



EXPEDITIONARY
LEARNING

Grade 5: Module 2B: Unit 3: Lesson 2

Expert Research Groups: How the Traffic Signal and Airplane Met Society's Needs, Part 1



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Long-Term Targets Addressed (Based on NYSP12 ELA CCLS)

I can conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (W.5.7)
 I can gather relevant data from print and digital sources; I can summarize or paraphrase information in notes and finished work. (W.5.8)
 I can quote accurately from the text when explaining what the text says explicitly and when making inferences. (RI.5.1)
 I can determine the meaning of general academic and domain-specific words. (RI.5.4)

Supporting Learning Targets

- I can conduct research to take notes about how an invention was developed to meet society’s needs.
- I can explain what people needed and how their needs were met, using quotes from the text.
- I can determine the meaning of unfamiliar words and phrases by using context clues and other strategies.

Ongoing Assessment

- Independent Reading Choice Board response (from homework)
- Expert Text graphic organizer
- Vocabulary task cards



Agenda	Teaching Notes
<ol style="list-style-type: none"> 1. Opening <ol style="list-style-type: none"> A. Homework Review and Engaging the Reader: Scientific Inquiry (10 minutes) 2. Work Time <ol style="list-style-type: none"> A. Determining the Gist: Expert Text 1 (10 minutes) B. Introducing the Expert Text Note-catcher: “The TV Guy” (25 minutes) C. Vocabulary to Deepen Understanding (10 minutes) 3. Closing and Assessment <ol style="list-style-type: none"> A. Debrief and Review Learning Targets (5 minutes) 4. Homework <ol style="list-style-type: none"> A. Independent research. B. Independent reading. 	<ul style="list-style-type: none"> • This lesson introduces the Expert Text note-catcher that guides student work through Lesson 4 and prepares them for the on-demand note-taking assessment in Lesson 5. The class works together to complete an Expert Text anchor chart about Philo Farnsworth’s invention of television. This task not only provides students with a reference tool for their work in this and the next two lessons, but it also helps point out the importance of completing each of the note-taking boxes before using that information to answer the synthesis questions in the thought and speech bubbles on their note-catchers. • In the Opening of this lesson, students complete a fluency self-assessment. Consider using the self-assessments as well as your notes regarding students’ reading fluency to set up individual meetings to discuss their strengths and areas for improvement in order to set appropriate fluency goals. • Students also start a new vocabulary routine in this lesson. They complete vocabulary cards for each key term and organize them on a metal ring. These cards will serve as a reference and support for the inclusion of a glossary in the graphic novelettes students create for the performance task later in this unit. • During part of this lesson, students revisit excerpts from the article “the TV Guy” (which they first read in Unit 2, Lesson 5). Note that “The TV Guy” article is also used for the “Show the Rule™” sequence of lessons. For more information Show the Rule™, see the overview document Foundational Reading and Fluency Skills Resources Package for Grades 3-5 and the Show the Rule™ document, both on EngageNY.org. For Grade 5, the sample Show the Rule™ lesson sequence helps students understand and determine the rules of conjunctions. You could use the Show the Rule™ introductory lesson during your Additional Literacy Block, as a follow-up shortly after Unit 3, Lesson 2. Having students work with conjunctions early on in this unit will support their ability to revise and create a graphic novelette during later lessons. • In advance: <ul style="list-style-type: none"> – Determine and post triads for airplane expert groups and traffic signal expert groups. – Decide whether you will reuse or re-create the Group Norms and Quote/Paraphrase anchor charts from Unit 1.



Agenda	Teaching Notes (continued)
	<ul style="list-style-type: none">– Create a new Expert Text anchor chart using the same format as the Expert Text note-catcher that students will use to record information about their invention and inventor during this and the next two lessons. Be sure to familiarize yourself with the Expert Text anchor chart (answers, for teacher reference). This will help you guide students during Work Time B.– Consider creating an Expert Folder for each student to hold the articles and documents they do not paste directly into their journals or add to a metal ring during Lessons 2–4 (this will help them organize and locate their materials more easily in successive lessons).• Post: Learning targets.



