Lesson Title: The Area of Clouds

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Topic: *Measure area of cloud using nonstandard units*

Targeted Grade Level: *Kindergarten*

Time Needed: 4 days (1/2 hour each day)

Subject Integration: *Mathematics / Art / Science*

Justification: Although it is stated in the kindergarten math standards that students should be taught measurement (length, volume, area, and time) educators usually focus on teaching linear measurements. In order to provide primary aged children with a strong mathematical foundation it is necessary to teach students about spatial measurement, such as area, because it helps them to understand the surrounding world and how to apply it in practical situations. Understanding area is a difficult concept for young students to grasp, so introducing it as early as possible is helpful in the long run. "Measurement knowledge and strategies play broadly and deeply into children's understanding of both science and mathematics, making measurement a vital component of pre-K through Grade 8 curricula" (So, 2013 as cited in Clements, Barrett, Sarama n.d. pg. 1).

References – Clements, D.H., Barrett, J.E., Sarama, J. Measurement in Early and Elementary Education (n.d.) *NCTM Measurement. https://www.nctm.org/Handlers/AttachmentHandler.ashx?attachmentID=LqBpwR2zmQk%3D*

Standards:

Next Generation Science Standards

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

Clarification Statement: Examples of qualitative observations could include descriptions of the weather (such as sunny, cloudy, rainy, and warm); examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. Examples of patterns could include that it is usually cooler in the morning than in the afternoon and the number of sunny days versus cloudy days in different months.

Assessment Boundary: Assessment of quantitative observations limited to whole numbers and relative measures such as warmer/cooler.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:

Make observation firsthand or from media to collect data that can be to make comparisons **Analyzing and Interpreting Data** 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. Connections to Nature of Science Knowledge is Based on Empirical Evidence Scientists look for patterns and order when making observations about the world.	**ESS2.D: Weather and Climate** *Weather is the combination of sunlight, wind, snow, or temperature in a particular region at a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.*	*Patterns in the natural and human designed world can be observed used to describe phenomena and used as evidence.*

New Jersey Core Curriculum Content Standards

ELA/Literacy

RI.K.1 With prompting and support, ask and answer questions about key details in a text. (K-ESS2-2)

W.K.2 Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.

Mathematics

K.MD.A.1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.

New Jersey Student Learning Standards for Science (NJSLS-S) are the same as Next Generation Science Standards (listed on previous page)

NJCCC Standards for Visual and Performing Arts

Standard 1.3 Performing: All students will synthesize skills, media, methods, and technologies that are appropriate to creating, performing, and/or presenting works of art in dance, music, theatre, and visual art.

Content Statement	Indicator #	Indicator
Dance The elements of dance are time, space, and energy. Improvisational structures facilitate movement invention. Musical or non-musical accompaniment is a choice. Dance can communicate meaning around a variety of themes.	1.3.2.A.1	Create and perform planned and improvised movement sequences using the elements of dance, with and without musical accompaniment, to communicate meaning around a variety of themes.
Visual Art Visual statements in art are derived from the basic elements of art regardless of the format and medium used to create the art. There are also wide variety of art media, each having its own materials, processes, and technical application methods for exploring solutions to creative problems.	1.3.2.D.1	Create two- and three-dimensional works of art using the basic elements of color, line, shape, form, texture, and space, as well as a variety of art mediums and application methods.

National Art Standards	
Dance Anchor Standard 1: Generate and conceptualize artistic ideas and work. Enduring Understanding: Choreographers use a variety of sources as inspiration and transform concepts and ideas into movement for artistic expression. Essential Question(s): Where do choreographers get ideas for dances? Kindergarten DA: Cr1.1.K a. Respond in movement to a variety of stimuli (for example, music/sound, text, objects, images, symbols, observed dance) b. Explore different ways to do basic locomotor And non-locomotor movements by changing at least one of the elements of dance.	*Visual Art* Anchor Standard 1: Generate and conceptualize artistic ideas and work. Enduring Understanding: Creativity and innovative thinking are essential life skills that can be developed. Essential Question(s): What conditions, attitudes, and behaviors support creativity and innovative thinking? What factors prevent or encourage people to take creative risks? How does collaboration expand the creative process? Kindergarten VA: Cr1.1.Ka Engage in exploration and imaginative play with materials.

