



Materials Used in Manufacturing Technologies

Illinois CTE Endorsement Area:
Architecture & Construction, Manufacturing
Teacher and Student Editions

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Converted to Format by Karen Aldworth

Current Phase of Lesson: Phase 3 of 5



**Illinois
State Board of
Education**



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Lesson Overview:

This lesson introduces the students to the use of materials in a manufacturing process. The students will view a video on how an office chair is made. From the video students will discuss the manufacturing processes and the materials used.

Next students will be given a pencil and asked to sketch and annotate the parts of the pencil. Then they will watch a video on the making of a pencil.

The final section will introduce the students to a Shaker Bench. They will recreate the bench with materials of their choice.

Classes or Discipline:

- Architectural classes
- Introduction to manufacturing
- Woods and metals classes

Career Cluster:

- [Architecture & Construction](#)
- [Manufacturing](#)

Illinois CTE Endorsement Area

- [Architecture and Construction](#)
- [Manufacturing](#)

Grade Level(s):

- This topic is appropriate for grades 9-12.

Suggested Days/Minutes: 2-3 class periods of 50 minutes each.

Learning Objectives:

At the conclusion of this lesson, students will be able to:

- Differentiate renewable and nonrenewable materials.
- Identify the manufacturing process of a given product.
- Describe the importance of a sketch or drawing.
- Justify how materials are selected for a given product based on their purpose.
- Explain the purpose of a Bill of Materials (BOM).

Standards Addressed:

- [Standards for Technological Literacy:](#)
 - #19-Students will develop an understanding of and be able to select and use manufacturing technologies
- [Next Generation Science Standard:](#)
 - HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics

Enduring Understandings:

- A knowledge of materials including the how and why they are used for a particular application is beneficial for the consumer.
- Students will understand that trade-offs will always be a factor in any career path they choose.

Resources and References:

1. Computer with access to Internet
2. Student access to computer/Internet to research information
3. Teacher Internet access for opening video and/or slideshow
4. Material selected for projects
5. Video:
 - [How Its Made – Office Chairs](#)
 - [How we make pencils](#)
 - [Drifter Skateboard Manufacturing](#)
 - [Wooden Bench Video](#)
6. Slideshow:
 - [Materials used in Manufacturing Technologies](#) (Activity 1)
7. Handouts:
 - [Activity 1 handout](#)

Essential Employability Skills:

There are four [essential employability skills](#):

- Personal Ethic: integrity, respect, perseverance, positive attitude, present and engaged in work
- Work Ethic: dependability, professionalism, completes assignment
- Teamwork: critical thinking, effective and cooperative work, problem solving skills
- Communication: active listening, clear communication

The focus of this lesson is on present and engaged in work, completes assignment, active listening, clear communication, critical thinking and problem solving skills.

Skill	How it is addressed:
Present and engaged in work, Completes assignment	In the Explore section the students will be given a pencil and asked to annotate a drawing of the pencil. This will require students to be engaged in the assignment and turn it in completed.
Active Listening Clear Communication	In the Engage section students will view a video and then have a conversation regarding different materials and fasteners from the video.
Critical Thinking Problem solving skills	In the Elaborate section students will be asked to create a bench. This will require following directions and also finding a solution to any issues that arise.

Suggested Differentiation Strategies:

- Record lesson in classroom. This will allow for a visual aspect of the lesson being taught for different types of learners.
- Allocating roles to each member of the group can also help pupils organize themselves according to their different skills and capabilities. This gives less able students a way to add value and generate more confidence.
- Rather than setting a task with a single outcome or 'right' answer, taking a more interpretive approach to an exercise gives students the flexibility to arrive at a more personalized result. Students of different abilities will arrive at outcomes that match their level of understanding and learning.

Throughout this lesson suggested teacher notes and comments are in red.

1. Engage (5 minutes):

1. Watch video [Drifter Skateboard Manufacturing](#) (5 minutes).
2. What tools did you see being used?
3. What surprised you about the manufacturing processes used by this company?

