Let’s Fly- An integrated STEM lesson

Submitted by:

Parul Vohra

Topic: Let’s Fly- An introduction to aviation.

Grade Level- This project is planned for the kindergarten classroom. But with little modification, it can be extended to a broader range of PK-2.

Time- This whole project can be completed in seven 45-50 minutes class periods. I have a total class size of 10 students. If the class size is bigger, then it may take few more classes.

Standards:

CCSS-M

1. K.CC- Counting and Cardinality

2**.** K.MD.B.3- Classify objects and count the number of objects in each category.

3. K.MD.A1-Directly compare two objects with a measurable attribute.

4. K.G.A1- Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as *above*, *below*, *beside*, *in front of*, *behind*, and *next to*.

NGSS

K.PS- Motion and stability: Forces and interaction

1. K-PS2-1-With guidance, plan and conduct an investigation to compare the effects of different strengths or different direction of pushes on the motion of an object.

2. K-PS3-1-Make observations to collect data that can be used to make comparisons.

DISCIPLINARY CORE IDEAS

1. ETS1.A-Defining and delimiting an Engineering problem.

2. ETS1.B-Developing Possible Solutions

3. PS2.A-Forces and motion.

4.PS3.C-Relationship between energy and forces.

Let’s Fly- An integrated STEM lesson

ELA/Literacy

1. SL.K.3-Ask and answer questions in order to seek help, get information, or clarify something that is not understood.

2. RI.K.1-With prompting and support, ask and answer questions about key details in a text.

Engaging Contexts: People of all ages have always been fascinated with the birds in the sky. This fascination led to the invention of aircrafts, but, we are not done yet and are on a continuous quest to design a bigger, better, faster flying machine. Our students have their own ideas for the same.

Kids have a natural curiosity about their world and how it works. They are fascinated by the sound and the sight of a shiny, big object moving in the sky. I would use this interest as my phenomena to spark learning and take airplane ideas across the curriculum.

For engaging, I would make the continents on the carpet with duct tape. We are including Geography in this portion as well. Since I have students from diverse countries in my class, we will start by standing where we come from and then discuss how we can all came together at one place.

We will go for nature walk and observe things that fly. We would watch youtube videos and would wonder how do things fly? That would surely ignite the curiosity. This is a very simple, yet fun way to connect students’ previous knowledge to the science and engineering that NASA aerospace engineers and rocket scientists use when they design and create the huge aircrafts This project is developmentally appropriate for the target group i.e. Kindergarten as it covers almost all standards of domains like Geometry, Measurement and data and counting for kindergarten CCSS-M. The Science and engineering component also reinforces the math concept in this project. The resources and activities used for this project are age and developmentally appropriate for Kindergarten. The students would be able to do most of the work with minimum assistance thus making them more involved at each stage of the activity.

Activities that explore the basics of aviation are not only fun but can teach and review aspects of the scientific process and the engineering design process. The kids will be inspired by seeing other kids tackling the challenge and will understand how the activity relates to aerospace exploration. These are opportunities to unleash an individual’s ingenuity and creativity. However, the focus of this lesson is to create controlled flight using a classic paper airplane design and excite the imagination by helping children to better understand aviation and take the initiative for new investigations in aerodynamics.

Justification: This unit provides lots of opportunities to integrate other subjects into the aviation unit from weather to history to language arts and physical science. The idea is to build a flying

machine by engaging them in related design challenges. Hands-on activities to help prepare for, introduce, run, and wrap up the activity; discussion questions that explore the aerospace, engineering, and space related themes; and ways to make all subjects into the curriculum connections. This unit incorporates all disciplines of STEM and many more including literacy, geography, History and Art.

- In Science, we will do experiments and demonstrations to understand the concept of gravity and forces and motion.
- In Math, we will learn about symmetry, sorting and classifying, counting, comparing numbers and practice visual data representation skills (Bar graph with cubes).
- For Art, Engineering and Technology- the students will design and decorate a paper plane template online which they will print and fold symmetrically.
- For Language literacy and History- We will make a scientific vocabulary word wall with aviation words and read related books.
- For Geography, we will play a 'fly the plane to various continents' game.

We will build on knowledge from various disciplines to create new understanding where real life connections are made to the class room learning. This integration is logical and is needed to create new opportunities for learning.

Measurable Objectives:

1. Understand that all objects will fall to the ground because of the gravitational force between the Earth and the object.

