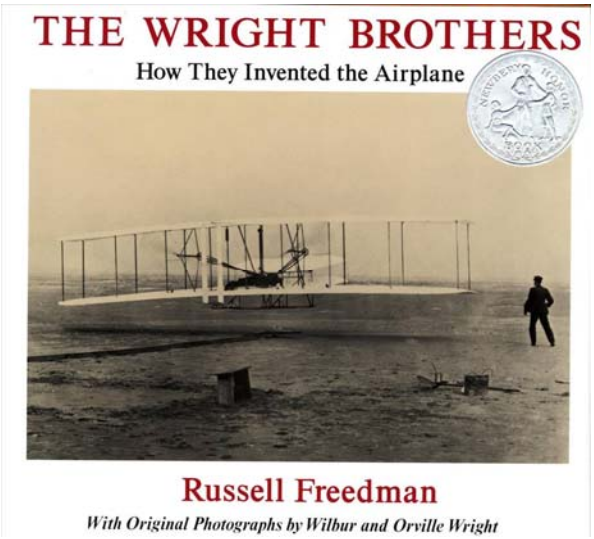
Close Reading Activity: Educator Guide
Russell Freedman, *The Wright Brothers: How They Invented the Airplane*

Book Description

In this book, Russell Freedman covers the history of the Wright brothers from their earliest interests in technology to their rise to superstardom after inventing the airplane. Freedman's history of the Wrights is not a biography, but rather focuses on the years between their first tests in 1900 and the period of their greatest fame between 1908 and the death of Wilbur Wright in 1912. In addition to providing a concise and readable account of the Wrights' success, Freedman also includes a number of large photo reproductions of the Wrights, their gliders, and their flyers.



Lexile: 1160L

Instructions: Students will answer the following comprehension and analysis questions on the Close Reading Activity Worksheet.

Chapter One: What Amos Root Saw

Vocabulary:

horseless carriage: an early term for an automobile

Comprehension Questions:

- What was Amos Root doing in Dayton when he saw Wilbur Wright piloting his flyer over a cow pasture? *He had come from his home 200 miles away because he had heard that the Wrights were going to test their flyer. (p. 1)*
- How long did the flight Amos Root observed last? *1 minute 36 seconds. (p. 1)*
- What role did Amos Root play in the development and popularization of human flight? *He wrote the earliest published eyewitness account of an airplane in controlled flight. (p. 1)*
- Who did Root compare the Wright brothers to and why? *He compared the Wright brothers to Christopher Columbus because he saw the success of the Wright brothers as a transformative event that would change the world. (p. 2)*

Analysis Questions:

- Amos Root traveled a long distance to catch a glimpse of the Wright Flyer. Why might he have invested so much of his time to see this device? What does this say about him and the technology the Wrights were creating? *Student answers will vary, but should note that the airplane was a novelty that stimulated great curiosity in many people.* **[CCSS.ELA-LITERACY.RI.8.1]**

This activity was funded by a Library of Congress Teaching with Primary Sources Grant.

Chapter Two: Wilbur and Orville

Vocabulary:

bachelor: an unmarried man

tuberculosis: a highly infectious bacterial disease that was a common cause of death until recently

Comprehension Questions:

- Where did the Wright Brothers go to college? *The Wright brothers never attended college. (p. 3)*
- How were Orville and Wilbur's personalities different? How were they similar? *Wilbur was usually quiet, confident, and spoke little around people. Orville was more outgoing. Both, however, were shy around people. (p. 5)*
- Where were Orville and Wilbur born? *Wilbur was born in Millville, Indiana; Orville was born in Dayton, Ohio. (p. 6)*
- What types of things did the Wright brothers build as children? *They built kites, a special folding machine, and even a lathe powered by the boys from their neighborhood. (p. 10)*
- What made the safety bicycle different from other bicycles before that? *The safety bicycle had two wheels that were the same size, had air-filled tires, and a chain that drove the rear wheel with a crank. (p. 11)*
- How were the Wright brothers able to maintain both their bicycle shop and their printing business? *They put Ed Sines in charge of their printing business once they opened their bicycle shop. (p. 12)*

Analysis Questions:

- Why were the Wright brothers an unlikely pair to have succeeded in the way they did? *The Wright brothers did not finish high school, never went to college, and lived most of their lives in Dayton, Ohio.* **[CCSS.ELA-LITERACY.RI.8.3]**
- Consider the following statement: The Wright brothers' interest in flying was mostly a product of their more general interest in new technologies. What evidence in chapter 2 supports this statement? *Student answers will vary. Students should craft an answer that either supports or challenges this statement using information from the book.* **[CCSS.ELA-LITERACY.RI.8.2, 8.3]**