Measurable Student Learning Objectives:

Students should be able to measure area using nonstandard units.

Students should be able to measure with multiple copies of units of the same size.

Students should be able to recognize what clouds are and what role they play in Earth's weather.

Nature of STEM:

Integrating science, technology, engineering, and mathematics allows for students to have a deeper understanding of numerous topics and concepts introduced to them. This approach to teaching promotes exploration of natural phenomena through various hands on activities. A stronger academic foundation is built the earlier a child is introduced to this type of learning. Skills like collaboration, communication, problem solving, risk taking and many other of the other 21st century skills are honed from this young age, so that our students of today are prepared to engage in world where thinking outside of the box is the strongest commodity.

Engaging Context/Phenomena:

What do you see in the sky during the day? Clouds!

Data Integration:

NASA Knows (K-4) Who was Katherine Johnson?

Katherine Johnson Legacy

Jigsaw Weather Puzzle

S'cool Cloud Identification Chart

Differentiation of Instruction:

Multiple learning styles addressed:

visual (video clips, photographs, book illustrations

auditory (listening to text, narration of video clip)

verbal (discussions, explanations)

physical (cloud movement interpretation)

logical (problem solving, counting, measuring)

social (collaboration)

Real-life Connection:

Studying clouds helps us to understand Earth's weather patterns.

Weather affects our lives: what we wear, what crops we grow; where we live and vacation; and what activities we partake in.

When we garden, landscape, remodel or decorate our homes we calculate the area of the various spaces.

Possible Misconceptions:

Area

"Everything is length. Children often believe that they can use rulers to measure area. Consequently, they often measure the perimeter *(the path around the figure).*

Units can be different.
Children often believe that it doesn't matter if the units are all identical. They believe that if they can fill a region (like a hand) with units of measure (like beans), then it doesn't matter if some of the units of measure (the beans) are of a different size - children simply count the number of objects contained within the region (the hand).

Cover need not be completed.
Children often believe that although the units of measure should be identical, it doesn't matter if they don't completely cover a region. For example, nine beans of the same size are used to cover a square depicted to the right. Just as long as the beans do not "spill over" or otherwise violate the boundaries of the figure, some children will report the area of the square as 9 beans."

Reference - Mathematics for Parents. (n.d.) *Area Measurement.* http://archive.wceruw.org/mims/Parent_Newsletters/Area_Measurement/newsletter13.html

Clouds

Clouds are sponges that hold water.

Clouds mean it is going to rain.

Clouds are made of wool or cotton.

Clouds move when we move.

Reference – Weather Misconceptions. *What's Going on Out There?* (n.d.) Retrieved on 4/25/2020https://sites.google.com/site/weatherwatchers65/home/weather-misconceptions-2

Lesson Procedure:

5E Model	5E Objectives
Engage	**Procedure:** 1 -To begin the lesson have students watch as a whole class Katherine Johnson Legacy and discuss (NASA Knows (K-4) Who Was Katherine Johnson?) Katherine Johnson, an African American NASA (National Aeronautics and Space Administration) mathematician, known as a human computer, helped send astronauts to the moon and back with her accurate calculations. Teacher will emphasize how students can use mathematics to learn more about science like Katherine Johnson. 2 – In order to assess students' prior knowledge, teacher will ask probing questions: What do you know about clouds? What do you want to learn about clouds? Teacher will also ask probing questions to encourage discussion: What are clouds? How are clouds formed? Why are clouds white/gray? Teacher will record student responses on a schema map.