2. Recognize that all objects will fall to the ground unless another force holds them up.

3.Observe and recognize that an object will fall when it is dropped.

4. To correctly name the different modes of air travel.

5. To sort the objects that fly in air. (Children will decide their own criteria).

6. To draw/cut the picture and name the major parts of an airplane.

7. Represent the airplane model with drawing.

8. Plan and conduct an investigation through construction of a model airplane using paper to calculate the distance traveled.

Lesson Procedure:

ENGAGE (1 lesson-45-60 minutes)

Let’s Fly- An integrated STEM lesson

The teacher would introduce the lesson with a map activity where students will stand in the duct tape continents on the carpet and will discuss how they will move to North America. We will discuss how airplanes have made our travel across the world so fast. We would wonder are airplanes the only things that fly? We will go on a nature walk and try and spot flying things like birds, air planes, I would use a helium balloon as well. We will watch youtube videos of other objects that fly like gliders, blimps, etc. In the end, teacher would conduct a quiz where the students listen to clues and guessed the name of aircraft. At the end of this lesson, they would do a worksheet where they circle the things that fly. These activities will also be used as diagnostic assessment to assess the students’ understanding and to make necessary adjustments in the future lessons.

EXPLORE (1 lesson-45-60 minutes)

In this lesson, the students would get the opportunity to sort the things that fly. The teacher will provide pictures of things that fly and students will sort them based on the criteria chosen by them (natural/man made or engine/no engine). They will make a collage and explain their criteria of sorting. This activity would get students more involved in the topic; providing them with a chance to build their own understanding.

EXPLAIN (2 lessons-45-60 minutes each)

In this phase, the teacher would connect their previous knowledge of airplanes to an inquiry question why planes can fly. We would throw tissue in air that would fall down. We will discuss what is pulling it down (Gravity). Explain to the students that in order to overcome gravity, airplanes have to achieve lift, a force that opposes (or pushes against) gravity. The greater the weight of the airplane, the greater the lift required. Explain to the students that today they will learn about a scientific principle that will help them understand lift. Tell the students that the principle is called the Bernoulli Principle; it is named after the man who discovered it. (Here you can give the students some simple background information about Daniel Bernoulli. You may also show the picture). We can do the airdryer and pingpong ball experiment to demonstrate the same. I would also introduce the four forces of flight but not expecting them to master it.

After their curiosity is stimulated and they build their understanding, the teacher will show a picture of a bird and a plane and students would spot the similarity in the shape of the wings. The teacher would explain this shape as aerofoil shape and discuss this aerofoil shape helps us overcome weight which is the effect of gravity pulling down on the weight of the aircraft. After these two lessons, the students will draw their visual model of the plane on paper and label its main parts.

EXTEND (2 lessons-45-60 minutes each)

In this phase, the students would be given a chance to used their knowledge gained so far and explore its implications. The teacher would demonstrate folding paper and then They would be provided with paper template and other necessary supplies. They would create a paper airplane and decorate it. The teacher would watch and assist the students who may not be able to follow correct paper folding procedures. Only one kind of template would be used to control the variables. The students would use this paper plane to measure the distance it flew from the launching pad.

The teacher would discuss what makes the real plane go forwards (burning fuels). The class would then discuss the correct safety procedure of launching a paper plane before starting their exploration. The teacher would let them observe that a soft throw or a hard throw would make the plane travel different distances. They would then collect evidence for the same by launching their plane from the launching pad with a hard throw and use chain links as a nonstandard unit of measurement and draw conclusions from data and evidence. They would compare their chains to see which plane went the farthest. As a class, they would also create a bar graph with cubes to represent the number of links in their chain.

As an extension activity, they can evaluate and explore other possible variables that could affect the flight pattern of a plane. They may come up with examples such as shape of wings, length of plane, its weight, etc. They can report out their results to the class upon completion of their investigation.

EVALUATE (1 lesson-45-60 minutes)

This stage would help teacher determine how much learning and understanding has taken place. Students would complete worksheets so that they can draw conclusions based on evidence from their tests. They would then share the results with the class. The teacher would use observation rubrics for grading and assessing students. A short interview would be the last activity of this project where students would record their responses about how they liked this project? What else they could have done to make their planes fly farther? What was the best part of the project for them?

The teacher would record the responses for students who struggle with writing sentences.

