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Inventor's Workshop: Design a Laboratory

Grade Level: 9 - 12th grade

Unit Objectives:

Students will...

1. Learn about the lift and scientific contribution of inventor Lewis Howard Latimer, through a virtual tour of the Lewis Latimer museum.

2. Compare Latimer's inventor workspace with other scientific laboratories, as well as with the modern day makerspace.

3. Build an understanding of the tools found in both Latimer's home laboratory and other scientific workspaces throughout history, while learning the importance of safety precautions, supplies, and equipment during the process of invention.

4. Develop a criteria to test the efficiency of a lab layout design, while studying its proportions and geometric measurements.

5. Design their own laboratory to explore their own personalized scientific needs, hypotheses, and procedures.

Concepts/Skills:

Prototyping, design, problem solving skills, and understanding lab facilities and equipment.

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The Inventor

Learn about places where inventor's work

Challenge
Create your own inventor's workshop

Learning Objective
Build an understanding of what inventors do, where they do it, and the importance of inventing!

Duration
Suggestion time 60 minutes

Lesson Outline

Engage	10 minutes
Explore	10 minutes
Explain	20 minutes
Elaborate	15 minutes
Evaluate	5 minutes

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ENGAGE

10 minutes

Students will be introduced to an inventor's workshop and design their own. Through an exploration of **Lewis Howard Latimer's** home workshop, students will recognize the tools needed for a productive workspace. We will explore what inventing at home looks like, and how a scientific hypothesis leads to larger societal change and discoveries.

One of the best ways to capture and engage students is by starting with familiar ideas and images. Ask students where they see inventors in their favorite TV Shows, Movies, Comic Books, or even on the news/current events.. **Where do people invent important things? What type of scientific advancements start in labs?**

However, integrating pop culture into your lesson does not mean that your entire discussion should focus on said reference. Instead, you can use these shows/movies/etc. to connect Latimer's Virtual House Tour with what students already know about laboratories.

THINKING PROMPT:

Think about the various spaces where scientists and inventors do their work. We call those spaces laboratories (labs), workshops or makerspaces.

Some examples of science labs or inventor workshops are in our television and media. Some popular culture examples include: Phineas and Ferb, Harry Potter and the Sorcerer's Stone, Despicable Me, and A Wrinkle in Time.

- *Have you seen a lab in a movie or television show?*
- *Have you ever visited a lab in real life?*
- *What did the lab look like? Who used the space? Can you remember what was explored?*
- *If you were to create your own science lab, what would be included in the layout? What would be most important?*

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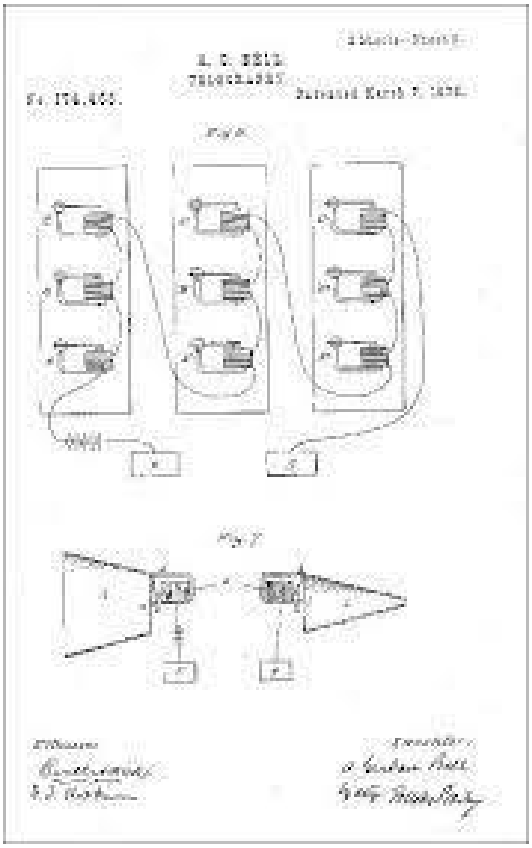
EXPLORE

10 minutes

Watch Video:
"Lewis H Latimer, Electrical Pioneer and Inventor, a Seldom Told History"
(6:45 Minutes)



Lewis Howard Latimer (1848-1928), was an African-American inventor, electrical pioneer, and a son of fugitive slaves. With no access to formal education, Latimer taught himself mechanical drawing while in the Union Navy, and eventually became a chief draftsman, patent expert, and inventor.