Lesson Vocabulary	Materials
<p>conduct research, take notes, invention, developed, explain, needed/needs, met, quotes, determine, meaning, context</p> <p>From “Transportation, from the Soapbox Derby to the Jeep: First Automatic Traffic Signal”: automatic, traffic, signal, congested, manufacturing, mechanics, acquire, extensively</p> <p>From “Wright Brothers: Inventors of the Airplane”: airplane, craft, engine, previously, glider, propellers, pioneers, aerodynamics</p>	<ul style="list-style-type: none"> • Document camera • Journals (begun in Unit 1, Lesson 1; one per student) • <i>Investigating the Scientific Method with Max Axiom, Super Scientist</i> (book; one per student) • Fluency self-assessment (from Fluency Packet and Unit 1; one per student) • Group Norms anchor chart (begun in Unit 1, Lesson 1) • “Transportation, from the Soapbox Derby to the Jeep: First Automatic Traffic Signal” (one per student, traffic signal expert groups) • “Inventing the Plane” (one per student, airplane expert groups) • Expert Text anchor chart (new; teacher-created; see supporting materials) • Details from “The TV Guy” envelope (one envelope per triad) • Quote/Paraphrase anchor chart (begun in Unit 1, Lesson 2) • Expert Text anchor chart (blank; one for display) • Expert Text anchor chart (answers, for teacher reference) • Expert Text note-catcher (one per student) • Expert Text note-catcher: The Airplane (answers, for teacher reference) • Expert Text note-catcher: The Traffic Signal (answers, for teacher reference) • Vocabulary task card (one per student) • Index cards, with a hole punched in one corner (eight per student) • Metal ring, to hold index cards (one per student) • Dictionary (one per triad) • Vocabulary Definitions: Lesson 2 (for teacher reference) • Independent Reading Choice Board (from Lesson 1)



Opening	Meeting Students' Needs
<p>A. Homework Review and Engaging the Reader: Scientific Inquiry (10 minutes)</p> <ul style="list-style-type: none"> • Display expert research triads using a document camera. • Direct students to quickly collect their journal and book, <i>Investigating the Scientific Method with Max Axiom, Super Scientist</i>, before sitting in their triad groups. • Ask students to locate the page in <i>Max Axiom</i> that they practiced reading with fluency for homework. Ask them to take a moment to practice reading aloud by “whisper reading” the passage to themselves. • After 1 minute, instruct students to take turns reading their passages aloud to their triad. • Circulate as students read and take informal notes about their progress with fluency goals, using the fluency self-assessment criteria. • After each student has had the opportunity to read in their triad, refocus students whole group. • Distribute a fluency self-assessment to each student. Have them quickly complete the self-assessment based on their read-aloud to their triad. • Collect the self-assessments to review and use for helping each student set appropriate fluency goals in a one-on-one meeting during another part of the day. • Next, encourage students to recall their discussions from Unit 1, Lesson 5 about how real-world scientists might use a process, different from the linear approach Max Axiom took, to solve problems and meet societal needs. • Then, ask students to turn to page 5 of <i>Max Axiom</i> and focus on the upper-most speech bubble in the lower right-hand frame. • Read the speech bubble aloud: <ul style="list-style-type: none"> * “The order or number of these steps can always change, but scientists often rely on these basic methods to organize information.” • Ask students to consider and discuss: <ul style="list-style-type: none"> * “How was the process Max Axiom used to solve a problem similar to Philo Farnsworth’s process for developing TV?” * “How was the process Max Axiom used to solve a problem different from Philo Farnsworth’s process for developing TV?” 	<ul style="list-style-type: none"> • Consider allowing reluctant readers to choose a partner they trust to read aloud to rather than reading to their assigned triad. • Offer a sentence frame to give all students access to the discussion: “Both Max Axiom and Philo Farnsworth _____” or “Max Axiom _____, whereas Philo Farnsworth _____.”



Opening (continued)	Meeting Students' Needs
<ul style="list-style-type: none">• After 1 or 2 minutes, invite several students to share their thinking with the class. Remind them to support their ideas with information from the text. Listen for responses such as:<ul style="list-style-type: none">– “Max Axiom and Philo Farnsworth both had an idea about what they wanted to create, and they both did experiments to figure out how to make their idea work in the best possible way.”– “Max Axiom did research to help him develop his hypothesis, and Philo Farnsworth did research to help him create a plan for his television.”– “When they finished with their experiments, Max Axiom and Philo Farnsworth both presented their findings.”– “Philo Farnsworth went back to revise his ideas many times before he invented a working television, but Max Axiom collected the information he needed after his first experiment.”• Explain that over the next several lessons, students will learn about the way one scientist used a process of scientific inquiry to develop an invention that met the needs of society.	



Work Time	Meeting Students' Needs
<p>A. Determining the Gist: Expert Text 1 (10 minutes)</p> <ul style="list-style-type: none"> • Explain that during this and the next two lessons, students will conduct research in their expert groups by closely reading several texts about either Garrett Morgan's invention of the traffic light or the Wright brothers' invention of the airplane. • Refer to the Group Norms anchor chart and ask triads to discuss: <ul style="list-style-type: none"> * "Which group norm was most helpful to you when working in your last group?" * "How can you use that norm in your new triad?" • After 1 or 2 minutes, cold call several students to share out whole class. Answers will vary, but students may mention taking turns, asking clarifying questions, and other strategies. Encourage students to remember these norms as they work in their new triads. • Distribute copies of "Transportation, from the Soapbox Derby to the Jeep: First Automatic Traffic Signal" and "Wright Brothers: Inventors of the Airplane" to the appropriate expert groups. • Remind students that when encountering a new text, they oftentimes start by reading for gist to get an overall sense of the flow and ideas presented in the text before reading for more specific details. • Direct them to take turns reading paragraphs from their expert texts aloud in their triads, and then discuss the gist of the article. • After 5 or 6 minutes, refocus students' attention whole group. Encourage members from each expert group to share out their thinking about the gist. Listen for: <ul style="list-style-type: none"> – "The gist of 'First Automatic Traffic Signal' is that Garrett Morgan invented the traffic signal to help drivers and people crossing busy streets stay safe." – "The gist of 'Wright Brothers' is that the Wright brothers invented the first airplane and then found ways to make it even better." • After students from each expert group have had a chance to share, ask them to record the gist of their expert text on a new page in their journals. 	<ul style="list-style-type: none"> • Offering a sentence frame helps all students access the discussion: "The group norm I thought was most helpful working in my last group was _____ because _____" and "I can use that norm in this triad by _____." • To support students with significant difficulties reading complex text, consider inviting them to a small group. Modify the length of the text. Be sure to select wisely so they are still set up to successfully contribute to the gist conversation with their triad.



