Integrated Arts Unit Plan

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Endeavor STEM Teaching Certificate Project

Clouds Can Predict the Weather!
Grades K-3
Elizabeth Lundeen

Background:

By learning about the various cloud types and how clouds can predict the weather, students can better understand when severe weather may be in the forecast. In this lesson, students will put themselves in "the shoes of NASA's Cloudsat mission team as they are developing an important Earth-observing satellite." Students can ask questions and learn strategies for observing the weather around them in this lesson based on "The Sky and Dichotomous Key" from NASA's Jet Propulsion Laboratory.

The weather in Northern California is typically consistent except in the late winter or early spring when we can have severe weather like rain or wind storms. The sky is usually a beautiful blue so when we have clouds they are beautiful and very dramatic. If students learn to identify cloud types, they can better understand when severe weather may be coming and prepare for it. In my area, I would present this lesson in late winter or early spring. This would be a multi-day lesson with observations of clouds and weather going on for a month.

In the second part of the lesson, students will also identify areas at their school site that might be affected by inclement weather. Students will define the problem, brainstorm ideas to help ease the impact, write an informative paragraph about it and present their proposal to the administrator and custodian. If approved, students will build, test and redesign their ideas to solve the problem. At our school, right outside my classroom there is a drain for run-off that backs up during rainstorms and causes a huge "lake" students have to wade through to get across campus. This would be a fantastic opportunity for students to put their engineering skills to work and help solve our cold, soaking wet feet dilemma.

As a way to integrate art, students will learn about how weather influences culture, daily life, and mood by examining paintings depicting different types of weather. Students will demonstrate their understanding by painting a picture depicting a particular weather condition.

Standards:

California Content Standards
Arts Education

1.3.: Identify and describe how foreground, middle ground, and background are used to create the illusion of space.
1.5.: Identify and describe elements of art in works of art, emphasizing line, color, shape/form, texture, space, and value.
2.3.: Paint or draw a landscape, seascape, or cityscape that shows the illusion of space.

National Standards For Arts Education
Visual Arts
Grade K-4 Visual Arts Standard 1: Understanding and applying media, techniques, and processes

Grade K-4 Visual Arts Standard 4: Understanding the visual arts in relation to history and cultures

NGSS

3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.

K-ESS3-2 Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to severe weather.

K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

K-ESS2-1 Use and share observations of local weather conditions to describe patterns over time.

Science and Engineering Practices

Engaging in Argument from Evidence:

- Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).
- Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-ESS3-1)

  Analyzing and Interpreting Data:

  Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.
- Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1)
- Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
- Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions.

  Asking Questions and Defining Problems
- Asking questions and defining problems in grades K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.
- Ask questions based on observations to find more information about the designed world. (K-ESS3-2)
- Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1)
- Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1)

Disciplinary Core Ideas

ESS3.B: Natural Hazards
- Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that the communities can prepare for and respond to these events. (K-ESS3-2)

ETS1.A: Defining and Delimiting an Engineering Problem
- Asking questions, making observations, and gathering information are helpful in thinking about problems. *(secondary to K-ESS3-2)*

ETS1.A: Defining and Delimiting Engineering Problems
- A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2-ETS1-1)
- Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1)
- Before beginning to design a solution, it is important to clearly understand the problem. (K-2-ETS1-1)

ESS2.D: Weather and Climate
- Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1)

ESS3.B: Natural Hazards
- A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (3-ESS3-1)

Crosscutting Concepts

Cause and Effect
- Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1)
- Events have causes that generate observable patterns. (K-ESS3-2)

Patterns
- Patterns of change can be used to make predictions. (3-ESS2-1)
- Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. (K-ESS2-1)

CCSS

Math:
MP.2 Reason abstractly and quantitatively (3-ESS3-1), (K-2-ETS1-1), (K-ESS2-1)
MP.4 Model with mathematics (3-ESS3-1), (K-ESS3-2), (K-2-ETS1-1), (K-ESS2-1)
MP.5 Use appropriate tools strategically. (K-2-ETS1-1)
K.CC Counting and Cardinality (K-ESS3-2)

ELA/Literacy:

W.3.1 Write opinion pieces on topics or texts, supporting a point of view with reasons. (3-ESSS3-1)
W.3.7 Conduct short research projects that build knowledge about a topic. (3-ESS3-1)
W.3.2 Write informative/explanatory texts to examine a topic and convey ideas information.