Chapter Three: The Art of Flying

Vocabulary:

pioneer: a person who is among the first to develop a new area of study or knowledge

Comprehension Questions:

- Why does the author recount the old Greek story of Icarus and his father Daedalus? *The author uses this story to emphasize how man has dreamed of flying for thousands of years, but these dreams have often been ridiculed as arrogance and fantasy. (p. 15)*
- Who was Eilmer, and why was he significant in the history of flight? *Eilmer was an English Benedictine monk who attempted to fly with two artificial wings in the eleventh century. (p. 15–16)*
- Who was the first to envision the airplane in its present-day form? *The British baronet Sir George Cayley. (p. 17)*
- How did Lilienthal maintain balance on his gliders? *He maintained balance by shifting his weight from side to side as he flew. (p. 20)*

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- What evidence does the author present to demonstrate that the U.S. government was impressed and encouraged with the Langley efforts? *The U.S. Army gave Langley $50,000 to continue his experiments, and the Smithsonian contributed $20,000 more. (p. 20)*

Analysis Question:

- Review the following important historical figures in the history of aeronautics: Samuel Pierpont Langley, Otto Lilienthal, Octave Chanute, and Charles Manly. What were the accomplishments of these historical figures? *Student answers will vary but should incorporate accurate information from the text to do so.* **[CCSS.ELA-LITERACY.RI.8.2, 8.3]**

Chapter Four: Wind and Sand

Vocabulary:

wing-warping: a method of bending the back of a fixed wing to control and aircraft

rudder: a hinged piece attached to the rear of a boat or plane and used to turn

elevator: a hinged piece attached to an aircraft and used to control altitude

Comprehension Questions:

- What three basic features did the Wright brothers determine were necessary for any successful heavier-than-air flying machine? *It would need wings, a source of power to push it, and a method of controlling in flight. (pp. 27-28)*
- What is the purpose of making the top of an airplane's wing convex and the underside concave? *This reduces the air pressure above the wing and increases upward pressure below it. (p. 28)*
- In what way did the actions of birds serve as inspiration for the Wrights' ideas about controlling an aircraft? *The Wrights realized that birds made turns by banking, or by tilting one wing down and one up. (pp. 30–31)*
- Why was it difficult for Wilbur to find Kitty Hawk at first? *It was in a difficult to find location, and there were no roads or bridges to this isolated location. (p. 32)*
- What were the camping conditions out on the sands of Kitty Hawk? *The area was desolate and full of nature, but the evenings were often windy, and sand storms were common. (p. 36)*
- How was the early glider different from Otto Lilienthal's gliders? *Unlike Lilienthal's glider, the Wright glider required the pilot to lie across the lower wing. (p. 36)*
- How far were the Wrights able to glide in their 1900 glider? *They flew about 300 to 400 feet. (p. 38)*

Analysis Questions:

- How did early aviation theorists use their experiences with other vehicles to develop ideas about airplanes and how they might be controlled? *Early aviation theorists looked at how ships were controlled with rudders and elevators.* **[CCSS.ELA-LITERACY.RI.8.3]**
- What does Wilbur's letter to his father describing his plans to test a glider suggest about his future plans and hopes for flight? *He notes that this is more than a hobby, and he may be able to achieve fame and fortune through these efforts.* **[CCSS.ELA-LITERACY.RI.8.5]**
- Was the 1901 glider an improvement over the 1900 glider? *In some ways the glider was an improvement. It had a more sophisticated system for wing-warping, for example. But, in general, it was a failure. It could not fly as the glider the previous year had. The elevator did not function as they had hoped, for example.* **[CCSS.ELA-LITERACY.RI.8.1]**

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Chapter Five: Back to the Drawing Board

Vocabulary:

catastrophe: a great disaster

painstaking: being careful or thorough

Comprehension Questions:

- Why did the Wrights build a 6-foot-long wind tunnel? *They used this wind tunnel to test different types of wing surfaces and obtain accurate air-pressure tables. (p. 47)*
- How large and heavy was the aircraft the Wrights designed in 1902? *It measured 32 feet from tip to tip and 5 feet from front to rear. It weighed just under 120 pounds. (p. 49)*
- Why did the Wrights decide to add a movable tail to the back of the glider? *The aircraft seemed to spin out of control every now and again when the pilot tried to level off after a turn. (p. 53)*
- Who came to visit the Wrights on the dunes during their 1902 test runs? *Their older brother Lorin, Octave Chanute, and many others (p. 54)*

Analysis Question:

- What does the meticulous testing of their designs after their 1901 efforts suggest about the Wrights? *It suggests that they were eager problem solvers and wanted to use what they learned through their failures in 1901 to improve their design.* **[CCSS.ELA-LITERACY.RI.8.3]**