Work Time (continued)	Meeting Students' Needs
<p>B. Introducing the Expert Text Note-catcher: “The TV Guy” (25 minutes)</p> <ul style="list-style-type: none"> • Direct students’ attention to the first two learning targets and read them aloud: <ul style="list-style-type: none"> * “I can conduct research to take notes about how an invention was developed to meet society's needs.” * “I can explain what people needed and how their needs were met, using quotes from the text.” • Draw students’ attention to the terms <i>invention</i> and <i>developed</i> in the first target. Ask them to consider and discuss the meaning of each of these terms in their triads. • After 1 minute, cold call a few students to share their thinking with the class. Listen for: <ul style="list-style-type: none"> – “An <i>invention</i> is a device that is created to perform a specific task or meet a specific need.” – “<i>Developed</i> means created.” • Circle or underline the phrase “conduct research to take notes” in the first target. • Invite a few students to explain what that means. Listen for ideas such as: <ul style="list-style-type: none"> – “It means to collect and record information.” – “When you read the text, you locate specific information relating to what you are researching. Then you take notes about the information; sometimes you write down direct quotes, and sometimes you use paraphrased details.” • Ask students to recall and discuss what they remember from Unit 2 about how to take notes that include <i>relevant</i> details. • After 1 minute, invite a few to share out what they recall about determining <i>relevant</i> details. Listen for: <ul style="list-style-type: none"> – “Relevant means related to the topic, question, or prompt.” • Display and refer students to the Expert Text anchor chart. • Explain that this is a larger version of the Expert Text note-catcher they will use over the course of the next several lessons. Tell the students that before they begin working in their research groups, the whole class will work together to complete the example note-catcher using the familiar text “The TV Guy.” 	<ul style="list-style-type: none"> • Consider inviting students who take longer to process to join you for a small group to sort a smaller number of details from “The TV Guy” envelope so they don’t lose out on important think time. • Provide a sentence starter to support the triad discussion: “It’s best to paraphrase when _____. It’s better to use quotes when_____.” • Consider displaying strong student suggestions about when to paraphrase and when to quote to support all students in justifying their thinking during the next part of the discussion. • During the reread of the texts from Work Time A, consider gathering the same small group of struggling readers together again to revisit the same modified text to gather details to bring back to their triad.



Work Time (continued)	Meeting Students' Needs
<ul style="list-style-type: none"> • Point out the four gray boxes on the Expert Text anchor chart. Explain that in each of these boxes, students will record relevant information from the text that responds to the prompt at the top of the box. • Read the first gray box from the anchor chart aloud: <ul style="list-style-type: none"> * “Background information about the INVENTION: Explain why people needed or wanted this invention.” • Draw students’ attention to the terms <i>needed</i> and <i>wanted</i>. Ask them to consider these terms carefully as they discuss in triads what type of information might go in the first box. • After 1 minute, invite a few students to restate the prompt from the first box in their own words and describe the type of information they might record in this box. • Read the title and prompt from the next box aloud: • “Background information about the INVENTOR(S): Explain the inventor(s) history, motivation to solve the problem, special skills, and/or preparation.” • Draw students’ attention to the terms <i>history</i>, <i>motivation</i>, <i>skills</i>, and <i>preparation</i>. • Ask triads to discuss the meaning of each term. • After 1 or 2 minutes, cold call several students to share their thinking. Listen for: <ul style="list-style-type: none"> – “<i>History</i> in this context means the events from the inventor(s) past, the events that happened before he/they created the invention.” – “<i>Motivation</i> is what inspires someone and pushes them to keep going.” – “<i>Skills</i> are abilities or talents.” – “<i>Preparation</i> is what you have done to become ready.” • If students are not able to determine the meaning of each term, provide definitions for them. • Invite a few students to use their understanding of these terms to restate the prompt in their own words. • Next, read aloud the box “Information about developing a SOLUTION: Explain how the inventor(s) solved the problem.” • Point out the term <i>solution</i>, which should be familiar from previous units and lessons. Cold call a few students to share out the meaning of this term (answer, result, explanation) and clarify if needed. • Invite a few students to restate this prompt in their own words. • Read the final box aloud, “Information about the IMPACT: Explain how this invention changed people’s lives.” 	