Assessment/Rubric:

Diagnostic:

Let’s Fly- An integrated STEM lesson

In the engagement activity, the students go for nature walk where they would be able to spot and illustrate the things that fly. They would also participate in quiz where their answers would demonstrate their understanding about aviation. This information would help in planning and sorting the class in groups.

Formative

The teacher will use the following observation rubric at each step of all the lessons to assess the students’ understanding and would also identify and gently guide the students who are struggling to follow directions. This is to make sure that each student gets the maximum benefit and opportunity to learn at the same time.

Observation rubric

Name _____

Lesson	Criteria	Proficient	Intermediate	Beginner	Comments
Lesson 1	Understands that airplanes are fastest mode of transport.				
Lesson 1	Identify/name things that fly in the air.				
Lesson 2	Sort and classify things that fly.				
Lesson 2	Able to verbally explain the sorting criteria.				
Lesson 3 and 4	Understands that gravity is the force that pulls the objects down.				
Lesson 3 and 4	Recognizes that all objects fall to the ground.				

Lesson 3 and 4	Name all four forces of flight.				
Lesson 3 and 4	Name at least two forces of flight.				
Lesson 3 and 4	Can spot the similarity between the bird wing and an air plane wing.				
Lesson 3 and 4	Name the special wing shape.				
Lesson 3 and 4	Can draw and label major parts of an airplane.				
Lesson 5 and 6	Can fold the paper plane template independently.				
Lesson 6 and 7	Understand and demonstrates the correct procedure of launching a plane.				
Lesson 6 and 7	Actively provides verbal explanation based on experimental observations and compare that to the peers’ explanation.				
Lesson 6 and 7	Can predict the effects of hard throw on the distance a rocket would				

	travel after observing the trials.				
Lesson 6 and 7	Accurately uses nonstandard units of measurement for collecting the data about the distance traveled by the plane.				
Lesson 6 and 7	Can compare the distance measurement that are greater or less than to describe their meaning.				
Lesson 6 and 7	Can represent this data in a bar chart using cubes.				
Lesson 8	Uses specific evidence from data collecting to provide the results of the experiment.				
Lesson 8	Accurately counts to a number to answer how many links are there in each chain and correctly identifies which plane flight is greatest or least.				

Let’s Fly- An integrated STEM lesson

Summative

All of the above activities culminate in a final lesson where students use a combination of drawing, counting, dictating and writing in various worksheets to describe the results of their experiment and would provide their feedback as a closing statement about this project.

Lesson Materials and References:

1. https://www.youtube.com/watch?v=DXm-tv9FCxQ – Bernoulli's Principle -- for Students (NASA.GOV)

2. https://www.nasa.gov/sites/default/files/atoms/files/bernoullis_principle_k-4-02-09-17-508.pdf- Bernoulli’s Principle- Educator Guide.

3. howthingsfly.si.edu - Science behind Aerodynamics

4. https://www.nasa.gov/sites/default/files/atoms/files/bernoullis_principle_k-4-02-09-17-508.pdf-The four forces of flight

5. https://www.nasa.gov/sites/default/files/atoms/files/bernoullis_principle_k-4-02-09-17-508.pdf-Picture of Daniel Bernoulli

6. https://www.hq.nasa.gov/office/aero/pdf/getting_on_an_airplane_k_2.pdf-Diagram of a plane to label its parts

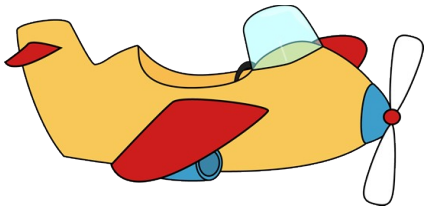
7. http://howthingsfly.si.edu/activities/paper-airplane-Design, decorate and print paper plane template

8. https://teachables.scholastic.com/teachables/books/things-that-can-fly-kindergarten-basic-skills-classifying - circle the things that fly worksheet

9. https://nasaeclips.arc.nasa.gov/teachertoolbox/the5e - The 5e instructional model

10. www.corestandards.org

11. www.nextgenscience.org/



Paper Airplane race challenge Chart

You are ready to fly your paper airplanes!

Trial	Distance traveled (number of links)
1	
2	
3	

1. My plane traveled _____ links far from the launch pad. _

_

2. _____ plane traveled the farthest. It was _____links far from the launching pad.

3. I had _____links less than _____(2).