

Invention and Innovation at Springfield Armory

This lesson, or rather series of mini lessons, can all be done to provide a complete history of the Armory, or different mini lessons can be selected depending on what you are looking for.

Each mini lesson has formative assessments, but the overall summative assessment is the Learning Showcase which encompasses content from each of the main lessons.

Lesson Content and Design

Central Focus/Big Idea: In this series of mini lessons the students will learn about the different technological advancements that occurred at Springfield Armory. Aside from being a firearm museum, Springfield Armory was a site of major technological innovation during the Industrial Revolution and after. The Blanchard Lathe lives on today in modern form and so does the assembly line, both of which were seen at the Armory.

Context/Rationale: Springfield Armory while being the Nation's First Armory is not all about firearms. The site played a significant role in the Industrial Revolution and technological advancement. In these activities students will explore the different technological advancements that occurred at the Armory that impact them directly today! Students will be able to make a direct connection with the Blanchard Lathe and Assembly Line to their lives today. By learning about inventions students will gain a better understanding of the work done at Springfield Armory and its lasting significance.

Objective(s):

- Explain and identify what a patent is and why they are important.
- Design and develop their own patent, and then create their patented bridge.
- Identify key inventions made at Springfield Armory and their significance to technological development.
- Compare and contrast hand craft production to assembly line production.

Assessments:

Each activity has a formative assessment related to the task completed. The summative assessment has the students taking their knowledge of Springfield Armory and creating an argument as to why historic sites, as such, should be preserved for future generations. Students will need to apply their knowledge about the workers and inventions at the Armory to create a cohesive argument using examples. Not all activities will need to be completed for the students to complete the summative assessment; it is your judgement as an educator on how many of the activities you would like the students to complete before giving them the summative assessment based upon the level of students in your classroom.

Vocabulary

Foundational (Terms to understand the content (base words))

- Primary Source
- Firearm

Comprehension (Terms to understand and apply)

- Sem-automatic
- Patent
- Assembly line
- Mass production
- Interchangeable parts

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Presentation/Syntax		
Activities	Materials	Detailed Description
Introduction	Our Invention Worksheet	Pose to the students what they think it means to be an inventor and have a few of them share their ideas and write them down in a place where students can reference them in the patent activity. Explain to the students that they are now inventors and they have been struck by an idea! Break the students into smaller groups (3-4 per group) and hand out one Our Invention worksheet per group. In this activity the students will get to design an invention of their own, that is school appropriate. If the students are having difficulties in coming up with an invention, ask them to identify a problem and what could they create to solve that problem. The students will design their invention, create a name, identify what it does, and draw it. Give the students about 10-15 minutes to complete the worksheet. Once completed each group will share their invention with the others. Explain to the students that aside from producing firearms, technological advancements occurred at Springfield Armory and new items were invented.
Patents	Thomas Blanchard Worksheet Patents and Inventions Worksheet Laminated Patents Bridge Supplies (Straws, tape, weights and stamp)	In this activity students will be examining the design process and patents. Thomas Blanchard had 22 patents one of which is the Blanchard Lathe which revolutionized the process of making gun stocks. Prior to the development of the lathe, gunstocks were carved by hand which could take between 2-3 workdays. The Blanchard Lathe reduced the time down to 8 minutes, which gave them a rough cut which needed to be smoothed down and the lock, barrel, trigger area cut out. But even with these still needing to be carved out the time to make a gunstock was drastically reduced. Students will examine different patents and learn why people create an item and patent it. After learning about Thomas Blanchard they will be designing their own bridge, receiving a patent, and then building it. <u>Instructions</u> This activity has the students walking though patents and how they relate to Springfield Armory and then designing and testing their own patent to see if it works, like many of the inventors did. The students will be in small groups of 2 or 3 for this activity. After getting the students into groups, hand out the two student sheets

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(Patents and Innovations and Thomas Blanchard). In their groups have the students discuss what they believe a patent is and write in their definition. After students have written down their thoughts, ask a couple of groups to share before going over the actual definition.

After ensuring that all students understand what a patent is, had out a laminated copy of a patent to each group. Students will then examine their patent and write down what they see and what they think it is. Students should be given a few minutes to do this in their groups. Each group will then share with the other groups their patent what they think it is. After each group shares, tell them what their patent actually is and what it was used for along with the invention date. After going through all of the groups, have the students complete the last question identifying why they think their invention was made.

The students will then put this worksheet aside, returning to it later, and move to the Thomas Blanchard sheet. As a class go through the reading on Thomas Blanchard and explain why the Blanchard Lathe is significant. Ask the students to share their thoughts on how they think a key is related to the Blanchard Lathe before explaining that the way keys are cut today is very similar to the Blanchard Lathe! (To show the students a clip of the Blanchard Lathe in action, check out our video on [YouTube](#) from 4:32 to 6:15.)

On the back side of the Thomas Blanchard worksheet are two of the images Blanchard included with his patent. Have students fill out why they think it is important to include a picture/drawing in their patent and then share with the class. Pictures provide a visual representation of the object and can be used to compare to other patents.

After discussing and working through patents and Thomas Blanchard, the students, in their groups, will be then tasked with designing a bridge that can support weight. They will need to create their design on the back of the Patents and Innovations worksheet and receiving their official patent stamp (from you with the included stamp) before they can begin building their bridge. You can if you would like to show them the materials, they will be using to make their bridge (each group will get the same items). Students will then be given time to build their bridge according to their approved patent design. You can decide the gap (river) distance that the bridge must span, but 4 inches is recommended.