Work Time (continued)	Meeting Students' Needs
<ul style="list-style-type: none"> • Focus students on the term <i>impact</i> and ask them to discuss what this word means. After a moment, invite one or two students to share out. Listen for students to explain that <i>impact</i> means to make things different, to have an effect or influence on someone or something. • Ask students to consider how they could restate the prompt in their own words. Then, invite a few to share their thinking with the class. • Finally, point out the speech and thought bubbles. Tell students that after they record relevant information from the article into the four main boxes, they will synthesize their thinking by answering the questions in the thought and speech bubbles. Explain that the first step they will take is to determine which details from “The TV Guy” belong in each box of the Expert Text anchor chart. • Distribute Details from “The TV Guy” envelope to each triad but tell students to leave their envelopes closed for the time being. • Explain that a number of the important details from “The TV Guy” have been pre-selected for today’s activity. It is each triad’s job to sort the details into one of four categories: background information about the invention, background information about the inventor, information about the process and solution, or information about the impact of the invention. • Direct triads to open their envelopes and begin sorting details into one of four piles. Clarify directions as needed. • After 4 or 5 minutes, refocus students’ whole class. • Cold call a student to select a detail and explain in which box on the anchor chart she or he believes the detail belongs. • Then, cold call a few students from other triads to share whether they agree or disagree and why. • Once the class comes to a consensus about the placement of the detail, explain that they must determine the most effective way to record the information. • Point out the Quote/Paraphrase anchor chart. • Invite a few students to remind the class about the difference between quoting and paraphrasing details. Listen for: <ul style="list-style-type: none"> – “Quotes are exactly what’s said in the text, so you need to place quotation marks around the phrase or sentence when you add it to your notes, to show they are someone else’s words.” – “When you paraphrase, you put the idea into your own words. Sometimes you shorten it, or sometimes you just say it in a different way. If it’s in your own words, you don’t need to use quotation marks around the sentence or phrase.” 	



Work Time (continued)	Meeting Students' Needs
<ul style="list-style-type: none">• Ask triads to think about and discuss when it might be more effective to use quotes on the Expert Text note-catcher and when it might make more sense to paraphrase.• After 1 or 2 minutes, cold call a few students to share their thinking whole class. Listen for suggestions such as:<ul style="list-style-type: none">– “If you can express the idea clearly in your own words, you might want to paraphrase.”– “If the detail you underlined is very long, it might be more effective to paraphrase so you can pull out the most important information.”– “If the author’s wording helps support your thinking, you might want to quote exactly.”– “If the exact wording of the text helps you respond to the prompt on the note-catcher in a clear and effective way, you would want to use a direct quote.”• Ask students to consider whether the detail they are discussing from “The TV Guy” would be more effective on the anchor chart quoted or paraphrased. Take their suggestions into consideration as you record the detail on the anchor chart.• For each of the remaining details, cold call a few students from different groups to explain where they believe each one belongs on the anchor chart and why. Encourage them to explain whether they believe the detail will be more effective paraphrased or quoted.• Record student suggestions on the anchor chart. Refer to the Expert Text anchor chart (answers, for teacher reference) for possible suggestions.• Invite a student to read the first thought bubble aloud:<ul style="list-style-type: none">– “What need or want inspired the development of this invention?”• Ask triads to refer to the anchor chart to help them consider and discuss a response to this question. Also, remind them that they should use key terms from the question in their responses.• After 1 or 2 minutes, cold call several students to share their thinking whole group. Record a strong response or a synthesis of responses in the thought bubble on the Expert Text anchor chart.• Invite a student to read aloud the question from the speech bubble:<ul style="list-style-type: none">– “How were people’s needs met, and by whom?”	



Work Time (continued)	Meeting Students' Needs
<ul style="list-style-type: none">• Give triads 1 to 2 minutes to refer to the anchor chart and discuss a response. Once again, remind them to use key terms from the question in their responses.• Cold call a few students to share their thinking whole class. Record a strong response or a synthesis of responses in the speech bubble on the Expert Text anchor chart.• Tell students that they will now complete a similar note-catcher using details from their own texts about either Garrett Morgan's invention or the Wright brothers' invention.• Distribute one Expert Text note-catcher to each student. Direct students to work with their triads:<ol style="list-style-type: none">1. Reread the article from Work Time A.2. As you read, look for and underline details that respond to the prompt in each gray box.3. Discuss the details you locate with your triad members.4. Record at least one or two relevant details in each box, using a combination of quotes and paraphrases.5. Refer to your notes (quotes and paraphrased details) to help you respond to the thought and speech bubble questions. Remember to use key terms from the questions in your responses.• Circulate to provide support and guidance as needed.• After 10 or 12 minutes, refocus students' whole class.• For each of the four gray boxes, cold call a few students from each expert group to explain details they recorded. Encourage them to explain why they chose to record specific details in each box, as well as how they determined if the detail should be quoted or paraphrased. Refer to the Expert Text Note-catcher: The Airplane (answers, for teacher reference) or Expert Text Note-catcher: The Traffic Signal (answers, for teacher reference).• As time allows, cold call a few students from each group to share their responses to the questions in the thought and speech bubbles.	