2. Explore (70 minutes):

Part I

1. Watch the following video: [How Its Made – Office Chairs](#) (5:07 minutes)
This short video shows the processes of how an office chair is made. Different manufacturing processes are shown (assembly, bending, welding, sewing....). Also, different materials are mentioned (foam, leather, plastic, hydraulic, aluminum base...). Use “ILCTE Materials used in Manufacturing Technologies (Activity 1)” as a visual guide to go through this activity.
2. In a small group, make a list of as many terms about the manufacturing processes seen in the video as you can remember.
3. Next, make a list of the materials shown in the video.
A competition between groups may help motivate the students to think of more processes or materials.
Each group should now have a list of processes and materials. As the teacher, go around and ask each group for one material and one process that is different from a previous group. Write these on the board. Give students “Activity 1 Handout” to document work for this lesson.
Once the lists are compiled on the board with the student information. The teacher will then assign terms to each table and group.
4. Your teacher will assign a material and/or process to each group. Research this topic and come up with a 1-3-minute explanation of the terms.
Give them 5 minutes to research and discuss and then go group by group with a short explanation.

Part II

1. Get a pencil from your teacher.
2. Make a detailed sketch of the pencil. Be sure to include all the parts.
3. Label all the parts of the pencil along with material the parts are made from. The list of parts is called the “Bill of Material.”
(painted body (two halves), ferrule, eraser, core).
4. Indicate on your sketch the classification of each of the materials. You can select from the following list of classifications:
 - a. renewable

- b. non-renewable
 - c. organic
 - d. inorganic
5. Watch the video of how a wooden pencil is made.
[How We Make Pencils](#) (4:30 minutes)

3. Explain (20 minutes):

1. Explain why materials are identified as either renewable or nonrenewable.
Renewable material can be replenished. Non-renewable products are from a source that is not easily or quickly replaced (such as rock).
2. List the steps of the manufacturing process of a pencil.
This could be any product, but the students just watched a video on the pencil and should be able to list the steps in order.
3. Why would a sketch be important when making a product?
A sketch has basically two purposes:
 - a. As a means of “seeing” the proposed product to better understand and address problems.
 - b. As a means of communication to others.
4. Use an example of why a certain material is selected to be used in a product.
Allow the students to select the product, the material, and provide a few reasons why it was selected for that application.
5. How does a Bill of Material help someone in making a product?
Knowing the quantity, size, and material allows the builder to make the right selections.

4. Elaborate/Extend (50 minutes):

Students should use the folder with the bench pictures to review and answer the following questions.

1. Your teacher will supply access to a folder of photos of a Shaker Bench. Study the photos and answer the following questions.
 - a. What function does this perform?
 - b. If this bench was overloaded, how might it break?
 - c. What material(s) is the bench made from?
 - d. What is holding the bench together?

Encourage the students to study the photos carefully. Some answers will be speculative but should be supported with as much information as possible. For example, question C could be as simple as "wood." Require that if they cannot identify the species, they should identify the characteristics that would be necessary to make a good bench.

2. Redesign this bench to perform the same function but make it from environmentally friendly materials.

Students can select any material, but do not allow them to make significant design changes. It must still look like a Shaker Bench.
3. Complete a detailed sketch of your design identifying and classifying all parts, just like you did for the pencil earlier.

You may also assign the development of a Bill of Materials.

4. Your teacher may ask you to build a scale model of your bench.

Scale models can be built of cardboard, foam core board, or ¼" foam insulation board. Perhaps it would be appropriate to build full size using the proper materials. This would allow testing of the product.

5. Evaluate:

1. Your teacher may use the following rubric to evaluate your work from the Elaborate / Extend section.

Category	1	2	3
Materials	Materials will cause the bench to fail early in life cycle or are not environmentally friendly	Materials will work but are not appropriate for this application. They are not the most environmentally friendly option available.	Selected appropriate materials given the constraints of the design and construction.
Fasteners	Fasteners will not hold the bench together adequately.	Fasteners will work but do not match the design requirements of the Shaker Bench.	Selected appropriate fasteners
Joinery	Joinery will not be strong enough to withstand normal forces.	Joinery will work but is not consistent with the bench design or the materials used.	Joinery selected is appropriate

Notes:

All ILCTE lessons are vetted by Curriculum Leader, Dr. Brad Christensen.

To see a review of this lesson by previous users, [click here](#).

We invite users of this lesson to [click here](#) to leave follow up information and rating.

We would like to publish pictures / videos of your students using this lesson. Please send to Rod McQuality at: rdmcquality@ilstu.edu. By sending pictures, you have met all the picture / video release for your school.

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