Latimer's at-home workspace was quite different then the laboratories he used when working with Thomas Edison in 1884. After watching the following videos, spend time discussing the similarities and differences with your students. Tell them to begin thinking about what their own scientific layout would look like. What equipment would be there? What kinds of experiments would be performed? What kind of scientists would be welcomed?

KEY VOCABULARY

Science Laboratory (lab): A scientific space used to test important theories, measure properties, document findings, and explore useful experiments.

Inventor's Workshop: Home Based labs that provides flexibility for inventors to work when inspired.

Makerspace: A collaborative space where inventors share ideas about technology, equipment, and brainstorms on future innovations.

PLACES FOR INVENTING & MAKING

For some students the concept of a laboratory that is not a scientific laboratory is difficult to contextualize. It is important for students to explore the concept that invention happens in different spaces.

What is a science laboratory?

A **science laboratory (lab)** is a place or setting used to test scientific information. In this room, experiments are performed. Observations and investigations either agree or disagree with a beginning hypothesis.

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What is an Inventor's Workshop?

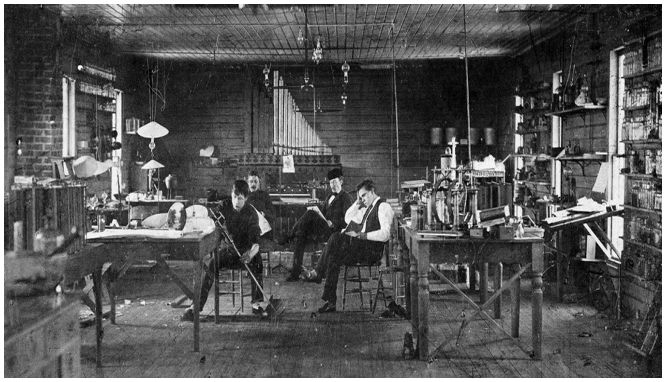
In the times of Lewis Latimer, many labs were based in homes. This provided flexibility for inventors, designers and engineers to work when they were inspired - whether it be early in the morning, or in the middle of the night.

What are some historic and modern inventor's workspaces?

Thomas Edison was the founder of the Edison Company (now known as General Electric). In 1884, Latimer was employed by Edison alongside a team of other scientists - men and women with a variety of skills and educational backgrounds - to invent electrical advancements meant to societally improve the quality of life.

Modern labs are found in colleges, universities, and companies helping to reimagine everyday inventions - from pharmaceuticals creating a new toothpaste flavor, to the motor industry designing self-driving electric cars. Scientists are working in laboratories all over the world, discovering new and exciting ways to fix today's biggest problems.

Think about the history of scientific innovations. Which ones stand out to you, whether it be technological advancements, or public health inventions needed for the greater good of society. How have the ultimate goals and direction of scientific labs changed with society over time?



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What is a Makerspace?

A **makerspace** is a place in which people with shared interests and scientific perspectives gather to share ideas, brainstorm new projects, and collaborate. Through an extensive process of trial-and-error, these makerspace projects may or may not bring important scientific advancements.

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THINKING PROMPT:

Lewis Howard Latimer was an inventor who worked with other scientists including Thomas Alva Edison to create a ***better light bulb****. That laboratory was called the* ***Edison Lab (General Electric)****. There, Latimer worked extremely hard to improve Edison's invention, making it more suitable for people's needs.*

Sometimes, Latimer had ideas that he wanted to work on in the middle of the night. This is when he became inspired to work on new ideas for new inventions of his own.

- *Did Mr. Latimer work in an institutional laboratory all the time? Why or why not?*

  "He liked to work at home because he had ideas that were different from those of his scientific peers. He wanted to think about his ideas and solve problems in his own space."

- *Why was Latimer's home-based lab so important to him?*

  "Latimer established his own creative space, while allowing him to explore his ideas without any premature judgment or opinion from others. "

- *What are some challenges about working from home?*

  "Interruptions, responsibilities, missing important time with family, not having the proper tools, danger/fire/explosion....."

