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Inventor's Workshop: Design a Laboratory

Grade Level: 6 - 8th grade

Unit Objectives:

Students will...

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

2. 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.

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

4. Work in a small group to create their own laboratory using software and art supplies to depict 3-D objects using 2-D representations.

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 the physical spaces where scientists, engineers, and inventors work.

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

Introduce the concepts of length, width, and perimeter to your students. Make sure that they know how to determine the surface area for simple rectangular shapes (width x length).

Have them practice their measurement skills in your classroom, determining the dimensions of your classroom and objects in it, such as your desk, student desks, and any chairs, tables, and bookcases.

If you are working with older students, teach them how to find the area of polygons by breaking them into component shapes and estimating.

Brainstorm with your class the elements that a laboratory might have, such as lab benches, stools, equipment, safety stations, 3D printers. Which items are needed **vs.** which are desired? What should a laboratory accomplish for a scientist? Do all laboratories look and perform the same?

THINKING PROMPT:

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

Let's talk about laboratories! Follow the questions below to see how much your students know about working in a lab

Answers could include: Having a lab in your science classrooms, rules: wearing goggles, washing your hands, cleaning all your tools, etc. Careers could include: Chemist, Biologist, Lab technician, etc.

Ask your students to consider the key elements of a lab, and make a class list.

INQUIRY QUESTIONS:

- Have you seen a lab in a movie or television show?
- Have you ever had class in a lab? Are there any special rules you need to follow when you're in a lab?
- What careers are focused in a lab?

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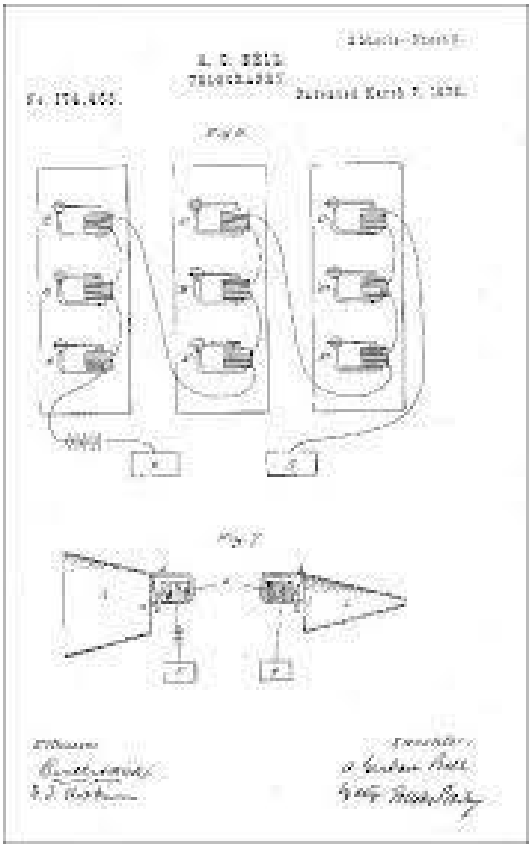
EXPLORE

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. The equipment, scientific tools, and measurements used to form new experiments have largely improved with time and technological advancements. After watching the

following videos, spend time discussing the similarities and differences with your students.

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 understand. Guiding students to the realization that invention can happen in a variety of ways and settings is an important concept to explore.

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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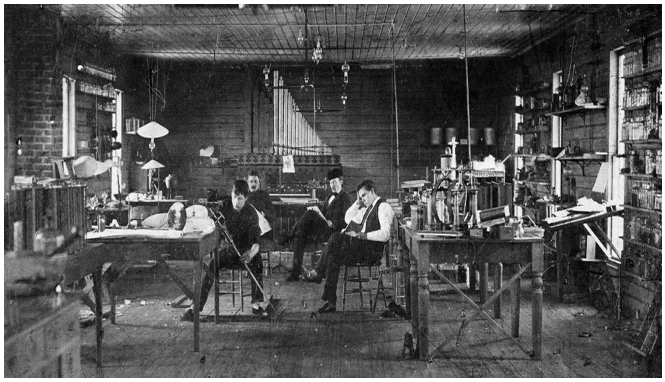
What is an Inventor's Workshop?

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.



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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.

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! When you are working in a laboratory you need to be safe and cautious. Below, list everything you think someone who works in a lab needs to wear or rules that they need to follow!

What do some of the tools look like?

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DISCUSSION QUESTIONS:

What do some of these laboratory tools have in common?

Why do you think laboratories need safety rules to follow?

Have you seen any of these tools in other settings?

