



Technology Education Curriculum
Level: Secondary

Subtractive Machining



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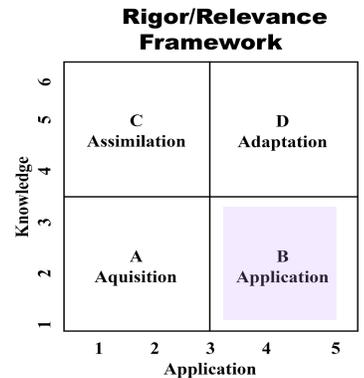
Technology Education Curriculum Level: Secondary Teacher Lesson Plan

INDUSTRIAL & TECHNOLOGY EDUCATION Career & Technical Learning Activity - CTLA

Lesson Objectives & Student Expectations

Rigor/Relevance Framework: B

Length of lesson: 4 class periods



The student will:

1. Discover the process of subtractive machining.
2. Compare and contrast the subtractive and additive machining process.
3. Analyze the benefits of subtractive manufacturing in today's market.

Common Core Standards Addressed

Benchmark#	Description
LACC.68.RST.1.1	Cite specific textual evidence to support analysis of science and technical texts
LACC.68.RST.1.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions
LACC.68.RST.3.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table)
LACC.68.WHST.1.1	Write arguments focused on discipline-specific content.
LACC.68.WHST.3.9	Draw evidence from informational texts to support analysis, reflection, and research

Key Vocabulary Terms

Additive	Subtractive	Accessible	Conventional
Architect	Entrenched	Prototyping	





Materials & Supplies Needed For This Activity

Article, Portfolio/Notebook Paper, Teacher PowerPoint, Projector, Student Worksheets.

Teacher Sequence To Present Lesson *Day 1 of 4*

Est. Time (minutes)	Description of Teacher Action	Notes
5	Bell work activity - Have students answer the question, then review the answer. Page 2 of presentation.	Use the Subtractive Machining PowerPoint to guide your lesson.
10	Show students the video about the 3D printing revolution. Have students do a think, pair, share to address the question, "What problems do you think would come from anyone being able to print anything they want at home?" Page 3 of presentation.	Prepare video and groups ahead of time. Link to the video: http://www.bbc.co.uk/news/technology-20137791
5	Review vocabulary words with students	Prepare word boards or add words to your word wall.
15	Hand out the article(s) "Will 3D printing revolutionize manufacturing?" and/or "Will Hybrid Additive/Subtractive Fabrication Devices prove to be the Key to Unlocking an Even More Successful Manufacturing Future?" and student worksheets. Prepare students for reading by explaining the text marking process and what marks to use. Mark "P" if the text is describing past manufacturing methods, Mark "F" if the text is describing future manufacturing methods, Mark "S" if a savings of time, money or labor is being described. Allow students time to read the article.	Prepare copies ahead of time.
10	Have students answer the questions from the text.	
5	Have students cleanup and complete a daily reflection.	Do any type of reflection, ex. Exit slip, daily reflection log, discussion, or answering a question.

Student Procedures To Do This Lesson *Day 1 of 4*

1. Begin Bell work activity per teacher's directions.
2. Participate in Bell work discussion.
3. Watch the 3D Printing Revolution video.
4. Answer the discussion question.
5. Review vocabulary terms and mark paragraphs in the article.
6. Read the article and answer questions.





Teacher Sequence To Present Lesson *Day 2 of 4*

Est. Time (minutes)	Description of Teacher Action	Notes
5	Bell work activity - Have students answer the question, then review the answer. Page 7 of presentation.	Use the Subtractive Machining PowerPoint presentation to guide your lesson.
10	Review the answers from the text questions, with the students.	
5	Direct students to the company profile worksheet. Explain that students will be using the computers to do a preview of the company they will be visiting. They will look for key elements that they should observe on the company tour.	Review searching criteria with students or direct them to the exact company website. Prepare this ahead of time.
15	Allow students to go to the computer and begin working.	Prepare copies ahead of time.
10	Review the answers with the students.	
5	Discuss with students the process of taking notes while on the trip using the directed note taking worksheet.	Collect students' note-taking worksheets to pass out when on the field trip.

Student Procedures To Do This Lesson *Day 2 of 4*

1. Begin Bell work activity per teacher's directions.
2. Participate in Bell work discussion.
3. Review answers from the text questions.
4. Complete the company profile worksheet and review with your instructor.
5. Discuss the directed note taking process with your teacher and prepare for the field trip.

Teacher Sequence To Present Lesson *Day 3 of 4*

Est. Time (minutes)	Description of Teacher Action	Notes
60	Pass out the students' directed note-taking worksheet. Review the procedures for asking questions while on the tour.	
5	After the tour collect the students' worksheets to redistribute in class the following day.	

Student Procedures To Do This Lesson *Day 3 of 4*

1. Ask questions while on your tour.
2. Write down notes from your tour.



Teacher Sequence To Present Lesson *Day 4 of 4*

Est. Time (minutes)	Description of Teacher Action	Notes
5	Bell work activity - Have students answer the question, then review the answer.	Use the Subtractive Machining PowerPoint to guide your lesson.
10	Have students share their observations from the tour on the previous day. Encourage students to write additional observations based on their classmates' experiences. Have students put a check mark in the box that best matches the statement.	If a note doesn't match a check box it's okay. These are for students to begin identifying topics for their writing.
20	Using their notes, instruct students to draft an essay on the student worksheet. Remind students to use both their notes from the tour and textual evidence when writing the essay.	
5	Review and collect all student work.	

Student Procedures To Do This Lesson *Day 4 of 4*

1. Begin Bell work activity per teacher's directions.
2. Participate in Bell work discussion.
3. Review and share notes from your tour.
4. Analyze notes.
5. Write an essay that includes information from the text and tour observations.
6. Turn in your essay and cleanup for dismissal.

Evidence of Student Achievement

Students will complete an essay that uses evidence from text and observations they make while on the company tour. The essay will be graded by the teacher for accuracy, punctuation, spelling and format.



Student Name _____
 Class Period _____ Date _____

Essay Grading Rubric

Category	4 Points	3 Points	2 Points	1 Point
Focus & Details	There is one clear, well focused topic. Main ideas are clear and are well supported by detailed and accurate information.	There is one clear, well focused topic. Main ideas are clear but are not well supported by detailed information.	There is one topic. Main ideas are somewhat clear.	The topic and main ideas are not clear.
Organization	The introduction is inviting, states the main topic, and provides an overview of the paper. Information is relevant and presented in a logical order. The conclusion is strong.	The introduction states the main topic and provides an overview of the paper. A conclusion is included.	The introduction states the main topic. A conclusion is included.	There is no clear introduction, structure, or conclusion.
Word Choice	The author uses technical words and phrases. The choice and placement of words seems accurate, natural, and not forced.	The author uses technical words and phrases. The choice and placement of words is inaccurate at times and/or seems overdone.	The author uses words that communicate clearly, but the writing lacks variety.	Jargon or clichés may be present and detract from the meaning.
Sentence Structure, Grammar, Mechanics, & Spelling	All sentences are well constructed and have varied structure and length. The author makes no errors in grammar, mechanics, and/or spelling.	The author makes a few errors in grammar, mechanics, and/or spelling, but they do not interfere with understanding.	The author makes several errors in grammar, mechanics, and/or spelling that interfere with understanding.	The author makes numerous errors in grammar, mechanics, and/or spelling that interfere with understanding.

Total Points: _____
 A = 16 – 14, B = 13 – 11, C = 10 – 8, D = 7 – 5, F = 4 or less

