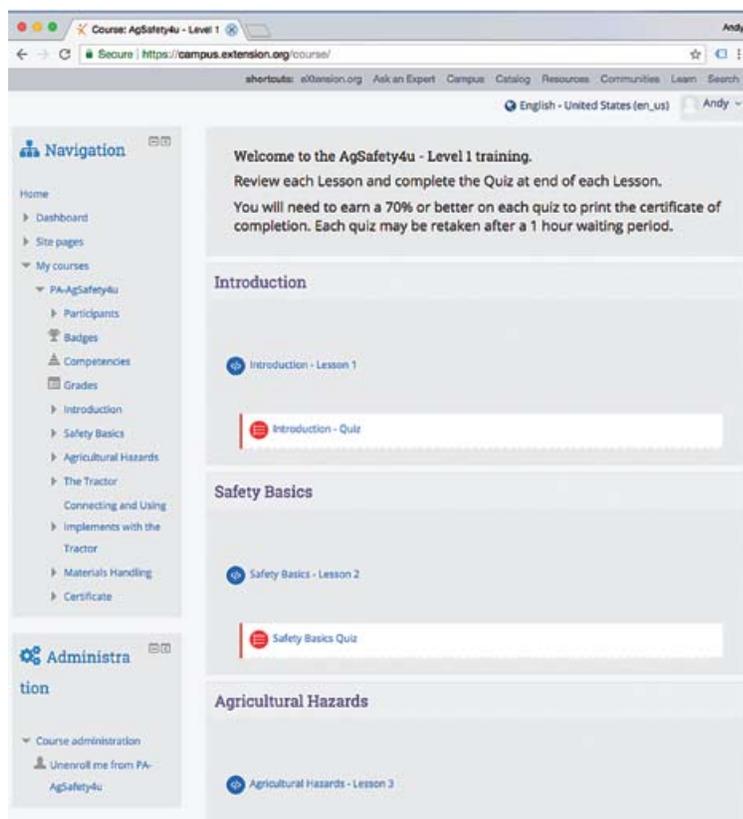
The AgSafetyU certificate course organizes training in six modules, each of which focuses on a particular area:

1. Introduction
2. Safety Basics
3. Agricultural Hazards
4. The Tractor
5. Connecting and Using Implements with the Tractor
6. Materials Handling

▶ STANDARDS ALIGNMENT

Academic standards define what students should know at the completion of a program of study. Specifically, the AFNR standards serve as a guide for the development of rigorous, well-planned curriculum and assessments for an AFNR-related program, and can be used for all three components of the agricultural education model. The AgSafety4U curriculum aligns to the following Power, Structural, and Technical Systems standards:

- ▶ PST.02.01.01.b. **Develop a preventative maintenance schedule for equipment, machinery and power units used in AFNR power, structural and technical systems.**
- ▶ PST.02.02.02.a. **Examine and identify safety hazards associated with equipment, machinery and power units used in AFNR power, structural, and technical systems (e.g., caution, warning, danger, etc.).**
- ▶ PST.02.02.02.b. **Apply safety principles and applicable regulations to operate equipment, machinery and power units used in AFNR power, structural and technical systems.**
- ▶ PST.02.02.01.c. **Perform pre-operation inspections, start-up & shut-down procedures on equipment, machinery and power units as specified in owner's manuals.**



AgSafety4u Course Outline

▶ SAMPLE OBJECTIVES

Objectives help you plan your lessons and ensure that what your students are learning in class align to how they will be evaluated. Using the **ABCD** method, objectives should include an **A**udience, **B**ehavior, **C**onditions, and **D**egree of mastery needed. Bloom's Taxonomy of cognitive learning is a hierarchical framework that teachers can use to promote higher order thinking and learning. Below are example objectives at various levels of Bloom's Taxonomy that teachers can use in their lesson plans.

By the end of this lesson, students will be able to:

- ▶ Identify hazards associated with power, structural, and technical systems according to industry standards.
- ▶ Operationalize pre-operation checks on a tractor according to certification course.
- ▶ Describe safe operation of a tractor according to certification course.
- ▶ Design a workshop on ag safety according to rubric.