Engaging Contexts:
Teacher:
Have you ever looked up in the sky and noticed there are different kinds of clouds? What do the different shapes and textures of the clouds tell us? Have you noticed that there is a particular cloud pattern when there is certain weather? Have you noticed that our weather can affect and cause difficulty here at our school? Wouldn't it be amazing if we put our heads together and solved the problem like actual engineers?

Justification:
By learning and identifying types of clouds and their corresponding weather, students understand that clouds can predict the weather. Students will collect authentic data and interpret the relationship between cloud patterns and weather. Students will learn how real-life NASA scientists collect data using a Dichotomous Key to identify objects. Students will also connect their research to a real-world issue by using engineering skills to design a solution to a problem at their school.

Objectives:
Students will be able to:

- Identify and describe types of clouds using the S'COOL Cloud Identification Chart
- Observe and gather cloud data using a dichotomous key, thermometers
- Organize, represent and interpret data using the S'COOL Cloud Observations Report Form
- Show the data using a simple graph and interpret information
- Identify patterns in temperature, pressure or cloud types
- Explain how clouds can predict weather
- Connect types of clouds to types of weather patterns
- Compile information from multiple sources to address topic
- Design and conduct an experiment that will solve a problem
- Critique experimental designs
- Develop a logical argument using informative text
- Report solutions to peers and administrators
- Identify and describe elements of art found in selected works of art (color, shape/form, line, texture, space, and value).
- Identify and analyze the depiction of weather and the seasons in works of art.
- Analyze, assess, and derive meaning from works of art, including their own, according to the elements of art, the principles of design, and aesthetic qualities.
- Create original artworks with paper, watercolors, and salt that depict type of weather or a season.
- Develop specific criteria to assess and critique works of art.

Materials Needed:

Cloud Vocabulary Handout

Dichotomous Key- https://www.jpl.nasa.gov/edu/pdfs/dichotomouskey_handout.pdf

Shapes in the Sky: A Book About Clouds by Josepha Sherman

DOK Question Stems on sentence strips

S'COOL Cloud Identification Chart or go to the online S'COOL Cloud Identification Chart- https://scool.larc.nasa.gov/cldchart.html

S'COOL Cloud Observation Report Form- https://www.globe.gov/documents/16792331/0/S%27COOL+GLOBE+Observation+Form+FINAL9sm.pdf/bf111e4a-7468-458b-9bd6-e463b98be61c

Cloud Identification Viewers printed on cardstock and glued to tongue depressors- http://fullofgreatideas.blogspot.com/2012/03/to-cloud-diy-cloud-identification-tool.html

Tongue depressors

Thermometers

Graph paper

Informative writing graphic organizer- https://s-media-cache-ak0.pinimg.com/736x/c9/f9/07/c9f907a46978c85d7522fe6e0f942973--problem-solution-graphic-organizer-problem-and-solution-anchor-chart.jpg

Online images of the following paintings:

- The Caucasus
- Danube Landscape
- Paris Street in the Rain
- The Hay Wain
- View of Toledo
- Road in Maine
- Above the Eternal Tranquility
- Coucher de Soleil No. 1
- Rain in an Oak Forest
- Starry Night

Copy of Elements of Art and Design Information Sheet- https://artsedge.kennedy-center.org/~/media/ArtsEdge/LessonPrintables/grade-3-4/weather_conditions_elements_of_art_and_design.ashx

Earth Science Lesson Plan:

Engage:

Day 1: Gallery Walk- using phenomena (pictures of clouds from https://www.wired.com/2009/09/clouds/2/) students do a gallery walk and write down observations at each picture. Students come to carpet and have class discussion as students explain their observations using evidence. Depth of Knowledge (DOK) question stems can be used here to assess prior knowledge of concepts.
Teacher reads "Shapes in the Sky" to students. Use DOK question stems to check for understanding and encourage discussion.

Explore:

Back at their tables, students can explore and identify types of clouds and the weather associated with them using their Chromebooks at https://scool.larc.nasa.gov/cldchart.html or the printed S'COOL Cloud Identification Chart and the cloud vocabulary handout. Students sketch, color and label types of clouds and corresponding weather in their science journals. Teacher checks as students work. Students cut out a cloud identification viewer and glue to a tongue depressor.

Explain:

Day 2: *Teacher:*
"We are going to observe clouds and record the outside temperature using our cloud viewers and thermometers for one month. We can make predictions about the type of weather we might be having by observing the various types of clouds."
Distribute how to use the Dichotomous Key Handout. Discuss the meaning and purpose of a dichotomous key as a tool that scientists use in many contexts.
Take students out to work in groups to begin cloud observations and temperature readings using cloud identification viewers and thermometers.
Complete S'COOL Cloud Observations Report Form as whole class and discuss findings based on observations.
Create a whole-class graph to display data on types of clouds, related weather and temperature. Identify if there are patterns in cloud type, temperature, weather patterns.

