Early Flight Resources Overview

Standards Covered

Science

2010 Standards
4.4.1 Investigate transportation systems and devices that operate on or in land, water, air, and space and recognize the forces (lift, draft, friction, thrust, and gravity) that affect their motion.
4.4.2 Make appropriate measurements to compare the speeds of objects in terms of the distance traveled in a given amount of time or the time required to travel a given distance.

2016 Standards
4.PS.1 Investigate transportation systems and devices that operate on or in land, water, air, and space and recognize the forces (lift, drag, friction, thrust, and gravity) that affect their motion.
4.PS.2 Investigate the relationship of the speed of an object to the energy of that object.
7.PS.4 Investigate Newton’s first law of motion (the law of inertia) and how different forces (gravity, friction, push, and pull) affect the velocity of an object.
3-5.E.3 Construct and perform fair investigations in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Social Studies
4.1.11 Identify and describe important events and movements that changed life in Indiana in the early twentieth century.

Math
4.M.1 Measure length to the nearest quarter-inch, eighth inch, or millimeter
4.M.3 Use the four operations (addition, subtraction, multiplication, and division) to solve real-world problems involving distances, intervals of time, volumes, masses of objects, and money. Include addition and subtraction problems involving simple fractions and problems that require expressing measurements given in a larger unit in terms of a smaller unit.

ELA
4.RV.1 Build and use accurately general academic and content-specific words and phrases.
4.RN.1 Read and comprehend a variety of nonfiction within a range of complexity appropriate for grades 4-5. By the end of grade 4, students interact with texts proficiently and independently at the low end of the range and with scaffolding as needed at the high end.

4.RN.2.1 Refer to details and examples in a text when explaining what a text says explicitly and when
drawing inferences from the text.

4.RN.2.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.

Objectives
* Students will be able to use and apply content specific vocabulary.
* Students will be able to calculate the distance they could travel, and the time that it would take to travel, in an early model aircraft.
* Students will be able to solve math problems using the main operations.
* Students will use what they have learned about the creation of aircraft to design and construct their own gliders.
* Students will be able to measure how far their aircraft has flown using both quarter inches and millimeters.
* Students will be able to read an informational piece about the history of aircraft and answer comprehension questions.
* Students will be able to find the main idea of a non-fiction text.
* Students will be able to use the text to infer answers to questions as well as find explicit information in a text.

Additional Resources and Interactive Websites

http://Howthingsfly.si.edu

http://www.grc.nasa.gov/WWW/k-12/airplane/

http://airandspace.si.edu/exhibitions/pioneers-of-flight/interactive/airracer/airracer.swf

https://www.grc.nasa.gov/www/k-12/UEET/studentSite/historyofflight.html

In-Class Activities
Activity #1
Early Flight Exhibit Vocabulary Development

Standards
4.RV.1 Build and use accurately general academic and content-specific words and phrases.

Objectives:
*Students will be able to use and apply content specific vocabulary.

Lesson Ideas
Review with students the vocabulary words related to the Early Flight Exhibit. Students should copy down these words in their science notebooks while the teacher reviews the definitions.

Enrichment
Students could look up the words themselves to find the definitions and write them in their science notebooks.

Differentiation/Accommodation
Students could be given a copy of the Vocabulary List for Teachers to glue into their science notebooks while the teacher reviews the definitions.

Practice/Assessment
Students are given the Vocabulary Activities handout. This can be used as an assessment to gauge student understanding of the words or just as a practice to help students learn the vocabulary words.
## Vocabulary List for Teachers:

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>aviator</td>
<td>A pilot</td>
</tr>
<tr>
<td>biplane</td>
<td>Early type of aircraft with 2 pairs of wings</td>
</tr>
<tr>
<td>drag</td>
<td>The force that slows down the plane’s speed, generated when the plane moves through the air</td>
</tr>
<tr>
<td>fuselage</td>
<td>The main body of an aircraft</td>
</tr>
<tr>
<td>lift</td>
<td>The force keeping the plane up (mostly generated by the wings)</td>
</tr>
<tr>
<td>monoplane</td>
<td>An airplane with one pair of wings (modern-day airplane)</td>
</tr>
<tr>
<td>pitch</td>
<td>The up or down movement of the plane nose</td>
</tr>
<tr>
<td>roll</td>
<td>The up or down movement of the plane wing tips</td>
</tr>
<tr>
<td>thrust</td>
<td>The force driving the plane forward generated by the engines or propeller of the aircraft</td>
</tr>
<tr>
<td>weight</td>
<td>The force (gravity) pulling the plane down</td>
</tr>
<tr>
<td>yaw</td>
<td>The left and right movement of the plane nose (a turn)</td>
</tr>
</tbody>
</table>
### Vocabulary Activities

Match the following vocabulary words with their definition.