▶ ACTIVITIES

The AgSafety4U certificate course is comprised of student-directed, online modules with corresponding quizzes. The modules consist of written information, diagrams, and pictures for students to read and analyze.

The image to the right is from the module on Connecting and Using Implements with the Tractor. For example, within this lesson, students will learn about the following subtopics:

- ▶ Connecting implements to the tractor
- ▶ Using drawbar implements
- ▶ Using 3-point hitch implements
- ▶ Making PTO connections
- ▶ Using PTO implements
- ▶ Using implements with hydraulic components
- ▶ Using implements with electrical connections

Hitching and the Center of Gravity

In Lesson 4.12, Tractor Stability, you learned about the tractor's center of gravity and stability baseline. Tractor hitches are designed so the downward and rearward force during a pull are below the center of gravity (see Figure 5.2.a.). To maintain tractor stability, the "angle of pull" should be kept as low as possible by hitching to the drawbar only.

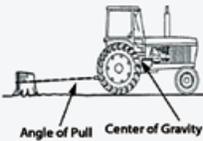


Figure 5.1.a. An example of safe hitching. The drawbar will lower if the front end lifts off the ground. This reduces the "angle of pull" and the risk of a rear overturn.

Pulling a load with the downward and rearward force above the tractor's center of gravity will result in a rear overturn. You must hitch only to the drawbar to prevent the tractor from rearing up and turning over. Even small lawn and garden-size tractors can flip rearward if not properly hitched to a load.

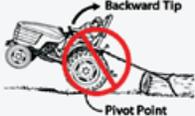


Figure 5.1.b. The log is fairly immovable. A chain hooked above the center of gravity of the tractor (e.g., top of 3-point hitch bracket), allows a rearward tip of the tractor. Improper hitching has overridden safe tractor engineering design. Many people have lost their lives as a result. Safety Management for Landscapers, Grounds-Care Businesses, and Golf Courses, John Deere Publishing, 2001. Illustrations reproduced by permission. All rights reserved.

AgSafety4u Lesson Example

▶ PERSONALIZED SAMPLE ACTIVITIES

Modalities of learning are ways in which students use their senses throughout the learning process to acquire new skills. Using different modalities when teaching new material can help make sure that all students receive instruction in a way that suits their personal learning style. In addition, students retain information better when they have a chance to apply what they've learned and use their new skills in a hands-on way. Below are example activities teachers can use to enhance their students' learning.

- ▶ Before and/or after completing the online training modules, students can show what they know by creating a map of the classroom/lab space, and then identify hazards associated with school equipment. This activity would be ideal if you have a school farm, Ag mech workshop, etc.

- ▶ Teaching is the best way to learn! Students can apply what they've learned to design and facilitate an ag safety demonstration/workshop for other agriculture students/FFA Members, local community members, etc.
- ▶ Given a variety of farm incident(s) scenarios, students can use what they learned in the course to develop a plan to prevent that incident from occurring. This will require students to use those critical thinking skills!

▶ EVALUATION

Evaluation is an essential part of learning because it gives students a chance to show what they know, as well as an opportunity for teachers to see how well students have learned the material. This feedback is important for improving curriculum as well as help teachers determine if they need to reteach something or move on to the next lesson/unit.

To evaluate learning for the AgSafety4U curriculum, there is an online quiz after each lesson. Students must answer 70% questions correctly before continuing to the next module.



▶ OVERVIEW OF NATIONAL SAFE TRACTOR & MACHINERY OPERATION PROGRAM (NSTMOP)

The **NSTMOP** was originally developed and designed for 14- and 15-year-olds seeking employment in production agriculture. The U.S. Department of Labor's Hazardous Occupations Order in Agriculture (AgHOs) regulation prohibits 14- and 15-year-olds from operating farm tractors and attached powered equipment unless the youths have successfully completed an approved safe tractor and machinery operation training program.

The training is led by local county extension or high school agricultural educators (For those seeking to become a certified NSTMOP Instructor, the online course can be accessed at Instructor Training Course) Subjects covered include general agricultural safety, tractor and equipment operation, and highway transportation.