	3 – Introduce basic cloud types: cirrus, cumulus, and stratus using a modified version of sky_cloudchart.pdf . Assign students to small groups. Hand out modified version of sky_cloudchart.pdf . Take class outdoors to cloud watch. Encourage students to observe clouds and identify clouds from cloud chart. **Modifications:** Students are provided with multiple learning styles: visual, kinesthetic, auditory **Standards Addressed:** K-ESS2-1. Use and share observations of local weather conditions to describe patterns over time. **Formative Assessments:** Schema map (background knowledge, misconceptions and want to learn) Students' ability to identify clouds and match clouds to the Sky Cloud Chart Students' descriptions of clouds and cloud shapes (i.e. rabbit, boat, etc.) **Resources:** NASA Knows (Grades K-4)-Who was Katherine Johnson? (2020, Feb. 24). www.nasa.gov. Retrieved 3/19/2020 from https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/who-was-katherine-johnson-k4 NASA Knows (Grades K-4)-What are Clouds? (2017, Dec. 19). www.nasa.gov. Retrieved 3/19/2020 from https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-are-clouds-k4.html The Area of Things. Retrieved 2/2020 from https://www.nctm.org/Classroom-Resources/Illuminations/Lessons/The-Area-of-Things/ S'cool Cloud Identification Chart. (2004, October 24). Retrieved 3/19/2020 from https://www.jpl.nasa.gov/edu/pdfs/sky_cloudchart.pdf
Explore	**Materials:** • Blue construction paper

	• Liquid glue • Cotton balls • Book: *It Looked Like Spilt Milk*, by Charles G. Shaw • Yarn (one 12” piece for each child) • Pencils • Writing paper **Procedure:** 1) Gather as a whole class to read *It Looked Like Spilt Milk*, by Charles G. Shaw to continue interest in clouds. This story uses the natural movement of what seems to be a cloud to create many different shapes (i.e. a squirrel, a tree, and a bird). After reading the story, explain that students will make their own cloud artwork. 2) Introduce the concept of measuring area using nonstandard units by modeling: A -Predict number of cotton balls required to fill the region and write the number on the bottom of the construction paper. B - Model how to create a shape by outlining a region with a thin trail of glue; place the yarn on top of the glue; and make sure the two ends of yarn touch to create an enclosed region/area. C - Fill the region with cotton balls, make sure it is completely covered, and glue the cotton balls into place; count the total number of cotton balls used and write it on the bottom of paper; put a circle around the number. This numerical label gives students a mental picture of area and helps them understand the concept of measuring area. D - Write a descriptive sentence about the cloud shape artwork which includes the total number of cotton balls used. 3) Give each student a 12-inch piece of yarn, one sheet of blue construction paper, bottle of glue, a handful of cotton balls, writing paper and pencil. Have students follow the steps the teacher modeled. Teacher is assisting (writing, gluing, counting, etc.) students, when necessary, during this stage of

	the lesson. **Modifications:** Students may write a sentence describing their artwork; label their artwork or dictate a sentence to the teacher. Students may draw a shape with a pencil, outline with glue then add yarn to glue trail. Students who cannot go outside due to health reasons can look at NASA's Gallery of Clouds. **Standards Addressed:** NJCCCS RI.K.1 With prompting and support, ask and answer questions about key details in a text. W.K.2 Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic. Mathematics K.MD.A.1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object. **Formative Assessments:** Questions & Discussions Ask students to compare the number of cotton balls they predicted versus the number of cotton balls they used. Based on the cloud chart what type of cloud did they create? If your shape is smaller/larger would you use more/less cotton balls. **Resources:** The Area of Things. Retrieved 2/2020 from https://www.nctm.org/Classroom-Resources/Illuminations/Lessons/The-Area-of-Things/

Explain	**Procedure:** 1) Separate students into small groups. 2) Instruct students to observe cloud artwork and create movements that represent the artwork. **Modifications** Provide a home base such as an X on the floor for dancers to orient themselves to and self-monitor their positioning. **Standards Addressed:** **NJCCC Standards for Performing Arts** Dance - DA: Cr1.1.K c. Respond in movement to a variety of stimuli (for example, music/sound, text, objects, images, symbols, observed dance) **Formative Assessments** Questions and Discussion Why did the group choose this type of movements for the cloud artwork? Observe students' movements as they interpret cloud artwork **Resources** None
Elaborate	**Procedure:** Provide students with other nonstandard units (beans, snap cubes, large and small paperclips) and picture cards with outlined shapes.