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WORKSHEET

NAME **DATE**
GRADE **TEACHER**

ACTIVITY:

Mr. Lewis Howard Latimer's home Inventor's Workshop was a great place for discovery. Here, he designed a variety of inventions that are still used today! What are some things that you would see in a laboratory? What would you put in your virtual laboratory?

What do some of the tools look like?

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DISCUSSION QUESTIONS:

What do some of these laboratory tools have in common?

What tool do you think you would add to your own virtual laboratory? Why are they not in a regular laboratory?

Have you seen any of these tools in other settings?

What kind of experiments would you like to do in your laboratory?

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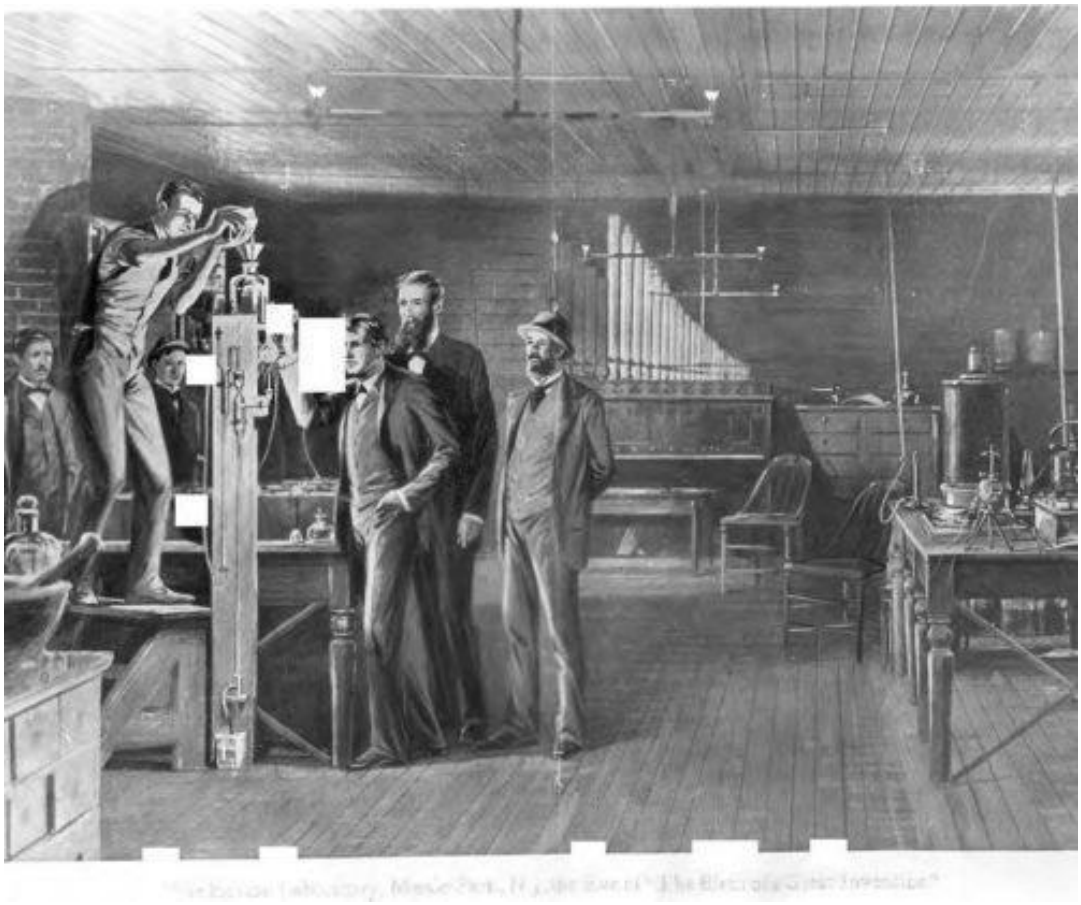
EXPLAIN

20 minutes

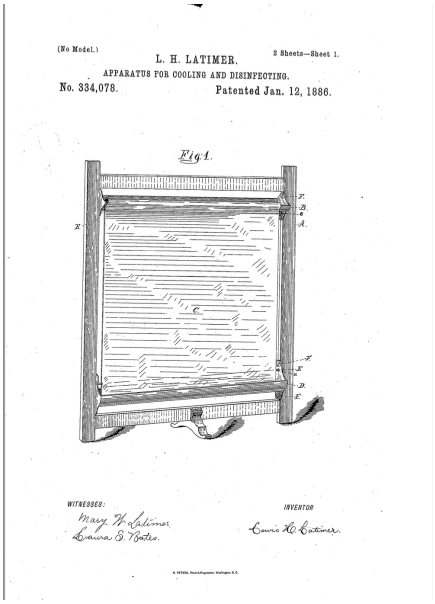


Lewis Latimer was an inventor who lived and worked in the late 1800's. His ideas brought new and improved inventions to people in the United States and around the world. He had many ideas, and some of those inventions are the foundation of a machine we have today.