Work Time (continued)	Meeting Students' Needs
<p>C. Vocabulary to Deepen Understanding (10 minutes)</p> <ul style="list-style-type: none"> • Direct students' attention to the third learning target and read it aloud: <ul style="list-style-type: none"> * "I can determine the meaning of unfamiliar words and phrases by using context clues and other strategies." • Point out the terms <i>determine</i>, <i>unfamiliar</i>, and <i>context</i>. • Invite several students to use their knowledge of these terms to restate the learning target in their own words. • Cold call several students to share out the types of strategies they have practiced throughout this module to determine the meaning of unfamiliar terms. Listen for them to share ideas such as: <ul style="list-style-type: none"> – "We can use text that is around the word to help us figure out what it means." – "We can look for and define parts of the word that we are familiar with to help us determine the meaning." – "We can use our knowledge of roots, prefixes, suffixes, and affixes to help us determine what the word means." – "We can use a resource like a dictionary to look up the meaning of a word." • Explain that in this unit, students will create vocabulary cards with the key terms from their texts. Tell them these cards will help them create a glossary for their graphic novelettes. If students need a reminder about what a glossary is, direct them to turn to page 30 in their <i>Max Axiom</i> book to refresh their memories. • Distribute vocabulary task cards, index cards, and metal rings. Make sure students have access to print or online dictionaries. • Read the directions on the task card aloud and clarify as needed. • Ask students to work in their triads to complete vocabulary cards for at least the first three terms on their task card. • After 7 or 8 minutes, refocus students whole class. • Invite students from each expert group to share definitions for the terms they discussed in their triads. Refer to Vocabulary Definitions: Lesson 2 (for teacher reference). 	<ul style="list-style-type: none"> • Write or draw synonyms for key words above or below where they appear in the target to support ELLs. • To support accurate homework completion, check in with students who typically struggle with writing or vocabulary work in general. Make sure they have an accurate model to take home as a resource.



Closing and Assessment	Meeting Students' Needs
<p>A. Debrief and Review Learning Targets (5 minutes)</p> <ul style="list-style-type: none"> • Ask students to quickly locate a partner who is not a member of their triad and share an interesting detail from their Expert Text note-catcher. • After 1 or 2 minutes, cold call a few students to explain the detail their partner shared. • Reread each of the learning targets aloud. Ask students to discuss which target they found most challenging today and why. • Collect students' Expert Text note-catchers and identify those who may need additional support completing the note-catcher during Lessons 3 and 4. 	<ul style="list-style-type: none"> • Provide a sentence frame to support all students in responding to the prompt: "The target I found most challenging today was _____."
Homework	Meeting Students' Needs
<ul style="list-style-type: none"> • Reread your article, "Transportation, from the Soapbox Derby to the Jeep: First Automatic Traffic Signal" or "Wright Brothers: Inventors of the Airplane." Locate and add at least three more quotes or paraphrased details to the boxes on your note-catcher. • If necessary, complete your vocabulary cards for all terms listed at the top of the Vocabulary task card (for your expert text only.) • Read independently for at least 20 minutes. Complete a new box on your Independent Reading Choice Board. <p><i>Note: Because students will need access to their Expert Text note-catchers for homework, find a time before the end of the day to make copies of the note-catchers to gauge their initial understanding of how to locate and record relevant notes (in the form of quotes and paraphrased details from the text). Make determinations about which students may need more support mastering these skills before taking the on-demand note-taking mid-unit assessment in Lesson 5.</i></p> <p><i>Review the definitions/synonyms/drawings on the vocabulary cards students were able to finish in class today to evaluate whether they require additional support before they can independently use a variety of strategies to determine the meaning of unfamiliar words and phrases. Be prepared to return students' index cards in the next lesson.</i></p> <p><i>Review student materials for Lessons 3 and 4 to determine the most effective way for them to organize and access the materials they will need.</i></p>	



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Supporting Materials



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“Transportation, From the Soapbox Derby to the Jeep: First Automatic Traffic Signal”



