

Project/Problem Based Learning Lesson Template

Created By:	Topic: <i>City Planners</i>	Grade Level or Subject: <i>Geometry & Advanced Manufacturing 2</i>
Science Standards:		
Math Standards: <u>G.CO.D.11</u> Perform formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). <u>G.CO.D.12</u> Use geometric constructions to solve geometric problems in context, by hand and using technology.* <u>G.GMD.A.1</u> Understand and explain the formulas for the volume and surface area of a cylinder, cone, prism, and pyramid. <u>G.GMD.A.2</u> Use volume and surface area formulas for cylinders, cones, prisms, pyramids, and spheres to solve problems in a real-world context. <u>G.MG.A.1</u> Use geometric shapes, their measures, and their properties to model objects found in a real-world context for the purpose of approximating solutions to problems.*		
ELA Standards: <u>ELA.9-10.L.VAU.6</u> Acquire and accurately use general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the post-secondary and workforce readiness level.		
Computer Science Standards:		
CTE (Program of Study) Standards: <u>2.1 Simple Drawings:</u> Create linear and angular drawings to represent real-world physical scenarios in two and three dimensions. For example, based on physical requirements for a bracket, develop a plan, and create a drawing based on the required geometry for accurately fabricating the bracket, including precise linear and angular measures.		

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2.2 Mathematics: Apply mathematics concepts to solve electronics and manufacturing industry problems. For example, calculate the impact of the addition of random variables representing material dimensions that include several tolerances and dimensional allowances on the final combined work product.

2.3 Dimensional Drawings: Create two- and three-dimensional scale drawings using accepted dimensioning rules and measurement systems. For example, as part of a project to fabricate a custom-shaped metal block, develop the complete drawings that specify the dimensional details for each step of the construction process

Additional Standards (Social Studies, Art, Physical Education, etc.):

PBL Summary: Write a few sentences describing this PBL lesson/unit.
 Students in the Advanced Manufacturing Courses will collaboratively work with Geometry students to solve a community problem. Involving Industrial Board or Chamber of Commerce members, students will be given an opportunity to apply their mathematics and knowledge of manufacturing principles to solve a local issue. Student solutions will be presented back to the Industrial Board or Chamber of Commerce in a capstone project.

Multi-Dimensional/Driving Question: Think of a relevant problem with multiple solutions that will drive student learning.

 How can mathematics and manufacturing work together to solve a local issue?

Tennessee Academic Standards for Science Connection

Disciplinary Core Idea(s):	Science & Engineering Practice(s):	Cross Cutting Concept(s):

21st Century Skills Addressed (circle all that apply):

Creativity

Collaboration

Critical Thinking

Communication

Culminating Event: What final student learning products will show student mastery of the content area standards?

Students will present their final model with suggested solutions to the Chamber of Commerce or Industrial Board. Students should highlight the project specifications used to generate their solution.

Hook / CTSO Competition Event:

Develop an introductory activity that will spark student interest and further questions.

Hook: A member from the local Chamber of Commerce or Industrial Planning board will come in to speak to the Advanced Manufacturing course to highlight a local issue they would like students to apply their knowledge and seek ideas or solutions for. *i.e .A storage solution is needed for a local business.*

Knowledge gained from this PBL will directly prepare students for the SkillsUA Additive Competition, Automated Manufacturing Technology Competition, Career Pathways-Industrial Engineering Technology, CNC Programming Competition

Industry/Community Partners:

List potential business or industry partners that could add to the learning experience for students. Include websites or contact info.

Members for the Local Chamber of Commerce or Industrial Planning Board

What do you need from these partners (i.e. guest speaker, field trip, help facilitate an activity)?

A guest speaker to introduce the problem/lesson hook to the students.

A community partner could speak to the students about their role on the board as well as providing students with information on the project they are seeking solutions or ideas to solve.

Daily Activities: What activities will students complete to answer the multi-dimensional/driving question (that reinforces content from the standards)?

*The project will begin with a kick-off presentation from a guest speaker. A community member of the Industrial Board or Chamber of Commerce will present a local issue to students and ask

Resources/Materials Needed:

Required materials will be specific to the individual program materials and problem presented.