Extend:

Days 3-5: *Teacher:*
"Using what you have learned about clouds and related weather, let's think of how our school might be affected by severe weather such as high wind, heavy rain intense heat or sun. Are there problems here at our school as a result of this weather? What can we do to help remedy the situation?"

Students work in collaborative teams and define a problem on the school campus that is a result of weather. Teams will follow the steps of the STEM engineering design process- research, design, build a prototype, test and improve. Students will tour the school, speak with the administrator or custodian and specify a problem that can be solved. For example: areas that flood, doors that swing open in the wind, or areas that could be shaded from intense sun or heat. Students can use the internet to research solutions to their dilemma. Students will collaborate, brainstorm and draw or sketch solutions using readily available materials found at school or home. Teams will build a model and test their solution. If needed, they will re-design and test their design again to improve its performance.

Extension activities to support ELD students would be:

Singing "Oh When the Clouds Go Floating By" -
http://www.teacherweb.com/NV/Batterman/Wolf/informative-explanatory-rubric.jpg

Students can work in teams and do the Make a Cloud in a Jar experiment.

Students can keep a weather journal and draw pictures of the weather from their observations outside.

Evaluate:

Teacher will provide on-going formative assessment through observations, group interactions, DOK questions, data reports, and science journals.

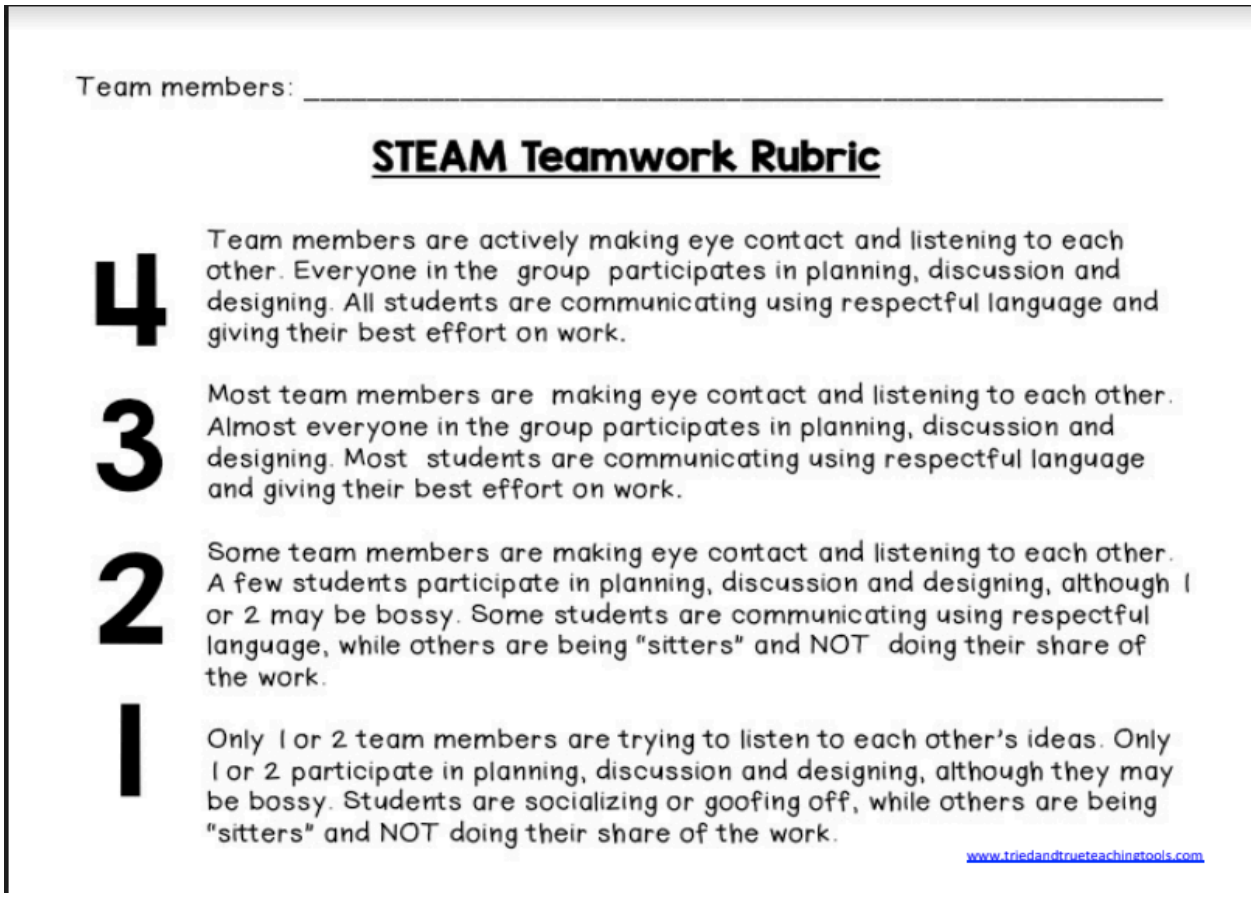
Summative assessments:

Students will use the informative text graphic organizer to write a informative paragraph explaining and developing a logical argument for their team's solution. Teacher will assess using the following rubric:

Informative/Explanatory Writing Rubric – 3rd Grade

Ask Yourself:	1 ★	2 ★★	3 ★★★	4 ★★★★
Did you introduce the topic?	No, I didn't introduce my topic at all.	Well, I somewhat introduced my topic.	Yes, I introduced my topic.	Yes, I introduced my topic in a very creative way!
Did you group related information together?	No, I didn't group related information together.	Well, I grouped SOME related information together.	Yes, I grouped related information together.	Yes, I clearly grouped related information together in a very creative way!
Did you include illustrations when useful to aiding comprehension?	No, I didn't include illustrations at all.	Well, I included a FEW illustrations to aide comprehension.	Yes, I included SEVERAL illustrations when useful to aide comprehension.	Yes, I included MANY illustrations when useful to aide comprehension in a very creative way!
Did you develop the topic with facts, definitions, and details?	No, I didn't develop the topic with facts, definitions, or details.	Well, I developed the topic with a FEW facts, definitions, and details.	Yes, I developed the topic with SEVERAL facts, definitions, and details.	Yes, I developed the topic with MANY facts, definitions, and details in a very creative way!
Did you use linking words and phrases to connect ideas (*also, another, and, more, but*)?	No, I did not use linking words and phrases to connect ideas.	Well, I used SOME linking words and phrases to connect ideas .	Yes, I used SEVERAL linking words and phrases to connect ideas.	Yes, I used MANY linking words and phrases to connect ideas in a very creative way!
Did you provide a concluding statement or section?	No, I didn't provide a concluding statement or section at all.	Well, I somewhat provided a concluding statement or section.	Yes, I provided a concluding statement or section.	Yes, I provided a concluding statement or section in a very creative way!

Students will present their solution to their peers and to administrator and custodian, design, build a prototype, test, revise and implement their solution. Students will use a teamwork rubric to grade their group's performance:



Team members: _____

STEAM Teamwork Rubric

4 Team members are actively making eye contact and listening to each other. Everyone in the group participates in planning, discussion and designing. All students are communicating using respectful language and giving their best effort on work.

3 Most team members are making eye contact and listening to each other. Almost everyone in the group participates in planning, discussion and designing. Most students are communicating using respectful language and giving their best effort on work.

2 Some team members are making eye contact and listening to each other. A few students participate in planning, discussion and designing, although 1 or 2 may be bossy. Some students are communicating using respectful language, while others are being "sitters" and NOT doing their share of the work.

1 Only 1 or 2 team members are trying to listen to each other's ideas. Only 1 or 2 participate in planning, discussion and designing, although they may be bossy. Students are socializing or goofing off, while others are being "sitters" and NOT doing their share of the work.

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Art Integration Lesson:

Engage:

Day 6: Gather the students around a window in the classroom and look outside to observe the weather. Ask the students the following questions:

- *What is the weather like today?*
- *What is the current season? How you describe the palette of colors associated with this season?*
- *What objects or changes in the environment (the sky, trees, ground or sidewalks, clothing, etc.) provide clues about weather and/or the season?*
- *What is your favorite kind of weather and why?*

After students have responded to these questions, have them look at the paintings by various artists. As students look at the paintings online, ask them:

- *How is light expressed in the painting?*
- *What kind of feeling or mood does the painting generate?*
- *How are the colors used to convey light or darkness?*

Explore:

Distribute Elements of Art handout. Discuss the elements of color, shape, and texture with students. Look again at the paintings in the resource carousel; review and analyze the pictures with students, while discussing the use of color, shape, and texture to portray a particular weather condition.