Transportation

From the Soapbox Derby to the Jeep

First Automatic Traffic Signal

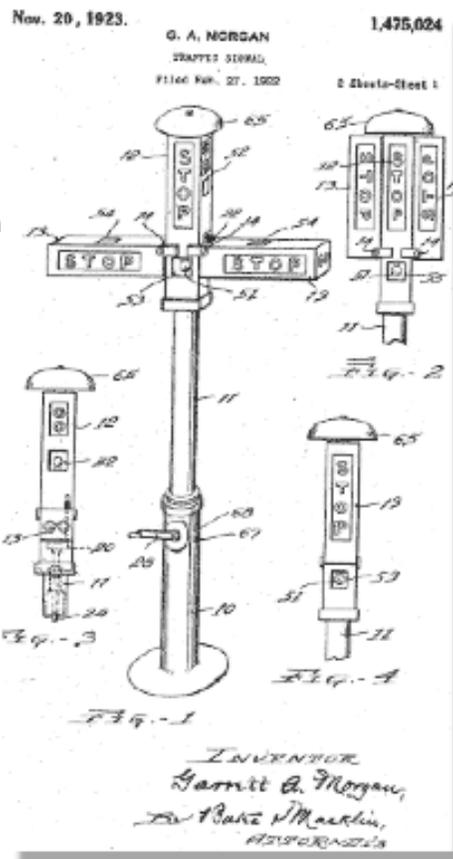
Garrett A. Morgan, an African-American businessman and inventor, invented the first automatic traffic signal in 1923. It brought order and greater safety to city streets congested with the increasingly popular horseless carriages. The first traffic signal was installed in Cleveland at the corner of Euclid Avenue & East 105th Street. Inspiration for the invention came to Morgan as he watched traffic flow on the busy streets of Cleveland. Morgan sold the invention to the General Electric Co for \$40,000, and GE began manufacturing the signals.



Morgan was the son of former slaves, and grew up on a farm in Kentucky. As a teen, he moved to Cincinnati, Ohio. While he never went past elementary school in formal training, he did work with a tutor in Cincinnati. Morgan moved to Cleveland in 1895 and went to work as a sewing machine repairman. His understanding of mechanics helped him both in this trade and also in his memorable inventions. In 1907, he launched his own business that repaired sewing machines and also trained others to do the same. Not a man to focus just on one thing, Morgan started a newspaper in 1920 called the "Cleveland Call." It was during this period that Morgan came up with the idea of the traffic signal.

While colored lights were incorporated later, Morgan's idea was a machine that displayed three versions of signs: "stop" -- "go" -- and an "all-directional stop." The all directional stop was design to allow people to cross the busy streets. While other may have been working on similar ideas at the time, Morgan was the first to acquire a U.S. patent for his work, which was granted on November 20, 1923.

Morgan also contributed to public safety with other inventions. He invented helmets and gas masks used by firefighters in the early 1900's. He also invented a gas mask that was used extensively in 1914 during World War I to protect service people from the effects of chlorine gas fumes.





“Transportation, From the Soapbox Derby to the Jeep: First Automatic Traffic Signal”

Did You Know?

- Morgan invented the first hair straightener which he sold as "Morgan Hair Refining Cream."
- He also designed a "de-curling" comb.
- Morgan invented "zig-zag" sewing machine stitching.

Find out more...

- **Garrett Morgan: Father of the Stoplight**
(www.nhtsa.dot.gov/kids/safeschool/morgan2.html)
- **Morgan's Patents and Illustrations**
(www.princeton.edu/~mcbrown/display/morgan_patents.html)

“Inventing the Plane”

by Kate Reuther

A hundred years ago, most people thought that human beings would never fly. How could people fly without wings? The whole idea of flying seemed crazy and dangerous. Yet a new century was dawning and with it, a new world full of new discoveries. It was a time where everyone was trying to break the old limits and boundaries. So many inventors, including Orville and Wilbur Wright, tried to invent a flying machine.

Most airplane inventors at the time were impulsive and disorganized; they would think of an idea, build a plane as quickly as they could, and then try to fly it as soon as possible. Some people tried strapping wings to their arms. Other inventors created planes that looked like giant bouncing umbrellas. As you can probably guess, most of these planes crashed immediately. The inventors would carry home their broken plane, having no idea why it didn't work.

The Wright brothers were much more scientific and methodical inventors. They believed in testing their ideas in smaller or safer versions before building an actual plane. Scientists today, like the Wright brothers, don't just build things and see what happens; they make observations, then form a hypothesis or guess, and then do more tests to see if their hypothesis is correct. This is known as the "scientific method." For example, the Wright brothers built a wind tunnel to compare wing shape ideas. By attaching an old shop fan to a 6-foot-long wooden box, they could blow "wind" on hundreds of different miniature wings and measure with a scale exactly how much lift each wing produced. The Wright brothers also flew countless kites as well as motor-less gliders to test their designs. They studied the way birds move through the air and tried to duplicate it with their models. Throughout all their experiments, Orville and Wilbur took careful notes and measurements so they could analyze what worked and what didn't.

Eventually, the Wright brothers felt they were ready to test their planes, but they needed to find the right spot. They wrote for help to the U.S. Weather Bureau, who told them that Kitty Hawk, North Carolina would make a perfect test site because of its high winds, its hilly terrain, and its sandy dunes (in case of crash landings). In 1900, 1901, and 1902, Orville and Wilbur tested increasingly bigger and more effective gliders. A glider is like a plane except that it has no motor and depends on the wind to propel it. Based on their results, they added a movable tail, dual propellers, wing-warping wires (for steering), and a gasoline-powered motor to their design.



