**STEM Middle and High School Mini Lesson Template**

STEM lessons will take a transdisciplinary approach. This template is designed to aid in the development of a transdisciplinary STEM lesson.

**Title:** Basic CNC Machining using G & M Code. Using the coordinate system.

**Grade Level:** High School – Computer Integrated Manufacturing

**Questions to ask before designing a lesson:**

1. **What is the essential question(s) for the lesson?** How can we mathematically model CNC milling?
	1. **Why is this question relevant?** We can use the final designs to program the CNC mill and produce the part.
	2. **What is the connection to real life?** Nearly all manufacturing uses CNC programming for their manufacturing systems.

**\*\***This lesson can be used in connection to the STEM completers and the Metals and Machines Class.

1. **What techniques are used to make the lesson:**
	1. **inquiry- based?** Information is given about the design and the programming, and students must develop a design of their own.
	2. **project- based?** Activities can be given to students as part of the lesson, or as a follow-up or a long term assignment.
2. **What are the lesson outcomes?** Students can write G & M code and program the CNC Milling Machine. Other outcomes include learning the coordinate system and producing a real part.
3. **How is participant discourse promoted?** Everyone must develop a design of their own.
4. **How are science, technology, engineering, and mathematics addressed in the lesson?**

The lesson is a basically a math lesson, (coordinate system) that carries across to IED, CIM and machines and metals. The mill is high end technology.

1. Use the table below to match standards.

| **Standard** | **Standard Number (s)** | **Activity** |
| --- | --- | --- |
| **Common Core Standard for Mathematical Practice** | 4 | Model with mathematics |
| **International Technology Education Association** **Standards for Technological Literacy** | 12 | Characteristics & scope of technologyCore concepts of technology |
| **Common Core Reading Standards for Literacy in Science and Technical Subjects** | 410 | Interpret words and phrases as they are used in text…Read and comprehend science/technical texts at grade level independently and proficiently. |
| **Common Core Writing Standards for Literacy in History/ Social Studies, Science and Technical Subjects** | 410 | Produce clear and coherent writingWrite routinely over extended and shorter time frames. |
| **Skills and Processes Core Learning Goals for Science** | 27 | Post scientific questions and suggest investigative approachesShow connections between sciences and between science and other fields of knowledge |
| **Content Standard** | 2.3.3 CIM | Coordinate systems |

1. 5E Model – STEM lessons will use the 5E Model

| **5E Lesson Components** | **Description of Activity** |
| --- | --- |
| **Engagement**The activities in this section capture the participants’ attention, stimulate their thinking, and help them access prior knowledge. | Design a nameplate to be cut out on the CNC milling machine. |
| **Exploration**In this section, participants are given time to think, plan, investigate, and organize collected information. | Real life designing and programming of manufacturing machines. |
| **Explanation**Participants are now involved in an analysis of their exploration. Their understanding is clarified and modified because of reflective activities. | Follow-up activities such as circular interpolation. Create a design using circles. |
| **Extension**This section gives participants the opportunity to expand and solidify their understanding of the concept and/or apply it to a real world situation. | All situations are “real world.” Students can easily apply their knowledge with the STEM academy pathways and real world manufacturing.Using Inventor to design and program the machine.  |
| **Evaluation**Evaluation occurs throughout the lesson. Scoring tools developed by teachers and participants target what participants must know and do. Consistent use of scoring tools improves learning. | Evaluation of the design and the programming. Evaluation of the overall product created. See Ruberic |