Students are certified after successfully passing a fifty-question written knowledge test and successfully passing both a operating skills test and a pre-op/driving test.

▶ STANDARDS ALIGNMENT

Academic standards define what students should know at the completion of a program of study. Specifically, the AFNR standards serve as a guide for the development of rigorous, well-planned curriculum and assessments for an AFNR-related program, and can be used for all three components of the agricultural education model. The NSTMOP curriculum aligns to the following Power, Structural, and Technical Systems standards:

- ▶ PST.02.01.01.a. *Maintain the cleanliness and appearance of equipment, machinery and power units used in AFNR power, structural and technical systems to assure proper functionality.*

- PST.02.01.02.a. *Examine operator's manual to determine recommendations for servicing filtration systems and maintaining fluid levels on equipment, machinery and power units used in AFNR power, structural and technical systems.*
- PST.02.02.01.a. *Research and summarize the use of equipment, machinery and power units for AFNR power, structural and technical systems.*
- PST.02.02.02.a. *Examine and identify safety hazards associated with equipment, machinery and power units used in AFNR power, structural, and technical systems (e.g., caution, warning, danger, etc.).*
- PST.02.02.02.b. *Apply safety principles and applicable regulations to operate equipment, machinery and power units used in AFNR power, structural and technical systems.*
- PST.02.02.01.c. *Perform pre-operation inspections, start-up & shut-down procedures on equipment, machinery and power units as specified in owner's manuals.*

▶ SAMPLE OBJECTIVES

Objectives help you plan your lessons and ensure that what your students are learning in class align to how they will be evaluated. Using the **ABCD** method, objectives should include an **A**udience, **B**ehavior, **C**onditions, and **D**egree of mastery needed. Bloom's Taxonomy of cognitive learning is a hierarchical framework that teachers can use to promote higher order thinking and learning. Below are example objectives at various levels of Bloom's Taxonomy that teachers can use in their lesson plans.

By the end of this lesson, students will be able to:

- Operationalize safe tractor operating procedures according to NSTMOP training.
- Identify hazards associated with tractors to teacher satisfaction.
- Explain the function of tractor parts and implements to teacher satisfaction.
- Diagram the parts of a tractor to teacher satisfaction.

▶ ACTIVITIES

The NSTMOP curriculum can be broken down into six sections and a total of 92 task sheets. 48 of those task sheets are Minimum Core Content Areas (MCCA's) and are required to prepare for the written test.

Each task sheet contains written information, pictures, and diagrams for students to read and analyze. There are also activities provided at the end of each task sheet for students to apply what they've learned. For example, in *Task Sheet 1.1, The Work Environment*. After students read through the material, there are two provided safety activities that correspond to the information within the task sheet. In the first activity, students draw a line from the mechanical hazard to its definition, and in the second activity students compare mechanical hazards on an old and new tractor.



NSTMOP Class Instruction

▶ PERSONALIZED SAMPLE ACTIVITIES

Modalities of learning are ways in which students use their senses throughout the learning process to acquire new skills. Using different modalities when teaching new material can help make sure that all students receive instruction in a way that suits their personal learning style. In addition, students retain information better when they have a chance to apply what they've learned and use their new skills in a hands-on way. Below are example activities teachers can use to enhance their students' learning.

- ▶ Students can work with a group to become "experts" on one of the task sheets, and then design an artifact (poster/model/etc.) to be displayed in the classroom.
- ▶ Students can label and place sticky notes on a tractor to practice identifying the parts and describing their function.