	Model for students how to cover area of outlined shapes completely with nonstandard units. After students have completed measuring with nonstandard units activity they can play Weather Jigsaw Puzzle. **Modifications:** Students are presented with a variety of nonstandard units. **Standards Addressed:** NJCCCS Math: Measurement and Data K.MD.A.1 Describe and compare measurable attributes. 1. Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object. **Formative Assessments:** Discuss and observe student participation What is the area of a figure? How can we figure out the area using these cotton balls? Could we use beans to figure out the area of our shapes? Would using beans and cotton balls give you the same answer? If you had to teach this lesson to another student or your parents, what would you tell them and what directions would you give them? **Resources:** The Area of Things. Retrieved 2/2020 from https://www.nctm.org/Classroom-Resources/Illuminations/Lessons/The-Area-of-Things/

	Jigsaw Weather Puzzles. Retrieved on 4/26/2020 from https://scijinks.gov/jigsaw-puzzle/
Evaluate	**Procedure:** Teacher will collect students' cloud artwork to check their calculations of area using cotton balls. Teacher will collect descriptive writings. The artwork and descriptive writings will make a class book. Teacher will complete schema map, specifically new learning portion, by posing question: What have you learned about clouds and measuring area that you did not know before? Students will respond to questions and discuss their findings: How accurately did students define area? How accurately did you predict the number of cotton balls required to fill their region? Can you find the area using other nonstandard units (beans, snap cubes, river rocks, etc.)? **Modifications:** Scaffold student questions; conference with student to edit descriptive cloud writing **Standards Addressed**: Measurement and Data K.MD.A.1 - Describe and compare measurable attributes. 1. Describe measurable attributes of objects, such as length or weight **Summative Assessments:** As a summative assessment of their understanding or lack of understanding of measuring area students' artwork will be reviewed. Complete schema map with new learning. Rubric

	Resources: The Area of Things. Retrieved 2/2020 from https://www.nctm.org/Classroom-Resources/Illuminations/Lessons/The-Area-of-Things/

Teacher Background:

Clouds are a part of a larger study on weather. Students were able to investigate clouds by using their background knowledge, dispelling misconceptions, and participating in hands on activities that provided new information. Through discussion, small and large groups, observations, movement (dance), math and literacy skills, and artwork students explored the phenomena of clouds. Clouds help us to understand weather patterns. They are formed when the humidity is approximately 100%, dust particles attach themselves to water droplets in the air, and the air becomes cool. As the water droplets become too heavy, they fall as rain.

Types of clouds

Cumulus - low hanging, white, puffy clouds which change shape very quickly; found on warm sunny days; and less than one mile above the Earth.

Stratus - layered gray clouds that block the sun; sometimes covering the whole sky; and may bring rain or snow.

Cirrus - high, curly, wispy, feathery, white clouds made of ice usually found on fair days; and usually three miles above the Earth.

The portion of this lesson on measuring area is part of a larger study on measurement.

Scroll down for rubric.

Rubric for Engineering Design Challenge (Creating a Musical Instrument)	Non-Performance  1 No skills mastered	Emerging  2 Some skills mastered	Progressing  3 Mostly mastered skills	Proficient  4 Fully mastered skills
Communication 	I do not communicate with group members. I am not able to explain my project to an audience.	I interrupt and speak over group members while they are speaking.	Sometimes I share ideas and listen to group members. I explain some parts of my musical instrument to an audience.	I take turns sharing my ideas and listening to group members. I can explain all parts of my musical instrument to an audience.
Collaboration 	I do not work with group members.	Sometimes I have a hard time working with group members. Other group members do most of the work. I become upset and will not cooperate when my ideas are not accepted.	Sometimes I am off task and group members must give reminders. I may not always contribute to the designing and building aspects of the group project. I accept group decisions most of the times.	I work well with my group members. I help to design and build group project. I accept and respect group decisions even when it is not mine.
Critical Thinking 	I do not problem solve or make real world connections.	I wait for others to present their solutions.	Sometimes I think of possible solutions to problems. Sometimes I try to look for real world connections.	I test my musical instrument. When it did not work, I look for many solutions to correct it. I always look for patterns and connections between my project and the world around me.
Risk Taking 	I copied a musical instrument.	I copied project ideas from others and made no changes.	I copied my project, but also made a few original changes to it.	My project is original. It is exceptional and shows out of the box thinking.