ITQ ARTS AND SCIENCE INTEGRATION
GRADE 5
DANCE AND EARTH SCIENCE

I Heat Up…I Cool Down!

Uneven Heating of the Earth

Lesson #2

Complete this lesson in conjunction with FOSS, Grade 4, *Water Planet*, Investigation #3

CONTENT STANDARDS

Dance Grade 5

1.4 Incorporate the principles of variety, contrast, and unity with dance skills.

Earth Science Grade 5

ES4a Students know that uneven heating of the earth causes air movements (convection currents).

ESSENTIAL QUESTIONS *(Questions students might ask about the topic)*

- What happens to air and water molecules when they are heated and cooled?
- How can I show changes in density by applying the principle of contrast in my dancing?

OBJECTIVES & STUDENT OUTCOMES *(Students will be able to…..)*

- distinguish between and demonstrate changes in air and water density in group exercises by creating contrast in the element of space.

ASSESSMENT (*Various strategies to evaluate effectiveness of instruction and student learning)*

- **Feedback for Teacher**
  - Student answers to inquiry
  - Student performance
  - Student science notebook entry
- **Feedback for Student**
  - Response from teacher
  - Peer performance

WORDS TO KNOW

Dance

- **Contrast:** To set side by side. To emphasize differences. Changes in energy, space, relationship, and time all contribute to contrast of movement.
- **Space**: Immediate spherical surrounding of the body in all directions. Use of space includes shape, width, direction, pathway (curvature), level, relationship (the position of dancers to each other and to objects), symmetry and asymmetry.

Science

- **Air:** The mixture of gases surrounding the Earth.
- **Convection Current:** A circular movement of fluid (such as air) that is the result of uneven heating of the fluid.
- **Density:** The relationship between the mass (amount of stuff) of an object and its volume (the space it occupies).
- **Energy transfer:** The movement of energy from one place to another.
- **Molecule**: The tiny particles of which air (and water) are made.
- **Uneven Heating**: The result of different amounts of energy being transferred to adjacent surfaces.

MATERIALS

- CD Player
- Music
- Four table top signs labeled: Land, Air Over Land, Water/Ocean, Air Over Water/Ocean (attached)
- Diagram #1 "Molecule Density – Cold"
- Diagram #2 "Molecule Density – Warm"
- Science notebooks (1/student)

RESOURCES

- *FOSS California,* Grade 5, *Water Planet*, Investigation 4, "Heating Earth", Parts 2, 3 and 4
- Science notebooks (1/student)

PREPARATION

- Teach *FOSS California,* Grade 5, *Water Planet*, Investigation 4, Parts 1-4
- A large space with enough room to move safely.
- Prepare four table-top signs: Land, Air Over Land, Water/Ocean Air Over Water/Ocean (attached)
- Have Diagrams #1 and 2 "Dense Air/Water" and "Less Dense Air/Water" ready to show to class.

WARM UP *(Engage students, access prior learning, review, hook or activity to focus the student for learning)*

(7 minutes)

- *Ask: How does your body look when you are cold?* [Accept student responses.]
- *Say: When you are cold, your body takes up less **space**. You are huddled in a small shape and your energy is very bound and tight, sometimes you shiver and your teeth chatter.*
  - Ask students to pretend they are cold. They should create a small, tight shape.
- *Ask: How does your body look when you are hot?*
- *Say: When you are hot, your body takes up more **space** by opening up and spreading out. Your energy is very loose and free.*
  - Ask students to pretend they are hot. They should create a large, loose, open, free, shape.
- *Say: Cold and warm air **molecules** have **contrasting** behaviors. We showed that **contrast** in movement by creating small and large shapes that have different **energies**: bound and free.*
- Post diagrams 1 and 2 "Molecule Density - Cold" and "Molecule Density - Warm".
- *Say: When **molecules** are cold, they huddle together in a tight, low formation.*
  - Have the class clump together in a tight, low shape.
  - *Say: You are showing how cold air **molecules** behave. When **molecules** are packed closely together we call this more **dense**. Cold air is more **dense** than hot air and sinks to a lower level.*
- *Say: When **molecules** are hot, they spread out in an open formation. There is much more space between **molecules**.*
  - Have the class spread out in the **space** and create a large open shape at a high level (standing).
- *Say: You are showing how hot water **molecules** behave. When **molecules** are spread out they move more freely. We call this less **dense**. Hot air is less **dense** and rises to a higher level than cold air.*
- As a whole group, have students practice moving between more **dense** and less **dense** several times.