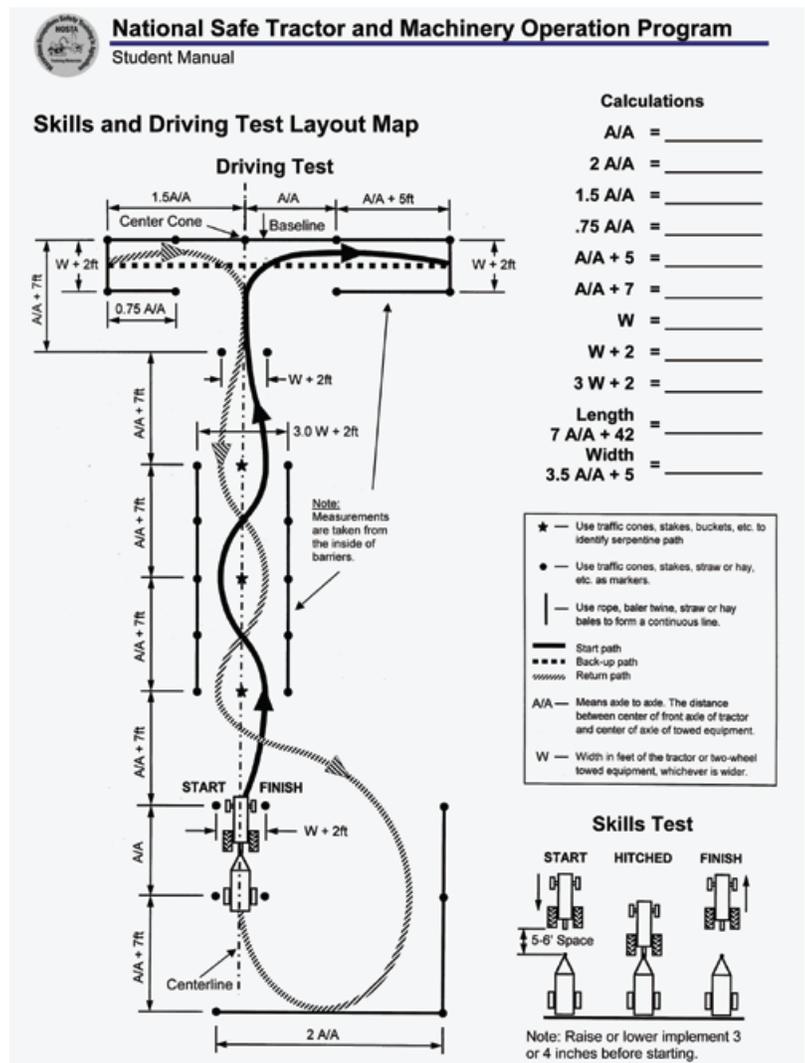
▶ EVALUATION

Evaluation is an essential part of learning because it gives students a chance to show what they know, as well as an opportunity for teachers to see how well students have learned the material. This feedback is important for improving curriculum as well as help teachers determine if they need to reteach something or move on to the next lesson/unit.

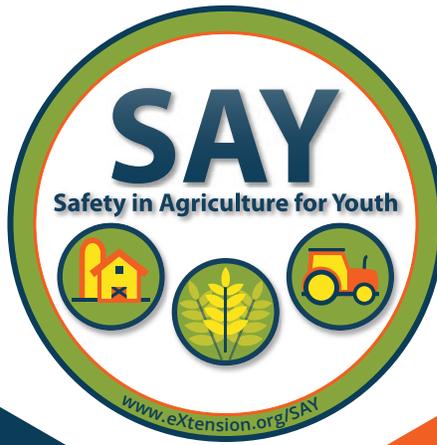
The NSTMOP evaluation consists of a written test and an operating skills and pre-op/driving tests.

The purpose of the written test is to evaluate students' knowledge of the agricultural safety and health topics that are listed in the Minimum Core Content Areas (MCCA) for the National Safe Tractor and Machinery Operation Program. The Written Test consists of a combination of 50 multiple-choice and true/false questions from a question bank based on NSTMOP Task Sheets that cover the MCCA. The Written Test must be passed with a 70% or better before the student can move to the Skills Test.

The goal of the Operating Skills Test is to evaluate your ability to safely and efficiently start a tractor and hitch to a wheeled or 3-point implement. The goal of the Pre-op/Driving Test is to test students' ability to safely and efficiently drive a tractor pulling a two-wheel implement through a specified course with spaces and borders. The Operating Skills and Pre-op/Driving Tests must each be passed with a minimum score of 70%, and zero "automatic failure" violations.



NSTMOP Student Driving Practicum Layout



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