Middle-level CTE Learning Experience Title: Faulty System Educator: Steve Perry, Retired Assistant Principal Agriculture, John Bowne H.S. Length of Lesson: 7 days (40 minute periods) Grade Level: 8	CTE Area: Agriculture CTE Theme: Problem Solving and Innovation CTE Content: Agriculture Mechanics Date Created: 4/21/20

PLANNING	
Curriculum Goal	Students identify a system that is not functioning properly. Students observe, identify and document the individual system components, how they operate, and how they interact. Students locate the system component that is not functioning, implement a change or repair, and evaluate the system to ensure that it is functioning properly. Students document the repair and propose preventative maintenance solutions.
Essential Question(s)	What knowledge and skills are necessary to demonstrate introductory understanding of the application of problem-solving processes and the acquisition, evaluation and application of the products of research for informed decision making? What knowledge and skills are necessary to demonstrate introductory understanding of how power, mechanical and technical systems support efficient work in the agriculture industry?
National Standards	Common Career Technical Core Standards https://www.careertech.org/career-ready-practices Career Ready Practices 2. Apply appropriate and academic and technical skills 4. Communicate clearly and effectively and with reason 6. Demonstrate creativity and innovation 7. Employ valid and reliable research strategies 8. Utilize critical thinking to make sense of problems and persevere in solving them 11. Use technology to enhance productivity 12. Work productively in teams while using cultural global competence National Agricultural Education Standards https://thecouncil.ffa.org/afnr PST.01. Apply physical science principles and engineering applications to solve problems and improve performance AFNR power, structural and technical systems CRP.02. Apply appropriate academic and technical skills CRP.06. Demonstrate creativity and innovation CRP.07. Employ valid and reliable research strategies CRP.08. Utilize critical thinking to make sense of problems and persevere in solving them CRP.11. Use technology to enhance productivity

NYS Standards	New York State Career Development and Occupational Studies (CDOS) Standards Intermediate Level http://www.p12.nysed.gov/cte/ Standard 1: Career Development Students will be knowledgeable about the world of work, explore career options, and relate personal skills, aptitudes, and abilities to future career decisions. Standard 2: Integrated Learning Students will demonstrate how academic knowledge and skills are applied in the workplace and other settings. Standard 3a: Universal Foundation Skills Students will demonstrate mastery of the foundation skills and competencies essential for success in the workplace.
Learning Objectives	Problem Solving and Innovation 1. Problem Solving Students will c) Define invention as new designs for technologies and systems d) Define innovation as new applications for existing technologies and systems 3. Troubleshooting Process (Reactive) Students will a) Implement a formal troubleshooting process to solve a given problem by a. Defining the problem being addressed b. Identifying criteria and specifications for the desired outcomes or operation c. Testing and evaluating to isolate the problem d. Correcting the problem by implementing changes or repairs e. Validating that the corrective action produced desired outcomes or operation f. Identifying strategies to prevent further problems 5. Careers in Problem Solving, Invention and Innovation Students will a) Investigate knowledge, skills and practices needed for a career utilizing problem solving, invention and innovation skills b) Analyze career paths requiring skills for problem solving, invention and innovation Agriculture Mechanics 1. Power, Mechanical and Technical Systems Students will a) List and describe the characteristics of power systems, mechanical systems and technical systems used in the agriculture industry b) Identify the tools, equipment, machinery and technology of power systems, of mechanical systems and of technical systems in the agriculture industry c) Cite examples of ways power, mechanical and technical systems foster efficient and effective work in the agriculture industry d) Explain how technological advances have changed the applications of power, mechanical and technical