<table>
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Activity #2
Early Flight Exhibit Reading Comprehension

Standards
ELA
4.RN.1 Read and comprehend a variety of nonfiction within a range of complexity appropriate for grades 4-5. By the end of grade 4, students interact with texts proficiently and independently at the low end of the range and with scaffolding as needed at the high end.
4.RN.2.1 Refer to details and examples in a text when explaining what a text says explicitly and when drawing inferences from the text.
4.RN.2.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.

Social Studies
4.1.11 Identify and describe important events and movements that changed life in Indiana in the early twentieth century.

Objectives
* Students will be able to read an informational piece about the history of aircraft and answer comprehension questions.
* Students will be able to find the main idea of a non-fiction text.
* Students will be able to use the text to infer answers to questions as well as find explicit information in a text.

Lesson Ideas
Have students read the Early Flight Exhibit article and answer the comprehension questions about what they have read.

Enrichment
Have students research Octave Chanute, the Wright Brothers, and/or Louis, Harry, and Julius Johnson to learn more about the role(s) they played in early aviation.

Differentiation/Accommodation
Students can work in pairs to read the story and work together to answer the comprehension questions. They could have their Early Flight Exhibit Vocabulary page with them to help as they read through the text.
Early aviators learned about lift by experimenting with gliders. Aviation pioneer Octave Chanute (1832-1910) figured out that two wings stacked one on the other provided optimal lift. He demonstrated this at Indiana Dunes near Miller Beach, Indiana, where his glider pilots launched from dunes to test various wing designs. Other things early aviators studied that affect flight are pitch – the movement of the plan nose up and down; roll - the movement of the plane wing tips up and down; and yaw - the movement of the plane nose left or right.

These experiments inspired the Wright Brothers and influenced the design of the two-winged airplane in which they made history in 1903. These were called biplanes because of the two primary wings. Wilbur Wright was born near Millville, Indiana, and went to school in Indiana and Iowa. The family moved to Dayton, Ohio, in 1884, when Wilbur was 17 years old. In 1903, he and his younger brother, Orville, took the first powered, controlled, sustained flight amid the sand dunes at Kitty Hawk, North Carolina.

There’s a reason you don’t see many biplanes today. While two wings provide more lift than one, they also create more drag, which reduces speed. Three brothers from Terre Haute, Louis, Harry and Julius Johnson, knew what it took to get more lift from one wing - a powerful, lightweight engine. Originally the brothers designed and manufactured engines for boats, but in 1910, they applied their knowledge to airplane engines and built the first successful monoplane in the United States. The Johnson brothers started from scratch, learning from photos of other aircraft and various aviation experiments. Their aircraft had many innovations including tricycle landing gear, a metal fuselage, a powerful lightweight engine, and a cooling system. The monoplane flew successfully in Indiana and Illinois for five years. A lack of interest from buyers and investors caused them to abandon their aviation business. They returned to making marine engines and eventually became a part of the famous Johnson-Evinrude Outboard Company.
Resource for activity #2

Answer the following questions using the Early Flight Exhibit article.

1.) Why don’t you see many biplanes today?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

2.) What were some of the things early aviators needed to learn more about to improve the airplane design?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

3.) What made the Johnson’s monoplane so unique? Use details from the text to support your answer.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
4.) What do you think is the main idea of this text?

- The Wright Brothers were the first to build and fly a plane.
- The Johnson Brothers were the most successful monoplane builders during the 1900s.
- Airplanes have gone through many design changes over the years.
- Monoplanes are a much better option than biplanes.

Give 2 details from the text that support that main idea.

1.)

2.)
Standards

Math
4.M.1 Measure length to the nearest quarter-inch, eighth inch, or millimeter
4.M.3 Use the four operations (addition, subtraction, multiplication, and division) to solve real-world problems involving distances, intervals of time, volumes, masses of objects, and money. Include addition and subtraction problems involving simple fractions and problems that require expressing measurements given in a larger unit in terms of a smaller unit.