Have students select, analyze, and discuss their favorite paintings. Have each student choose a favorite painting, and break the students into groups according to their favorite paintings. Students can print out the paintings directly from the online interactive, or you may wish to bring into class prints of these paintings. Within the groups, students should share their thoughts and feelings about why they liked the pictures, discussing the elements of art such as color, shape, and texture. Students should use the Elements of Art handout as a reference point during their discussion. Have them present their responses as a group in front of the class. Students use rubric to assess:

Analysis of A Work of Art : Analyzing Weather Conditions Through Painting

CATEGORY	4	3	2	1
Description	Makes a complete and detailed description of the subject matter and/or elements such as color, shape, and texture seen in a work.	Makes a detailed description of most of the subject matter and/or elements such as color, shape, and texture seen in a work.	Makes a detailed description of some of the subject matter and/or elements such as color, shape, and texture seen in a work.	Descriptions are not detailed or complete.
Analysis	Accurately describes several dominant elements or principles used by the artist and accurately relates how they are used by the artist to reinforce the theme, meaning, mood, or feeling of the artwork.	Accurately describes a couple of dominant elements and principles used by the artist and accurately relates how these are used by the artist to reinforce the theme, meaning, mood, or feeling of the artwork.	Describes some dominant elements and principles used by the artist, but has difficulty describing how these relate to the meaning or feeling of the artwork.	Has trouble picking out the dominant elements.
Interpretation	Forms a somewhat reasonable hypothesis about the symbolic or metaphorical meaning and is able to support this with evidence from the work.	Student identifies the literal meaning of the work.	Student can relate how the work makes him/her feel personally.	Student finds it difficult to interpret the meaning of the work.

Explain:
Day 7: Demonstrate the technique of drawing a weather/landscape scene using salt and watercolors. Paint the scene, then sprinkle salt over the wet painting to create texture. You may also wish to use rubber cement to create a stippled effect.

Have students complete their own paintings. After viewing all of the weather conditions depicted in the pictures, including the geographical component, distribute to the students watercolor paints, brushes, cups with water, salt, and white paper. Ask students to complete one of the following assignments:

- *Paint an image of your favorite day based on the weather conditions on the season.*
- *Paint a weather/landscape scene of a particular day based on your personal experience.*

Remind students that they should express their own unique style as they create their watercolor paintings. They should choose colors carefully to represent the scene associated with the particular day and weather condition they are painting. The objective is to represent the weather in the scene, as well as the way that the elements in the painting are being affected by the weather.

Tell students that the colors they choose may determine the mood of the painting. Give students ample time to complete their paintings.
If you do not have a drying rack for the paintings, be sure to have cleared off plenty of room for student work to dry.

Extend:

Day 8: While the paintings dry, perform one or more of the following activities with the students:

- Look at a relief world globe or map and observe the different shades. Ask the students why there are changes in the colors. Point out a certain area that has a very different topography. Ask students the following: *How might that affect how artists depict the landscape? Is there a difference between a storm in a coastal region, and a storm in the mountains? Discuss how some of those differences can be depicted in paintings.*
- On the overhead projector or using an LCD projector, present two pictures of different cultures that clearly show the impact of the weather on the culture. Compare two different pictures and discuss how the weather has an impact on the lives of the people in that culture. Discuss the similarities and differences among these cultures.
- Create an area for exhibition of the students' paintings.
  Have students write an artist's statement to accompany their paintings explaining their techniques and observations. Their statement should include a description of the materials and process they used as well as the factors which influenced their work.

Evaluate:

Day 9: Break students into groups of three to four and have each group evaluate the artwork created by fellow class members. Since some of the paintings reflect personal experiences with the weather, ask students to describe that experience and its meaningfulness to them.
Lead the class in a closing discussion, asking questions such as:

- *Can you see now that weather or a season can be depicted in a variety of ways in painting?*
- *What is your favorite type of weather or season? Describe the reasons why.*

References

Arieli-Chai, H., & Garran, D. (2018). ARTSEDGE: Lessons for Elementary School. Retrieved from ARTSEDGE: https://artsedge.kennedy-center.org/educators/lessons/grade-3-4/Exploring_Weather#Instruction

NASA Jet Propulsion Laboratory, California Institute of Technology. (n.d.). *Classroom activity: The sky and dichotomous key.* Retrieved from https://www.jpl.nasa.gov/edu/teach/activity/the-sky-and-dichotomous-key/