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<tr><td></td><td colspan="2">systems in the agriculture industry
2. Safety
Students will
a) Explain hazards associated with the tools, equipment, machinery and technology used in agricultural power, mechanical and technical systems
b) Follow guidelines for safe use of agriculture tools, equipment, machinery and technology
c) Demonstrate appropriate and consistent use of safety features found on agricultural tools, equipment and machinery
d) Demonstrate appropriate use and care of Personal Protective Equipment (PPE) and safety apparel in agriculture
3. Tools, Equipment and Machinery
Students will
a) Identify and select the appropriate tools, equipment and machinery for use in specific agricultural tasks
6. Careers in Agriculture Power, Mechanics and Technical Fields
Students will
a) Investigate a career in agriculture power, mechanics or technical fields and identify the pathways used to reach that career</td></tr>
<tr><td>Vocabulary</td><td>Academic
Innovation, Troubleshoot, Technology</td><td>Content
GPS, Robotics, Power, Mechanical, Technical, Drones, Technology</td></tr>
<tr><td>Materials and Resources</td><td colspan="2">Agriscience notebook (Day 1, 2, 3, 5, 6)
Comparing Agriculture of the Past with Today (Day 1)
https://www.animalsmart.org/animals-and-the-environment/comparing-agriculture-of-the-past-with-today
Poster paper, tape, pictures of: tools, equipment, machinery, computers, 2 or 4 stroke single cylinder engine, etc.(Day 1)
5 Ways Technology Has Changed Agriculture (Day 1)
https://www.businessinsider.com/15-emerging-agriculture-technologies-2014-4
New Mexico Agricultural Mechanics and Technology Lesson Plan Library. Unit A. Problem Area 1. Lesson 7. Page 3.(Day2)
https://www.nmffa.org/uploads/4/1/0/7/41075673/a1_7_exploring_careers_in_agricultural_mechanics_and_technology_systems.pdf
Purdue University Safety in Agricultural Mechanics (Day 3)
https://ag.purdue.edu/ipia/hasil/Unit%20B%20Lesson%202%20Personal%20Safety%20in%20Agricultural%20Mechanics%20Lesson%20Plan%20-%20English.pdf
Computers (Day 4)
Tools and Power Machinery quizlet (Day 4)
https://quizlet.com/37482034/ag-mechanics-tool-id-flash-cards
Small Gas Engine Assembly (Day 5,6)
https://www.icevonline.com/newsletters/agricultural-science/2018/09/interactive-coursework-in-agricultural-science/small-gas-engine-assembly-procedures</td></tr>
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	https://www.icevonline.com/applications/files/7315/3442/8193/CEV80408_Lesson_Plan.pdf https://www.icevonline.com/application/files/5815/2225/2908/CEV80408_Vocabulary_Handout.pdf Small Engine Troubleshooting (Day 7) https://www.motherearthnews.com/homesteading-and-livestock/small-engine-troubleshooting-zmaz89mjzshe https://www.4-h.org/parents/curriculum/small-engines https://www.georgiaffa.org/curriculum/topic.aspx?ID=8&TID=20 https://uen.org/core/core.do?courseNum=470606 Exit Ticket (Day 7)		
INSTRUCTION	What will the teacher do?	What will the students do?	How much time for each activity?
Pre-assessment	DAY 1 Teacher asks students to list everything they can remember eating the past two days. Indicate next to each food, if they believe the food was produced as a result of a farmer, either directly or indirectly. Teacher asks for students to share some foods from their lists and whether or not farmer produced. Teacher leads a discussion on where/how our food is produced and the technology available for that to happen. - Today, the average farmer feeds 155 people. In 1960, a farmer fed 26 people. Teacher asks the class "why are farmers able to feed so many more people today than they were years ago?" Source: Comparing Agriculture of the Past with Today https://www.animalsmart.org/anim	DAY 1 Students take out their Agriscience notebooks and make a list of all the foods they can remember eating over the past two days, listing next to each food if they believe it was produced, either directly or indirectly by a farmer. Students share some of their foods and indicate if they believe it was produced by a farmer. Students take notes in their Agriscience notebooks. Students offer their responses to the question.	DAY 1: 40 mins 10 mins

	als-and-the-environment/comparing-agriculture-of-the-past-with-today		
Do-now/Hook	Teacher asks students to hang up 6 pieces of poster paper spread around the room. Using the markers, place one of the six categories headings on one of the six poster papers. (One heading/one poster paper). - Preparing the Soil - Planting the Crop - Maintaining the Crop - Harvesting the Crop - Livestock Management - Transportation of a Crop or Livestock Teacher provides the class with a stack of various pictures of agricultural machinery, drones, tractors, planters, harvesters, trucks, robotics, etc. Any and all equipment, tools, etc. related to the agricultural field. Teacher instructs students to tape the picture onto the appropriate poster paper with the heading relating to the purpose of the picture.	Students hang up poster papers and create headings. Students each take some of the pictures. Students tape the picture to the appropriate poster paper.	20 mins
Procedure for Instruction/ Learning Activities	Teacher leads a discussion based on all of the various pictures of machinery, equipment and tools with regard to the various operations on a farm. Teacher asks the class, “when	Students take out their Agriscience notebooks. Students respond to the question with their	10 mins

	looking at these pictures, how do you think these machines, etc. have changed over time. In other words, how has technology changed farming and food production?" - sophisticated technologies such as robotics, temp. and moisture sensors, harvest automation, autonomous tractors, drones, GPS technology and precision agriculture have all added to the ability of farmers to feed more people on less land, hire less workers, be more efficient and cost effective. Source: 5 Ways Technology Has Changed Agriculture https://www.businessinsider.com/15-emerging-agriculture-technologies-2014-4	insights as to how technology has changed.	
	Teacher asks the class "what is meant by power, structural, mechanical and technical systems?" - deals with engineering, hydraulics, pneumatics, electronics, power structures and controls. People in this field design agricultural structures, machinery and equipment. - involves the operation, repair and maintenance of specialized farm, ranch and agribusiness power equipment of a stationary, mobile and/or hand-operated nature. These can include terrestrial and	Students offer their responses to the question. Students take notes in their Agriscience notebooks.	