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Objectives
*Students will be able to measure how far their aircraft has flown using both quarter inches and millimeters.
*Students will use what they have learned about the creation of aircraft to design and construct their own gliders.

Lesson Ideas
Have students use what they have learned about drag, lift, roll, thrust, yaw, weight, drag, pitch, monoplanes, and biplanes to construct their own aircraft. Students may make many different prototypes until they are satisfied with one to fly for the class. Students will fly their airplane 3 different times, measure the distance to the nearest quarter inch and record their results in the provided chart. Students will then make a change to their aircraft. (such as wing size, wing placement, nose size, etc.) Then have the students fly the aircraft 3 more times, measure, and record the results on the provided chart. Students will then need to compare what happened to the distance their aircraft flew when they made changes. Students can also answer the questions below the chart about the changes they made and what they noticed happened to their aircraft after those changes.

Enrichment
Students could be challenged to construct both a monoplane and a biplane. They should compare the differences in the two planes as they are flown and see if they can compare and contrast the advantages and disadvantages of both types of planes.

**Differentiation/Accommodation**

Students may be given a paper plane template or directions to use to help them in the construction of their own design. Some examples can be found on the NASA site listed below.

http://futureflight.arc.nasa.gov/designs/
**Early Flight Exhibit**

**Create Your Own Aircraft!**

After you construct your aircraft, you are going to fly it 3 times. You will need to measure the distance it travels to the nearest quarter inch. Then record the results in the chart below.

<table>
<thead>
<tr>
<th>Trial</th>
<th>Distance Traveled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inches</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Now make a change to your aircraft. You might change the wing size, the number of wings, or the size of the nose. Make a change that you think will help your aircraft fly further. Then fly your aircraft 3 more times. Measure the distance to the nearest quarter inch and record your new results in the chart below.

<table>
<thead>
<tr>
<th>Trial</th>
<th>Distance Traveled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inches</td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>
Resources for activity #3

Answer the following questions about your trial flights.

1.) In which trial did your aircraft fly the furthest? ____________________

2.) What change did you make to your aircraft? Why did you decide to change that feature of your aircraft?
   _____________________________________________________________________
   _____________________________________________________________________
   _____________________________________________________________________
   _____________________________________________________________________
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   _____________________________________________________________________
   _____________________________________________________________________
   _____________________________________________________________________
   _____________________________________________________________________
   _____________________________________________________________________

3.) What was the difference between your longest distance and shortest distance? __________________________________________

4.) If you could change a second feature on your aircraft, what would you change? Why would you make that change?
   _____________________________________________________________________
   _____________________________________________________________________
   _____________________________________________________________________
   _____________________________________________________________________
   _____________________________________________________________________
   _____________________________________________________________________
   _____________________________________________________________________
   _____________________________________________________________________
   _____________________________________________________________________
   _____________________________________________________________________
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   _____________________________________________________________________
   _____________________________________________________________________
Activity #4
Early Flight Exhibit Math Connection

Standards

Math
4.M.3 Use the four operations (addition, subtraction, multiplication, and division) to solve real-world problems involving distances, intervals of time, volumes, masses of objects, and money. Include addition and subtraction problems involving simple fractions and problems that require expressing measurements given in a larger unit in terms of a smaller unit.

Objectives
* Students will be able to calculate the distance they could travel, and the time that it would take to travel, in an early model aircraft.
* Students will be able to solve math problems using the main operations.

Lesson Ideas
Have students answer the math questions. This could be done in small groups or individually.

Enrichment
Have students create their own math problems involving distance and how far the Wright Brothers may have flown in a given time. Have students create a chart of different distances and how long it would have taken to fly that distance.

Differentiation/Accommodation
Provide students with a partner to help them solve the given problems.
Early Flight Exhibit

Math Connection

Answer the following problems about early aircraft.

Distance = Rate \times \text{Time}

1.) The first aircraft flown by Wilbur and Orville Wright travelled about 7 miles per hour. If you flew for four hours in this plane, how many miles would you have flown?

Answer: ___________________________

2.) If you traveled 63 miles, how many hours would you have been flying?

Answer: ___________________________
3.) If changes were made to the plane and it was now able to fly 10 miles per hour, how much faster would it take you to travel 70 miles than with the previous plane?

Answer: ________________________________

Explain how you found your answer

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________