MODELING *(Presentation of new material, demonstration of the process, direct instruction)*

(20 minutes)

- *Ask/Say: Let's pretend we're on a trip to the beach. When you take your shoes off, how does the sand feel on your feet?* [The sand feels hot.] *Where do you go to cool off?* [The water] *You run to the water as fast as you can to cool off. If the Sun is heating both the sand and the water at the same time and same temperature, why do you think the water is cooler?* [Accept student answers.]
- *Say: The sand and soil on the Earth heats up much faster than water. We call this **uneven heating** of the Earth. Some parts heat up faster than others.*

- **Uneven Heating** Dance Procedure
- Part One
  - Teach the basic dance combination to represent rising temperature of the land on Earth.
  - *Say: We will start at a cold temperature at a low level and rise to a high temperature at a high level.* Remind students as the body movement is rising the temperature of the land is also rising and heating up.
    - Start in a low level, crouched position.
    - Cross right hand to left knee (beat 1)
    - Cross left hand over right hand to right knee (beat 2)
    - Rising to a medium low level, cross right hand to left hip (beat 3)
    - Cross left hand to right hip (beat 4)
    - Rising to a standing high level, cross right hand to left shoulder (beat 5)
    - Cross left hand to right shoulder (beat 6)
    - Raise right hand/arm high in the air (beat 7)
    - Raise left hand/arm high in the air (beat 8)
  - Practice several times from a low to high position with and without music.
  - Use vocal cues *saying: You are (land) heating up! You are rising to a high level.*
  - *Say: For the second eight beats of our dance, we will start at a high temperature at a high level and sink to a low temperature at a low level.* Remind students as the body movement is sinking to a low level, the temperature of the land is cooling down.
  - Give students one minute to reverse the movement from a high level, returning to a low level. (Note: students must repeat the raise arm position for beats 1 and 2, then to shoulders, hips, knees.)
  - Use vocal cues *saying: You are land cooling down . You are sinking to a low level..*
  - Practice several times moving from the high position to the low position using vocal cues.
  - Rehearse both rising and sinking.
- Part Two
  - Teach the basic dance combination to represent rising temperature of the water on Earth.
  - *Say: We will start at a cool temperature at a medium low level and slightly rise to a slightly warmer temperature at a medium high level.* Remind students that their body movement represents the rising temperature of the water.
    - Start in a medium low level.
    - Cross right hand to left hip (beats 1-2)
    - Cross left hand to right hip (beats 3-4)
    - Rise to a medium high level, cross right hand to left shoulder (beats 5-6)
    - Cross left hand to left shoulder (beats 7-8)
  - Practice several times from a low to high position with and without music.
  - Use vocal cues *saying: You are heating up and rising to a medium high level!*
  - *Say: For the second eight beats of our dance, we will start at a warm temperature at a medium high level and sink to a cool temperature at a medium low level.*
  - Give students one minute to reverse the movement from a medium high level, returning to a medium low level. (Note: students must repeat the shoulder arm position for beats 1-4, then hips, beats 5-8.)
  - Use vocal cues *saying: You are cooling down and sinking to a medium low level .*
  - Practice several times moving from the medium high position to the medium low position using vocal cues.
  - Rehearse both rising and sinking.
- *Ask: How does the movement for the heating land **contrast** with the movement of the heating water?* [Accept student responses.]
- *Say: The movement for the heating up of the land shows a greater **contrast** than that of the water. **Contrast** is shown by the difference in level and speed of which temperature changes occur between land and water.*
- Uneven Heating of the Earth Dance
  - Divide the class in half. Place one half of the class representing land on the Earth, on the right

side of the performance space. Place the other half of the class representing the water, on the left side of the performance space. All students will face forward.
  - *Say:*
    - *It's a hot, sunny day in San Diego. Performing your movement at the same time, show me how the land and water heats unevenly by performing your different dance combinations for eight beats.* Count eight beats and have students perform.
    - *Now the Sun has set and it is night in San Diego. Performing your movement at the same time, show me how the land and water cool unevenly by performing your different dance combinations for eight beats.* Count eight beats and have students perform.
  - Both groups will perform the heating and cooling combinations, simultaneously for two sets of eight beats. Then repeat three or four times in a row without stopping.
  - Videotape the performance.