This an include but not limited to
CNC lathe
CNC mill

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<p>they work collaboratively with the geometry classes to create a solution given the problem specifics.</p> <p>*Students will brainstorm potential solutions, take measurements, and use both hand and digital tools to create size or scale model solutions.</p> <p>*Advanced manufacturing students will then present the Geometry class with the same tasks and students will analyze first round potential solutions. Students in the geometry class will double check mathematical calculations and provide feedback on potential solutions.</p> <p>*Students in Advanced Manufacturing courses will take their prototype solution feedback and make corrections to generate the best potential solutions.</p> <p>*Advanced Manufacturing students will begin to create size or scale solutions based on the project specifications and calculations</p> <p>*Students will then present their final solution ideas back to the Community Partner.</p> <p>***Additional Capstone presentation opportunities include community presentations for CTE on wheels or community open house.</p>	<p>Manual mills & lathes Plasma Table Welders Metal stock</p>
<p>Technology Integration: How is technology being utilized to support students in creating authentic learning experiences and/or products? How does technology enhance the learning experience?</p> <p>Tool Specific Technology will be used by the Advanced Manufacturing students. Specific technology types will be based on the requirements of their project and aligned to industry specific requirements. This can include, but are not limited to, CNC Lathe, CNC Mill, Plasma Table, ect.</p>	
<p>STEM/STE(A)M Career Connections: What STEM/STE(A)M careers (within your region) can you connect to this PBL Unit of Study?</p> <p>Many STEAM careers align with this activity and include, but not limited to, Welder, CAD technician, Mechatronics Engineering Technician, Fabricator, Electronics Technician, Machinist, Mechanical Engineer, Electrician Engineer, etc.</p>	
<p>CTSO Connections: What Career and Technical Student Organization connection can be made with this PBL Unit of Study?</p> <p>Activities from this lesson will directly prepare students for the SkillsUSA Additive Competition, Automated Manufacturing Technology Competition, Career Pathways-Industrial Engineering Technology, CNC Programming Competition</p>	

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Capstone Presentation: How will students present what they've learned publicly? This can be the culminating event if that event is presenting what has been learned publicly.

Students can present their capstone learning in a variety of ways.

Option 1: Students share their proposed solutions with the Industrial Board or Chamber of Commerce in a capstone project.

Option 2: Students will share and discuss their process with members of the community in presentations such as School Open-House or CTE on Wheels

Option 3: Skills developed as part of this project can be applied to various SkillsUSA competitions

Industry Certification: What industry certification opportunity is connected with this particular PBL Unit of Study?

Professional Certification in Industry 4.0, P.M.I. and OSHA 10

Performance Based Rubric

Standards	Developing	On-Target	Mastery
Science	N/A	N/A	N/A
Math	Students accurately apply of the geometric formulas and tools listed in the standards to solve a complex, real-world solution.	Students accurately apply most of the geometric formulas and tools listed in the standards to solve a complex, real-world solution.	Students accurately apply all of the geometric formulas and tools listed in the standards to solve a complex, real-world solution.
ELA	Students use general language but need support on using domain-specific language correctly when communicating in both oral and written form.	Students mostly use general and domain-specific language correctly when communicating in both oral and written form.	Students accurately use general and domain-specific language when communicating in both oral and written form.
Computer Science	N/A	N/A	N/A
CTE (Program of Study)	<p>Students can precisely and accurately complete only two of the three following tasks with supports:</p> <p>Create linear and angular drawings to represent real-world physical scenarios in two and three dimensions.</p>	<p>Students can precisely and accurately complete each of the three following tasks with supports:</p> <p>Create linear and angular drawings to represent real-world physical scenarios in two and three dimensions.</p>	<p>Students can precisely and accurately complete each of the three following tasks with minimal support:</p> <p>Create linear and angular drawings to represent real-world physical scenarios in two and three dimensions.</p>

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	<p>Apply mathematics concepts to solve electronics and manufacturing industry problems</p> <p>Create two- and three-dimensional scale drawings using accepted dimensioning rules and measurement systems.</p>	<p>Apply mathematics concepts to solve electronics and manufacturing industry problems</p> <p>Create two- and three-dimensional scale drawings using accepted dimensioning rules and measurement systems.</p>	<p>Apply mathematics concepts to solve electronics and manufacturing industry problems</p> <p>Create two- and three-dimensional scale drawings using accepted dimensioning rules and measurement systems.</p>
Additional Standards:	N/A	N/A	N/A

****This document is editable and can be customized to best fit your needs.***