“Inventing the Plane”

Finally on December 17th, 1903, Orville and Wilbur assembled their most ambitious plane, nicknamed the "Flyer I," on the sand on Kitty Hawk. Flyer I weighed over 600 pounds and had an impressive wingspan of 40 feet. With winter coming, the Wright brothers knew that they had to get this test right, or else they would have to wait for many, many months of bad weather before they could try again. The brothers flipped a coin to see who would be the first pilot. Orville won. With his brother at the controls, Wilbur pushed the plane down the short wooden ramp and it lifted into the air. Flyer I remained airborne for twelve seconds and it traveled just 120 feet, but Orville and Wilbur were ecstatic. Their plane really worked! By the end of the day, both brothers had made successful flights, with Wilbur covering a record 852 feet in 59 seconds. The Wright brothers left Kitty Hawk that day having done the impossible.

However, the Wright brothers were not satisfied with Flyer I. They went back to their shop and over the next two years constructed the Flyer II and then the Flyer III, which proved to be a much more reliable airplane than the original flyer. On October 5th, 1905, Wilbur set an endurance record in the Flyer III, flying over 34 miles in 38 minutes. In 1909, the Wright brothers formed the American Wright Company to manufacture airplanes for the US military. The brothers continued to experiment and modify their design until 1912, when Wilbur died of typhoid fever.



Expert Text Anchor Chart
(For Teacher Reference)

What need or want inspired the development of this invention?

How were people's needs met, and by whom?

Background information about the INVENTION
Explain why people needed or wanted this invention.

Background information about the INVENTOR(S)
Explain the inventor(s) history, motivation to solve the problem, special skills, and/or preparation.

Information about developing a SOLUTION
Explain how the inventor(s) solved the problem.

Information about the IMPACT
Explain how this invention changed people's lives.



Expert Text Anchor Chart
(Answers, for Teacher Reference)

What need or want inspired the development of this invention?

People wanted new ways to entertain themselves and share information.

How were people's needs met, and by whom?

Philo Farnsworth's television allowed people to send images across long distances. It provided people with new forms of entertainment, and it allowed them to learn about and explore things that were far away.

Background information about the INVENTION
Explain why people needed or wanted this invention.

- People wanted new ways to entertain themselves.
- People were interested in exploring new things.
- Philo wanted a way to send images

Background information about the INVENTOR(S)
Explain the inventor(s) history, motivation to solve the problem, special skills, and/or preparation.

- Philo Farnsworth was a farm boy from Utah.
- His first house had no electricity.
- When he moved to a house in Idaho with electricity, Philo was fascinated by all of the electrical devices.
- "Farnsworth believed that he could transform electricity into pictures by controlling the speed and direction of fast-flying electrons."
- Farnsworth drew a design to show his high school science teacher his idea.

Information about developing a SOLUTION
Explain how the inventor(s) solved the problem.

- He found investors who gave him money to experiment with his device.
- After a lot of working, he was able to transfer his first image in 1921.
- The first image on the television was a line.
- He made the television work by inventing an image dissector camera tube.

Information about the IMPACT
Explain how this invention changed people's lives.

The TV was a new form of entertainment. "Philo T. Farnsworth changed the way people all over the world talk to each other, learn about things, and entertain themselves."



Details from “The TV Guy”

Philo T. Farnsworth, who came from a little community outside of Beaver, Utah, built on the work of others. But he was the one who made the image dissector camera tube that put the first images on a television screen.

His invention opened up entirely new avenues for entertainment, information, and exploration—and landed him on a postage stamp in 1983!

Philo T. Farnsworth changed the way people all over the world talk to each other, learn about things, and entertain themselves. His invention made *Sesame Street*, news programs, sitcoms, dramas, and all the other television programs possible.

Philo Farnsworth came into a world just beginning to be electrified in 1906.

His family’s first house, near Beaver, Utah, had no electricity. So when the family moved to a new house in Idaho, young Philo was fascinated! Lights that came on when you flipped a switch and electric tools for the farm intrigued him.

In 1922, he drew a design for his high school chemistry teacher, Justin Tolman. The drawing had nothing to do with the class assignment, but Tolman kept it. Farnsworth believed that he could transform electricity into pictures by controlling the speed and direction of fast-flying electrons.

By the age of 13, he had won his first national contest, sponsored by *Science and Invention* magazine, for a thief-proof lock.

Philo was still thinking about how to send images through the air. But he had no money to work on his idea. Eventually, he met a pair of Californians who invested money in his idea. They gave him enough money that he could experiment with the device he had worked on in high school.

He successfully transferred his first image in 1927—at age 21. So what was the first real television image? Just a simple line!

"Utah State History." Philo Farnsworth. Utah Division of State History, Web. <http://www.ilovehistory.utah.gov/people/difference/farnsworth.html> .