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

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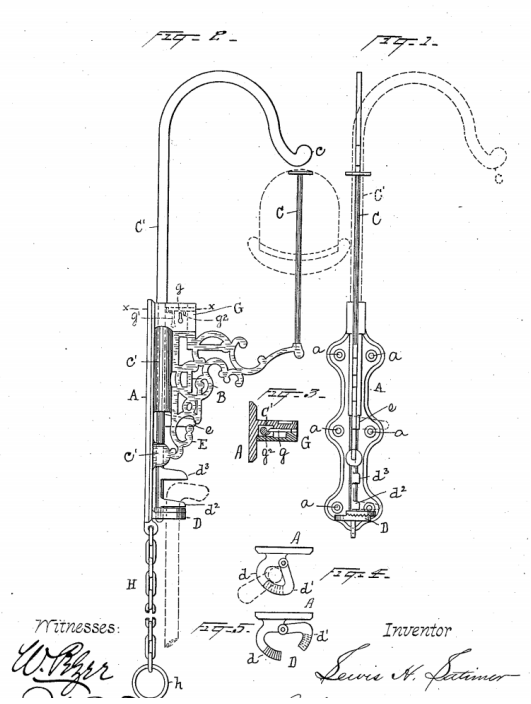
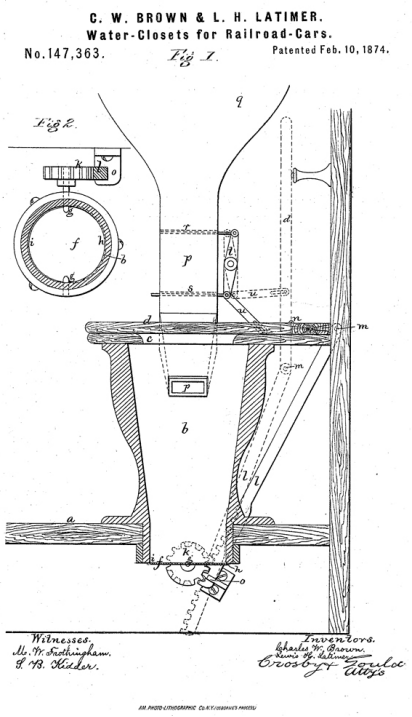
EXPLAIN

20 minutes





Lewis Latimer was an inventor who lived and invented in the late 1800's. His ideas brought new inventions to people in the United States and around the world. His innovations - and the tools used - are the foundation of a few machines we have today.

RESOURCES:

THOUGHTCO

“He also helped Alexander Graham Bell obtain the patent for the first telephone. Latimer was in great demand for his expertise later in his career as electric light spread across the country.”

(read more)

MASS MOMENTS

“Lewis Latimer was instrumental in helping Thomas Alva Edison develop the incandescent light bulb. He was awarded patents for ten of his own inventions and published a layman's guide to the once mysterious, now ubiquitous, electric light bulb.”

(read more)

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.”

(read more)

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 galactic space pods to explore different planets.

Classroom Workspace for Inventing: 3 minutes discussion

Students can also brainstorm how creation can be sparked in their classrooms, as well as which tools are needed to facilitate their own workspace. Whether at home or with their peers, have your students discuss what their ideal workspace might look like. Are there pictures of inventions they want to create? Are there workspace safety rules?

Examples: Making sure that one inventor's workspace is not messy, or distracting from another's experiment. Masking sure that experiment materials are safely used and transferred between scientists.

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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 simple 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

Latimer and all inventors work in an environment which allows them to be creative. We often think of this setting as a lab or makerspace. Think about what equipment and materials you would need in your creative space.

List some of these requirements below:

- _____
- _____
- _____
- _____
- _____

- _____
- _____
- _____
- _____
- _____

Now imagine that you are an outsider looking in at the lab. Draw a picture of the floorplan of your lab on the back of this sheet of paper as if you were looking down from above. Sketch the types of furniture, tools, equipment, etc. you would need in order to be a successful inventor like Latimer. You can use symbols to represent aspects of your lab. Think about the space you would need in between things, the relative measurements of different objects, and include any descriptions you feel are needed. Be prepared to share your work with the group.

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EVALUATE

5 minutes

ASSESSMENT RUBRIC

Use the students' design and written descriptions to evaluate students' ability to determine the layout of a safe and effective laboratory environment.

Evaluate their room description for the use of descriptive adjectives, voice, and organization and their illustration based on relative accuracy of size and dimensions.

	Excellent	Good	Satisfactory	Needs Improvement
Student demonstrated understanding of the requirements of a lab.				
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

Speaking & Listening
SL.6.4
Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.

Speaking & Listening
SL.7.4, SL.8.4
Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.

Next Generation Science Standards

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.