Chapter Six: Horsepower and Propellers

Vocabulary:

aileron: a hinged device on the edge of a wing used to control an aircraft

propeller: a device fixed to a revolving shaft and used to power a boat or airplane

Comprehension Questions:

- Why did the Wright brothers ultimately decide to build the engine they needed themselves? *They were not able to find a company willing to build the type of engine they needed. (p. 65)*
- Why did the Wrights decide to not place the engine in the center directly behind the pilot? What additional modifications did this change require? *The Wrights were worried that the engine would fall on the pilot in the case of a headlong crash. To make this work, they extended one wing by four inches. (p. 66)*
- How did the Wrights adjust their wing-warping technique in the new powered flyer? *They fixed the front end of the wing so that the wing-warping worked more like a modern aileron, with only the rear end moving up and down. (p. 66)*
- What types of problems did Wrights experience when they returned to Kill Devil Hills in the fall of 1903? *They had trouble keeping the sprocket wheels on while testing the engine. And the winter came in early, causing them problems with the cold. (p. 67)*
- What news did Orville read while returning to North Carolina from Dayton to get a new propeller shaft? *He heard that Samuel Pierpont Langley failed in his last attempt to fly his Great Aerodrome. (p. 71)*
- What did the Wrights call the starting track they designed? *The Grand Junction Railroad (p. 71)*
- Why were the Wrights eager to fly on December 17 despite the less-than-ideal conditions? *They wanted to test the repaired flyer and also wanted to be home by Christmas. (p. 74)*

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- What made the short 12-second flight on December 17 a major milestone in aviation history? *The flight was the first time a machine carrying a person had raised itself into the air by its own power and had landed at a point that was at the same elevation as when it started. (p. 76)*
- How far did the Wrights fly their 1903 flyer that year? *The longest flight was for 852 feet in 59 seconds. (p. 77)*

Analysis Question:

- Write a short paragraph answering the following prompt: What was the most important step the Wright brothers took that led to their success on December 17, 1903? *Student answers will vary. Students might focus on things like their single-minded determination or their willingness to risk their lives.* **[CCSS.ELA-LITERACY.RI.8.1, 8.3]**

Chapter Seven: The First Practical Airplane

Vocabulary:

derrick: a large crane-like fixture used for lifting heavy weights

boisterous: greatly excited or happy

Comprehension Questions:

- What steps did the Wrights take upon returning to Dayton after their first successful flights? *They began building a new flyer with a stronger motor, and they found a new testing ground closer to home. (p. 81)*
- Where did the Wrights begin testing their new flyer? *Huffman Prairie, just outside Dayton. (pp. 81–82)*
- What was the purpose of the modified derrick with the 1,600 pound weight? *The derrick was designed to catapult the flyer into a starting speed that was sufficient for lifting off the ground. (p. 82)*
- What major milestone in aviation history was crossed on September 20, 1904? *Wilbur made the first complete circle in the sky. (p. 82)*
- What was the most important innovation they made when they built their Wright Flyer III? *They transformed the controllers so that the rudder and warp controls were now controlled separately. (p. 85)*

Analysis Questions:

- Read the following quote from Orville in 1905:

"I think it was mainly due to the fact that human flight was generally looked upon as an impossibility, and that scarcely anyone believed in it until he actually saw it with his own eyes."

What does Orville mean by this? What is he responding to? *Student answers will vary, but should note that Orville was somewhat confused about why some refused to acknowledge the achievements of the Wrights.* **[CCSS.ELA-LITERACY.8.5, 8.1, 8.6]**

Chapter Eight: Fliers or Liars?

Vocabulary:

banked turn: a type of turn that involves the turning vehicle inclining into the inside of a turn

Comprehension Questions:

- Why did the Wright brothers decide to ground their flyer and keep it out of sight for over two years after their successful flights in 1905? *They wanted to make sure their patents were secure before telling more people about how their plane worked. (p. 89)*

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- How was the Wright Type A Flyer different from the other flyers they had built? *The pilot could sit upright, there was room for a passenger, and the flyer could be controlled by two hand levers. (p. 90)*
- What type of airplane did the U.S. Signal Corp request from the Wrights in 1908? *They wanted a flyer that could fly at least 125 miles at a speed of 40 miles per hour. (p. 90)*
- Why were the French skeptical of claims made by the Wrights? *The French thought they were well ahead of other nations in aviation development, and they had yet to match the Wrights' claimed progress. (p. 92)*
- What challenges did Wilbur face in preparing for his test flight in France? *His efforts were delayed because many of the flyer's parts had been damaged in transit. (p. 92)*
- What had most impressed the French spectators about Wilbur's first demonstrated flight? *They were most impressed with how he glided the plane so smoothly and made banked turns. (p. 94–95)*

