Lesson Title: The Incredible Shadow

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Topic: Light and light waves, shadows and their characteristics, how to create shadows, how to manipulate shadows, shadows are fun, shadows can keep you cool, shadows and the Messenger spacecraft

Targeted Grade Level: PreK

Time Needed: 3-4 lessons

Subject Integration: Art will be integrated into the following subject matter:

Science: -Students will actively create the objects to be studied as shadows
-Students will be inquiring into something that occurs in nature

Technology: -Students will be using simple technology to create the objects eg. scissors, flashlights, etc.

Engineering: - Students will solve the problem of how to make and manipulate shadows with light, position of object, distance of light, type of light

Math: - measuring of distance of object from light source
-angle of object
-size of object

Fine Motor Skills: - cutting, pasting

Socio-emotional: - sharing tools, working in pairs to create the shadows

The integration of these subjects is logical because each aspect is required and needs to be understood for the project to have meaning and value. Interestingly, a graphics publication

done by Stanford University, considers shadow creation a form of sculpture created by a 3d object transforming into something that is 2d.

Justification: - Children at this age are learning about the world around them. Shadows and its relationship to light and the sun is a part of everyday life. The children's active participation in the creation of the shadow objects through art will enhance their engagement and interest, with the consequent of more learning.

Standards: -The standards that will be utilized will be the West Virginia Pre-K Standards as well as well as the National Arts Standards

Measurable Student Learning Objectives: - Students should be able to understand that light travels in a wave and a straight line

-Students should be able to understand how to make a shadow

-Students should be able to understand how the sun makes shadows

-Students should be able to understand how direct light (eg. flashlight, sun) and diffuse light (lampshade, clouds) impact shadows in a very elementary way

-Students should be able to understand that two light sources= two shadows

-Students should be able to understand that the closer one is to the light source, the larger the shadow

-Students should be able to understand the shape of

the shadow changes with the angle of the light

-Students should be able to understand that the sun acts like the flashlight

NB It must be noted that the objective of this lesson set would be for each student to learn TWO of the above objectives, no matter which ones.

NGSS Performance Expectations: - 1) asking questions-How do we make shadows? Where do they come from?

2) investigations- developing and using models- creating the shadows

3) planning and carrying out the investigations- the shadow Exercises with respect to size, angle, light diffusion

4) analyzing and interpreting data-O with respect to distance from the light source

5) using mathematical and computational thinking- measuring, comparing distance from the light source

Disciplinary Core Ideas- physical science-PS1- Matter and its interactions- matter and its relationship with light

Crosscutting Concepts- 1) patterns- observing the shadows can prompt questions about relationships and causes underlying them

2) cause and effect- how the shadow is made, how it changes

3) stability and change- in size, in angle, direct vs. diffuse light

Nature of Stem:- Science- Investigating and asking questions about something that occurs

in the natural world

Technology- scissors to cut out shadows, flashlights (direct light), and Lampshades (diffuse light), video camera, camera to record the Project

Engineering- to solve the problem of how to make shadows

-construct different objects to experiment and make shadows with

Math- measuring and comparing size shadow with distance from the light Source

Engaging Context/Phenomena: - 1) playing guess who- showing shadows of cartoon characters eg. Paw patrol, Peppa pig, Mickey

2) NASA education stories- Keeping cool with shadows- This story also includes a section on Messenger and how it is using a fabric called “sunshade” to create a shadow to keep it cool

Data Integration: - showing consistency- the size of the shadow is greater when it is closer to the light source no matter what the object is

Differentiation of Instruction:- This lesson has auditory, visual and kinesthetic aspects inherent to the activity If further individualization and attention were needed, parent volunteers could be used to help.

Real-life Connection: - the sun as a light source and shadow production- Take the classroom outside

-what happens on a cloudy day(diffuse light)

Possible Misconceptions: - that shadows happen by chance

-that shadows are scary

Lesson Procedure: - 5E Model

Engage: - Anchoring Phenomena- playing guess who with the shadows of cartoon characters

-phenomena of the shadow becomes the centre of the investigation and is an observable event in the real world

-Keeping cool with shadows- NASA education- Messenger is a current event and makes shadows and its uses more relevant

-Standards addressed- National Core Arts Standards

1)- VA:CR1.2 PKA- engage in self -directed creative making (shapes and objects for Shadows

2)- VA:CR2.1 PKA- use a variety of art-making tools(paper, sticks, scissors, glue, etc.)

3)- VA:CR2.2PKA- share materials with others

-Standards addressed- West Virginia Pre-K Standards

1)- AL.-PK.5- Inquire and investigate- What do you see?