RESOURCES:
WIKIPEDIA
https://en.wikipedia.org/wiki/Lewis_Howard_Latimer

LEMELSON CENTER
"Edison's light bulb used a carbonized bamboo filament, which unfortunately burnt out rather quickly. Latimer created a way to make the carbon filament more durable by encasing it in cardboard."
(here)

He also formed the ideas behind the air conditioner and other everyday objects.


(No Model.) 2 Sheets—Sheet 1.
L. H. LATIMER.
APPARATUS FOR COOLING AND DISINFECTING.
No. 334,078. Patented Jan. 12, 1886.
Fig 1.
WITNESSES:
INVENTOR
Louis H. Latimer.

Many inventors also worked at home in inventor workshops. Smaller spaces that were specifically designed by the inventor.

BRAINSTORM

Explain to your students that inventions come from ideas, and that the best inventions are developed in teams that work together. Ask your students to also consider the differences of working in a large industrial **Science Laboratory**, a home-based **Inventor's Workshop**, and the various unit measures needed to develop a working makerspace.

Inventing Something New: 3 minutes discussion

Take notes on a board or Padlet. Exploring Lewis Latimer's workspace will support students as they gain an understanding that there were many inventions that changed the world. Where would we be without the lightbulb? What are other cool inventions that have changed our lives?

Examples: Perhaps a car that could fly? Or maybe small pods for living under the water?

Virtual Workspace for Inventing: 3 minutes discussion

Students can also brainstorm how creation can be sparked within the virtual realm. Have your students discuss the ideal workspace, and what it might look like. Be sure to include that they will have to redesign these online labs through **Scratch,** and should be as detailed in their creations as possible!

Examples: How many scientists are in this space? Are there any safety precautions? What types of inventions are made here? How are these inventions for the betterment of society-at-large?

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ELABORATE

15 minutes

After learning about Lewis Latimer's home, we will ask students to complete a short design challenge to consider the idea that Latimer was very successful as an inventor by working in his at-home workspaces, and improving on already-existing inventions.

Work with students to complete a virtual design of a space they would work in to fix a problem and design a new solution.

What would you invent in your workshop? Is there any new technology or machine that you would like to improve?

Remember students should consider:

1. Inventing something new or rethinking something old

2. What is a useful and safe workspace for inventing

Examples: a robotic arm, a chemical/bacteria that kills a new virus, a new cell phone with features that do not yet exist.

The sky's the limit for this activity. Encourage students to think big. Many students will not know the names of the tools they need, that is not important for this assignment. The focus is demonstrating an understanding that there are different workspaces and they are better suited for different types of invention.

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WORKSHEET

NAME **DATE**
GRADE **TEACHER**

ACTIVITY

Your challenge is to create your own virtual lab! Below, draw a sketch of what your laboratory is going to look like.

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EVALUATE

5 minutes

ASSESSMENT RUBRIC

Use the students' design and written descriptions to evaluate students' ability to determine the difference between spaces and concerns about safety, supplies and space for work.

Evaluate their room description for the use of descriptive adjectives, voice, and organization.

	Excellent	Good	Satisfactory	Needs Improvement
Student demonstrated understanding the differences between scientific laboratories and a home based inventors workshop.				
Student provided a clear understanding of the work conducted in a laboratory.				
Student shared their work successfully.				
Student clearly depicted their laboratory using grade level descriptive language.				
Student shared their work confidently to the class and were able to communicate with others.				

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Common Core Standards

Next Generation Science Standards

HS-ETS1-2
Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

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 as well as possible social, cultural, and environmental impacts.

3-5 ETS1-1
Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5 ETS1-3
Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

MS ETS1-1
Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS ETS1-3
Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS ETS1-4
Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.