Expert Text Note-Catcher

What need or want inspired the development of this invention?

How were people's needs met, and by whom?

Background information about the
INVENTION
Explain why people needed or wanted this invention.

Background information about the
INVENTOR(S)
Explain the inventor(s) history, motivation to solve the problem, special skills, and/or preparation.

Information about developing a
SOLUTION
Explain how the inventor(s) solved the problem.

Information about the **IMPACT**
Explain how this invention changed people's lives.



Expert Text Note-catcher: The Airplane
(Answers, for Teacher Reference)

What need or want inspired the development of this invention?

People wanted to be able to travel from one place to another more quickly.

How were people's needs met, and by whom?

The Wright brothers invented the first airplane with an engine. Airplanes travel much faster than trains or boats, so people can go long distances in a short amount of time.

Background information about the INVENTION
Explain why people needed or wanted this invention.

- Traveling by boat or train was very slow.

Background information about the INVENTOR(S)
Explain the inventor(s) history, motivation to solve the problem, special skills, and/or preparation.

- The Wright brothers grew up in Indiana and Ohio with their five siblings.
- Wilbur was 4 years older than Orville.
- They liked to invent things.
- They became interested in flying after their dad gave them a toy helicopter.
- "They experimented with making their own helicopters, and Orville liked to build kites."
- "They studied how birds flew and used their wings to help design the wings for their gliders and planes."

Information about developing a SOLUTION
Explain how the inventor(s) solved the problem.

- They experimented with gliders to design wings and controls.
- They made a lightweight engine and efficient propellers.
- "They were the first to make a successful human flight with a craft that was powered by an engine and was heavier than air."
- On December 14, 1903, Orville flew the first plane at Kitty Hawk in North Carolina.
- The first flight was 12 seconds long and went 120 feet.

Information about the IMPACT
Explain how this invention changed people's lives.

- "This was quite a milestone and impacted transportation throughout the world."
- Airplanes make it easier for people to travel because they can go long distances in a short amount of time.



Expert Text Note-catcher: The Traffic Signal
(Answers, for Teacher Reference)

What need or want inspired the development of this invention?

People needed a way to direct traffic so the streets could be more organized and safer for drivers and pedestrians.

How were people's needs met, and by whom?

Garrett Morgan's traffic signal told drivers when to stop and when to drive so they would not get in accidents and so people could cross the street safely.

Background information about the INVENTION
Explain why people needed or wanted this invention.

- There were many more cars on the roads and the streets were very congested.
- The traffic was not organized.
- It was not very safe for people to cross the street.

Background information about the INVENTOR(S)
Explain the inventor(s) history, motivation to solve the problem, special skills, and/or preparation.

- Garrett Morgan was the son of former slaves.
- He grew up on a farm in Kentucky but moved to Ohio.
- He worked as a sewing machine repairman.
- He was interested in mechanics.
- He started a newspaper.
- "Inspiration for the invention came to Morgan as he watched traffic flow on the busy streets of Cleveland."

Information about developing a SOLUTION
Explain how the inventor(s) solved the problem.

- He created the first automatic traffic signal in 1923.
- The machine had three signals, for "stop," "go," and "all direction stop."
- The all direction stop was to allow pedestrians to cross the street.
- Colored lights were added later.

Information about the IMPACT
Explain how this invention changed people's lives.

- The traffic light made the streets safer for drivers and people walking.
- It helped bring order to the "city streets congested with increasingly popular horseless carriages."



Vocabulary Task Card

1. Write each of your vocabulary terms on one side of your index cards.
 - **The airplane expert group:**
airplane, craft, engine, previously, glider, propellers, pioneers, aerodynamics
 - **The traffic signal expert group:**
automatic, traffic, signal, congested, manufacturing, mechanics, acquire, extensively
2. Determine the meaning of each of your vocabulary terms, using context clues or other strategies you learned during previous lessons.
3. Write a synonym or definition and draw a picture of the meaning of each term on the back of your index cards.
4. Do your best to arrange your vocabulary cards in alphabetical order, then add them to the metal ring provided.



Vocabulary Definitions: Lesson 2
(For Teacher Reference)

“Transportation, from the Soapbox Derby to the Jeep: First Automatic Traffic Signal”	“Wright Brothers: Inventors of the Airplane”
acquire – to get or obtain	aerodynamics – the field of science that explores how objects move through air
automatic – (a machine) working by itself, without a person to make it move or run	airplane – a powered, heavier-than-air flying machine with fixed wings
congested – overcrowded	craft – a ship
extensively – over a large area, widespread	engine – a machine with moving parts that turns energy into motion
manufacturing – using machines to make something	glider – a light flying machine with no engine
mechanics – the field of science that explores forces and motion	pioneers – people who are among the first to explore a new place or idea
signal – something that moves or changes to communicate information	previously – at an earlier time
traffic – vehicles moving on streets	propellers – angled blades that spin around to move an airplane forward