2)- AL.-PK.6- Persistent in completing tasks, activities, projects and experiences

3)- AL.PK.8- Engage in project or activity over an extended period of time

4)- AL.PK.11- Initiate and engage in learning experiences and play with peers

Assessment- through participation

Resources

1)- https://www.nasa.gov/audience/forstudents/k-4/home/F_Keeping_Cool_With_Shadows.html

2)- https://graphics.stanford.edu/~niloy/research/shadowArt/shadowArt_sigA_09.html

3)- https://rainforestlearningcentre.ca/teaching-preschoolers-shadows-early -childhood-science-lesson/

4)- https://www.nationalartsstandards.org/

5)- https://wvde.us/wp-content/uploads/2019/05/PKStandardsBookletUPDATE-Final-MAY-2019

Explore:- observe, explore, compare, discuss, how different objects, different distances from the light source and different types of light (direct vs. diffuse) impact on the shadows

Standards addressed- National Core Arts Standards

1)- VA: Cr1.1.PKA- engage in self-directed play with materials

2)- VA: Cr1.2.PKA- engage in self-directed, creative making

3)- VA: Cr2.1.PKA- use a variety of art-making tools

4)- VA.Cr2.2.PKA- share materials with others

5)-VA: Cr3.1.PKA- Share and talk about personal artwork

Standards addressed- West Virginia Pre-K Standards

1)- AL.PK.5- Inquire and investigate

2)- AL.PK.6- Persistent in completing tasks

3)- AL.PK.8- Engage in project or activity over an extended period of time

4)- AL.PK.11- Initiate and engage in learning experiences and play with peers

5)- SE.PK.10- Use materials purposefully, safely and responsibly

6)- SE.PK.15- Take turns with materials and during experiences

7)- SE.PK.3- Investigate cause and effect relationships through exploration, manipulation and investigation

8)- SE.PK.7- Engage in scientific talk by utilizing words (observe, compare, contrast, measure, etc)

Modification:- As previously mentioned, volunteers as is necessary

Assessment:- through observation and asking questions

Resources

1)- https://www.nationalartsstandards.org/

2)- https://wvde.us/wp-content/uploads/2019/05/PKStandardsBookletUPDATE-Final-May-2019.pdf

3)- https://rainforestlearningcentre.ca/teaching-preschoolers-shadows-early-childhood-science-lesson/

4)- https://tryengineering.org/teacher/me-and-my-shadow/

Explain: - facilitate opportunities for students to explain their understanding of the new concepts through discussion and circle time

Modification: - If some of the children have difficulty measuring, rubrics cubes to concretize and visualize the task

Standards addressed- National Core Arts Standards

1)- VA.Re8.1.PKA-Iinterpret art by identifying and describing subject matter

2)- VA.Cn10.1.PKA- Explore the world using descriptive and expressive words

Standards addressed- West Virginia Pre-K Standards

1)- AL.PK.12- Relate and share knowledge with peers- through discussion of results and data collected

2)- ELA.PK.30- With prompting and support, participate in collaborative discussions with peers and adults through multiple exchanges

3)- Sc.PK.10- Explore and describe changes in materials and relationships (eg. distance from light source, direct vs. diffuse light)

4)- M.PK.15- Represent and interpret data

Assessment:- through discussion

Resources

1)- https://nationalartsstandards.org

2)- https://wvde.us/wp-content/uploads/2019/05/PKStandardsBookletUPDATE-Final-May-2019.pdf

3)- https://www.spaceracers.com/educators/lesson-plans/shadow-time/

4)- https://rainforestlearningcentre.ca/teachung-preschoolers-shadows-early-childhood-science-lesson/

Elaborate: - Provides an opportunity to apply concepts, challenge deep ideas and build on or extend understanding and skills

-This is an opportunity to “put it all together” as well as consider new ideas within the same topic that could be explored (eg. NASA Messenger and the sunshade)

-The teacher can lead an open discussion during circle time to reinforce concepts and scientific terms as well as expand the topic for possible future (eg. outside light vs. inside light, ? clouds, ? colour of light, ?space)

Modification:- Students can draw what they have learned

Standards addressed- National Core Art Standards

1)- VA: Cr3.1PKA- Share and talk about personal artwork

2)- VA:Cn10.PKA.- Explore the world using descriptive and expressive words and art-making

Standards addressed- West Virginia Pre-K Standards

1)- AL.PK.4- Originate and combine ideas to learn and discuss a range of topics

2)- SE.PK.18- Participate in a variety of classroom activities and tasks

3)- ELA.PK.30- With prompting and support, participate in collaborative conversations about Pre-k topics with peers and adults

4)- Engage in scientific talk by utilizing words(eg. observe, compare, contrast, measure)

Assessment: - through any medium the child chooses to express what he has learned

Resources

1) https://nationalartsstandards.org
2) https://wvde.us/wp-content/upload/2019/05/PKStandardsBookletUPDATE-Final-May-2019.pdf
3) https://www.nasa.gov/audience/forstudents/k-4home/F_Keeping_Cool_With_Shadows.html

Evaluate:- Assess student knowledge, skills, abilities

Procedure:- It appears based on the National Association for the Education of Young Children and the National Association of Early Childhood Specialists, most evaluation of this age group is done through observation and documentation. Rubrics could also be applied.

-In order to assess the success of the lesson, one would have to revisit the objectives that were laid out at the beginning and evaluated if they have been met.

Modification:- Individual needs and adaptations where necessary

References

1)- https://www.naeyc.org/sites/default/files/globally-shared/

Teacher Background:- The concepts in this lesson plan are very simple and straight forward. If a review is necessary, the following website is suggested:

https://rainforestlearningcentre.ca/teaching-preschoolers-shadows-early-childhood-science-lesson