Analysis Question:

- Why was it important for the Wrights to bring their invention to France and test it there? *The Wrights were at a stage where they needed to gain lots of publicity for their invention. The best stage for this in the early 20th century was Europe. France prided itself on its technological progress, so a successful demonstration there would have been sure to garner attention that prospective investors would have heard about.* **[CCSS.ELA-LITERACY.8.1, 8.3]**

Chapter Nine: The Conquering Heroes

Vocabulary:

nosedive: a steep dive downward

Comprehension Questions:

- What caused the accident that caused the first airplane casualty in aviation history? *One of the propellers hit a bracing wire, sending the flyer crashing to the ground. (pp. 99–100)*
- Despite the accident that killed Lieutenant Selfridge and nearly killed Orville, why was the testing at Fort Myer a success? *The tests convinced the U.S. Signal Corps that powered human flight was the wave of the future. (p. 100)*
- Where did the Wrights travel together once Orville was well enough after the crash? *They all went from Paris to Pau in the south of France. (p. 102)*
- How long were the Wrights required to stay in the air in order to qualify for the army contract? *They had to stay in the air at least one hour. (p. 105)*
- Why did Orville select Lieutenant Foulois as his passenger for the second qualifying flight for the army contract? *Lieutenant Foulois was short and only weighed 126 pounds. (p. 105)*
- Which famous person had watched Orville fly near Berlin? *Prince Friedrich Wilhelm. (p. 108)*

Analysis Question:

- What do the Wrights' efforts at securing contracts indicate about the early days of the airplane industry? *These efforts are evidence of the fact that large investment interests were highly interested in encouraging further airplane development and financing this development.* **[CCSS.ELA-LITERACY.8.3, 8.1]**

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Chapter Ten: The Age of Flight

Vocabulary:

aerial exhibitions: events that showcased aircraft, and were commonly used in the early years of aviation history to demonstrate new aircraft

daredevil: a person willing to do reckless or dangerous things

Comprehension Questions:

- What were some of the limitations of airplanes in the first years of the Age of Flight? *These planes could only fly in daylight when the wind was just right. They were so small that they could not hold much weight. There were also few places to land or maintain the planes. (p. 110)*
- Why was Wilbur spending so much time in courtrooms? *Many people were trying to steal the Wrights' patented inventions to make their own flying machines. (p. 110)*
- What was the Wright Baby Grand Racer designed for? *It was built to break speed and altitude records. (p. 112)*
- How far did Calbraith Rodgers fly his Wright Flyer? *He flew from the Atlantic to the Pacific, 4,231 miles. (pp. 112–113)*
- What illness took the life of Wilbur in 1912? *Typhoid fever (p. 113)*
- What were the consequences of Wilbur's death for Orville and the business? *Orville sold the company and retired from flying just a few years after Wilbur died. (p. 116)*

Analysis Question:

- How was the airplane transformed in the decades after the Wrights' first success at Kitty Hawk? *The airplane was transformed from a novelty machine to an essential method of transportation used around the world.* **[CCSS.ELA-LITERACY.8.1]**

Using Sources

In this activity, students are encouraged to learn more about the sources Freedman uses in his book. You might want to consider giving an in-class explanation of primary and secondary sources. The student edition has a short explanation, but reinforcing this with additional examples and explanations would help.

Students have been directed to select a page from Freedman's book that has some quotes or references primary sources like letters from the Wrights, journal entries, or even newspaper articles. It is best to have them select pages that discuss events that occurred no earlier than 1900, as these will have the most documentation. Then, students will research the extensive collection of primary sources in the Wilbur and Orville Wright Papers at the Library of Congress to find the original primary sources themselves. Finally, they will draft a short paragraph summarizing the entire source.

Strong students may need little extraction for this activity, but weaker students will need help. Consider reviewing the site beforehand and putting together a short list of primary sources that you think are interesting and are referenced in the book.

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Essay Questions

Students should select one of the following prompts and write an essay that addresses the prompt using the reading. To do this, they should reference the primary sources Freedman uses. Encourage them to review the original sources themselves if they are located in the Wilbur and Orville Wright Papers at the Library of Congress. Also, encourage them to fill in any gaps in their research by reviewing available secondary works listed in the bibliography at the end of the book.

- In what ways were the successes of the Wright brothers built on a foundation of other inventors, tinkerers, and engineers?
- To make the first powered flights, the Wright brothers had to master a number of techniques, including aerodynamics, internal combustion engine design, propeller design, and many other specializations. Write an essay describing how the Wrights mastered these different techniques and what this suggests about their efforts and even them personally.
- The two Wright brothers were very close, but also very different in many ways. Using the evidence in the book, write an essay evaluating their different personalities and how these differences helped them become successful.

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