	airborne crop-spraying equipment; cutting equipment; tractors; planting and harvesting equipment; power sources and systems for silos, irrigation, pumping, and applications such as dairy, feeding and shearing operations and processing equipment. DAY 2 Teacher asks the class "can you think of some direct examples of specific equipment/machinery changes that have resulted in more efficient operations in the agriculture field?" Tractors Harvesters Irrigation Automated feeders Teacher asks students to break up into groups of 4, and informs them that they are now all part of an employment service. "Your job is to write several employment flyers advertising jobs that are available in the agricultural mechanics field. Try to think of as many areas of specialization in this field, make a flyer for each indicating name of specialization and jobs available in that specialization. Teachers has the groups present their flyers and job positions to the class. From their flyers, the following specializations should be developed.	DAY 2 Students take out their Agriscience notebooks. Students offer responses to the question. Students break up into their groups and develop flyers. Students present their flyers to the class.	DAY 2: 40 mins 20 mins. 20 mins

	- Agricultural Electrification, Power and Controls - Agricultural Power Machinery - Soil and Water Mechanical Practices - Agricultural Mechanics, Construction, and Maintenance Skills - Agricultural Structure, Equipment, and Facilities Source: New Mexico Agricultural Mechanics and Technology Lesson Plan Library. Unit A. Problem Area 1. Lesson 7. Page 3. https://www.nmffa.org/uploads/4/1/0/7/41075673/a1_7_exploring_careers_in_agricultural_mechanics_and_technology_systems.pdf		
	Teacher further illustrates the various job titles found within each specialization.	Students continue to take notes in their Agriscience notebooks.	
	DAY 3 Teacher assigns the following exercise to the students: "I want you to design a really dangerous shop. You heard me correctly, a dangerous one. List the elements of the shop that makes it dangerous. Feel free to construct a diagram/picture along with written descriptions of all its hazards."	DAY 3 Students take out their Agriscience notebooks and begin the assignment to design a dangerous shop.	DAY 3: 40 mins. 20 mins.
	Teacher asks for volunteers to share their shop designs with the class and indicate all the hazards	Students share their hazard-filled shops with the class.	20 mins.
	Teacher utilizes following	Students take notes in their Agriscience	

	PowerPoint to lead a discussion on agricultural mechanics safety: Source: Purdue University Safety in Agricultural Mechanics https://ag.purdue.edu/ipia/hasil/Unit%20B%20Lesson%202%20Personal%20Safety%20in%20Agricultural%20Mechanics%20Lesson%20Plan%20-%20English.pdf	notebooks.	
	DAY 4 Teacher instructs students to break up into groups of four. Each group is in front of a computer. Students are given the following website and instructed to begin to learn to identify the various tools and power machinery. https://quizlet.com/37482034/ag-mechanics-tool-id-flash-cards	DAY 4 Students break up into groups of four.	DAY 4: 40 mins 40 mins
	Teacher provides as many actual tools as possible for students to lay hands on and get to use.	Students use tools provided by the teacher.	
	Teacher projects the tool slides for students to practice final review of the names of the tools and identify their use(s)	Students review the slides of the tools for identification and use.	
	DAY 5 and 6 Teacher explains to the class that for the next two classes we will be learning about small gas engines (2&4 stroke) to include disassembling and reassembling.	DAY 5 and 6 Students take out their Agriscience notebooks.	DAY 5 and 6: 80 mins 80 mins.
	Teacher further indicates that	Students begin to diagram and describe each	

	students are to develop in their Agriscience notebooks a catalog of engine components with pictures, diagrams and descriptions of each component and their function(s). Teacher has students gather around a 2-stroke or 4-stroke engine as he/she disassembles it, indicates each part and its function(s), eliciting students hands on assistance. (use a single cylinder engine) Teacher has students identify and select the appropriate tools used in the repair and maintenance of the small gas engine. Teacher and students reassemble the engine explaining all the steps along the way. Source: Small Gas Engine Assembly https://www.icevonline.com/newsletters/agricultural-science/2018/09/interactive-coursework-in-agricultural-science/small-gas-engine-assembly-procedures https://www.icevonline.com/applications/files/7315/3442/8193/CEV80408_Lesson_Plan.pdf https://www.icevonline.com/application/files/5815/2225/2908/CEV80408_Vocabulary_Handout.pdf DAY 7	component of a small gas engine in their Agriscience notebook. Students gather around workbench with small gas engine on it. Students select appropriate tools to perform the task at hand. Students work with their teacher to reassemble the engine. DAY 7	DAY 7: 40 mins.