Once the bridges have been built, each bridge will be tested to see how much weight they can support. The bridge that supports the most wins!

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		This link, connects you to a website that has all of Thomas Blanchard's patents for future exploration and as a resource. We have included a handful of pictures of the original Blanchard Lathe and modern ones for reference.
Assembly Line Production The Lyle Gun	Assembly Line Production Worksheet Lyle Gun Template (sheet is a paper document only) Scissors Tape	This activity has students learning about production lines and how manufactures look to improve production while reducing cost. Using the Lyle Gun as an example (as it is easy to build!), students will compare and contrast craft production (handmade) vs. assembly line production (mass production and interchangeable parts). <u>Instructions</u> Using the Assembly Line Production Worksheet, as a class or in small groups, read through what assembly line production is pausing to stop for clarification on mass production, craft production and interchangeable parts as these terms are key to understanding the overall concepts. Next read about the Lyle Gun and why it was an important invention that was made at Springfield Armory. You can show the students a video of one in action by using the following link. Here a Lyle Gun demonstration is done at Sleeping Bear Dunes National Park. Upon completing the background reading, the students will need to practice making a Lyle Gun before the production race occurs. Each student should get one of the Lyle Gun handouts. Walk the students through the steps of how to make it (we have included a complete one, along with reference photos for assembly). Assembling the Lyle Gun Directions The students will first need to cut out the three pieces that make up the Lyle Gun. Next the students will need to fold on the dotted lines. It is recommended that they fold so the lines will be on the inside. After folding, assembly is the next step. Part two will fit inside of part 3 and should be placed on the indicated line. The barrel will sit on top nested in the two triangle cut outs with the rear of the barrel being positioned right on the edge of the triangle cut out.

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		Assembly Line vs. Handcraft Production After the students understand how a Lyle Gun is made it is time for the production race to begin! The students will need to be broken up into groups to test handcraft production and mass production. You will need a few groups of three and then some students who will be working by themselves. After breaking the students into groups, have the assembly line groups determine who will be the cutter, folder, and assembler/taper and that each student has the necessary materials for their job. The cutter will only cut out the pieces and then pass them off to the folder, who will fold on the lines, and the assembler will glue/tape the pieces together and finish the product. Explain to the students that they need to make their Lyle Guns 'perfect' and that they cannot be sloppy as parts should be interchangeable with others made. If the finished product doesn't meet the standards, it will be rejected and not count towards the student's final number of products made. As the students are making them, walk around and reject any of the poorly made, not up to standard ones. Set a timer (recommended 10 minutes) and have the students work to make as many Lyle Guns as they can in the allotted time. Once the timer has gone off each group should stop production; they cannot finish the current one they are on. Have the students return to the worksheet and fill out the top box identifying which team they were on and how many they made. Next have the students look around to see how many Lyle Guns other teams made. Once everyone has looked around, engage the students in a conversation about who made more and why they did. Ask them questions such as "Identify the pros of handcraft/assembly line production and the cons," "Why might/did businesses switch to assembly lines production?" and "What products do you think should be made by hand and not on an assembly line and why?" After engaging in a discussion have the students finish filling out the worksheet.
John Garand	John C. Garand Worksheet	John Garand was a significant inventor at Springfield Armory. During World War I the United States was looking to develop a semi-automatic rifle, or one that would eject a spent cartridge and load a new one automatically without the user having to pull bolt. John Garand began creating experimental designs at Springfield Armory. During his time here he invented the M1, which was a gas operated semi-automatic firearm. This firearm drastically changed firearm development. General George Patton stated that it was "The best battle

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		implement ever devised." It was used primary during World War II, but it found use in a variety of other conflicts including the Korean and Vietnam war. <u>Instructions</u> This is a more challenging read for students as it talks about firearms and if they are unfamiliar with various terms, it will be difficult for them to understand. It is recommended that this is read as a class or in small groups to help students work though the vocabulary. After the students have completed the reading, they should flip to the backside and answer some comprehension questions.
Firearm Evolution Ranger Presentation	Virtual Ranger Presentation (Contact us to schedule a time)	Innovation often comes about as one finds a problem or is looking to improve upon a current design. In firearm development people were always looking to make them more accurate, get more distance, have a more consistent fire, and to load more rapidly. This need for improvement lead to people creating new designs and improving upon old ones. A lot of innovation and invention occurred at Springfield Armory around firearm development. In this presentation with a Park Ranger, students will be able to see different changes in technology by highlighting different firearms made at Springfield Armory and how they changed overtime. There will be some history presented with each firearm, but the primary focus will be on how they changed from one to another. After the presentation we will have a discussion with your students about how the need for improvements lead to the creation of new technology to produce better firearms. Afterwards have the students think about how interchangeability and the assembly line would make these production processes easier especially as the firearms got more complex. Also think about why patenting or not patenting these inventions is signification. In this content it is important to note that many inventions developed by Springfield Armory were not patented but rather were shared with other manufactures.

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Exit Activity		Have the students select an item as a group (such as a smart phone, pencil, desk, etc.) and have them explain how this item is related to mass production and the assembly line on the provided exit ticket.
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