	Teacher explains to the class that today we will be looking at a Faulty System- our small gas engine. Something is wrong with it preventing it from running. Your job is to solve the problem by identifying what is wrong and correcting it allowing the engine to run. (teacher does a minor adjustment to the engine preventing it from starting) Teacher explains to the class that this is called troubleshooting an engine. Source: Small Engine Troubleshooting https://www.motherearthnews.com/homesteading-and-livestock/small-engine-troubleshooting-zmaz89mjzshe https://www.4-h.org/parents/curriculum/small-engines https://www.georgiaffa.org/curriculum/topic.aspx?ID=8&TID=20 https://uen.org/core/core.do?courseNum=470606 Teacher provides students with an exit ticket question: "How can understanding the trouble-shooting process help you solve mechanical problems you may run into in your future?"	Students gather around shop bench with the engine and begin to troubleshoot for problem(s) Students write responses to the exit ticket question and submit them to the teacher on their way out of the classroom. Students receive teacher comments in the following class period.	35 mins 5 min.

Differentiation	Students will be grouped by their abilities and interests. Teacher will provide scaffolded support where needed. Students who have physical disabilities will be accommodated for. Students who are meeting all of the expectations will be challenged to go above and beyond.		
Closure	Teacher provides students with an exit ticket question: "How can understanding the trouble-shooting process help you solve mechanical problems you may run into in your future?" Students write responses to the exit ticket question and submit them to the teacher on their way out of the classroom. Students receive teacher comments in the following class period.		
Extension	Engine instruction for this learning experience is only offered as an introduction to problem solving. Actual engine repair is quite a few units. If students indicate a real interest in the material, extensive lessons on this topic could be offered on several engines allowing students to receive some real individual hands on instruction.		
ASSESSMENT			
College, Career, and Life Readiness Skills	Based on Middle-level Life/Career Rubrics available at: https://nyctecenter.org/middle-level-life-career-rubric-database/rubrics?start=0		

Performance Measure	**Exemplary**	**Proficient**	**Developing**	**Beginning**
Analyzes Critical Information	Thoroughly evaluates the reliability of the source and the information researched using internal and external validation.	Thoroughly evaluates information researched using internal and external validation.	Evaluates information researched but not thoroughly.	Does not evaluate information.
Contributes New Ideas	Appropriately contributes new and innovative ideas based on reliable resources.	Often contributes new and innovative ideas based on known and reliable resources and skills.	Contributes some new and innovative ideas based on known resources and skills.	Rarely contributes new ideas as skills and resources are not developed enough.
Demonstrates Originality and Inventiveness	Consistently demonstrates creativity in new situations.	Demonstrates creativity in many new situations.	Demonstrates creativity but does not always understand how to express it.	Does not demonstrate creativity.
Is Aware of Own Thinking	Consistently aware of the process used to analyze problems and make decisions.	Is aware of process used to analyze problems and make decisions.	Shows limited ability to describe process used to make choices and solve problems.	Is unaware of or unable to describe the process of making choices.
Maintains Focus to Completion of the Project	Stays focused consistently, prioritizes tasks, recognizes time constraints of projects, and avoids distractions while meeting deadlines.	Develops a timeline for the work to be completed and stays focused throughout the project.	Is occasionally off task in regards to accomplishing the project, thus only a portion of it is completed.	Is often off task and does not complete the project.

Performance Measure	Exemplary	Proficient	Developing	Beginning
Resolves Problems that Arise in Completing Tasks	Easily and quickly identifies resources that may help solve a specific problem and applies critical thinking to using those resources effectively.	Identifies resources that may help solve a specific problem and applies critical thinking to using that resources correctly.	Sometimes identifies resources that may help solve a specific problem but does not apply critical thinking to using that resources.	Neither identifies resources that may help solve a specific problem nor applies critical thinking to aid in problem-solving.
Uses System Thinking	Recognizes and manipulates parts of a system to come together to accomplish tasks.	Recognizes how the parts of a system work together to accomplish tasks.	Identifies the parts of a system but cannot explain how they work together.	Is able to identify only some system parts and loses sight of how they work together.
Shows Willingness to Take Risks	Embraces the idea that attempting/experimenting is an important part of success and approaches opportunities with an understanding that failed attempts are likely.	Understands that attempting/experimenting is an important step on the path to success, including failed attempts.	Understands that attempting/experimenting is an important step on the path to success but does not understand that this includes failed attempts as well.	Does not understand how failed attempts are part of the process that leads to suc