GUIDED PRACTICE *(Application of knowledge, problem solving, corrective feedback)*
(20 minutes)

- *Ask: What can we infer about the temperature of the **air** that is above the land on a hot, sunny afternoon in San Diego?* Turn and pair share answers.
- *Say: The heat that is absorbed by the land is transferred to the **air** that is above the land. You can see this **energy transfer** when you are on the playground.*
- *Ask: Have you ever seen heat waves coming off the black top? You are watching heat **energy** being transferred from the land to the **air**. The **air molecules** bang into the hot black top. This causes the **air molecules** to move faster and faster, pushing them farther and farther apart.* Ask for student response: *When **air molecules** are heated and far apart, they are _____ (less dense).*
- Refer to diagrams 1 and 2 "Molecule Density - Cold" and "Molecule Density - Warm".
- *Say/Ask:*
  - *What do you think happens to the **air** that is above the water?* Turn and pair share.
  - *The **air molecules** that are above the water move slower and stay closer together We say the air above the water is more **dense**.*
- Demonstrate the movement for **air** (raise the roof). With hands flexed at shoulder level, push up the **air** with small pulsing movement.
- *Say: This is our motion to represent **air**.*
- *Ask:*
  - *How can we show more **dense air**?* Students should tuck their bodies into a low, tight, group shape while raising the roof.
  - *How can we show less **dense air**?* Students should open into a large shape and spread away from each other, moving quickly and jumping as they raise the roof.
- Instruct students to demonstrate the raise the roof movement with appropriate level, shape and space for more **dense** and less **dense air**, or cold and warm **air**. Mixing up verbal prompts:
  - *Cold **air***
  - *Warm **air***
  - ***Dense air***
  - *Less **dense air***
- *Ask: How does the movement between cold, **dense air**, **contrast** with warm, less **dense air**?* [Cold **air** moves slowly, at a low level, and there is less **space** between the **molecules** than warm **air**. The shape is small and bound. Warm **air** takes up more **space**, moves quickly, and at a high level. The shape is large and open.]
- *What happens to **air** over the land as the land heats up?* [The **air** also heats up.]
- Ask for a volunteer to demonstrate moving from a cold, **dense** shape to a warm less **dense** shape in eight beats.
- As a class, start everyone as cold, **dense air**. Count eight beats and have students slowly rise to warm, less **dense air**. Note: Encourage students to spread out as they rise and begin to jump freely and quickly like warm **air molecules**.
  - Use the vocal prompt *warming* for each beat of the eight beats. Slowly increase the volume of your voice from soft to loud (beats 1-8).
  - Reverse the movement to demonstrate cooling **air**. Use the vocal prompt *cooling*. Slowly

decrease the volume of your voice from loud to soft for the second group of beats 1-8.
    - Rehearse movement several times from cooling to warming and warming to cooling.
- *Ask/Say:*
    - *What causes the warming of the **air**?* [Accept student responses.]
    - *The solar energy from the Sun heats up the land. The land transfers its heat to the air. We call the transferring of heat **Energy transfer**.*
    - *What causes the cooling of the **air**?* [Accept student responses.]
    - When the Sun sets, the land is no longer being heated and the air also cool**s**.

- **Energy Transfer** Dance
- The teacher will act as the Solar Energy by using the arms to get larger as the voice increases in volume (warming) and to get smaller as the voice decreases in volume (cooling).
- *Say: We will now learn an **energy transfer** dance. I will act as the Sun and I will transfer solar energy to you, the land and water. You, in turn, will transfer your heat energy to the **air**.*
- Land and **Air** over land
    - Divide the land and water groups in half. You now have four groups. Label these groups land, **air** over land, water and **air** over water.
    - Have the land and **air** over land groups stand and face each other. Place table-top labels: land and **air** over land in front of each group.
    - Begin the land and the **air** over land groups in a low, moderately tight group shape.
    - Each group will perform at the same time. Count eight beats by using the prompt *warmer*.
    - Have the land group perform the **uneven heating** dance combination while the **air** over land demonstrates rising and warming of the **air**. Note: The land group should stay in their formation while the **air** over land group should spread out and move freely.
    - Reverse the movement using the prompt *cooler*.
    - Perform both warming and cooling, cooling and warming.
- Water and **Air over water**
    - Have the water and **air** over water groups stand and face each other. Place the table-top signs in front of each group.
    - Begin the water and the **air** over water groups in a medium-low tight group shape.
    - Each group will perform at the same time. Count eight beats by using the prompt *warmer*.
    - Have the water group perform the **uneven heating** dance combination while the **air** over water group demonstrates rising and warming of the **air**. Note: The water group should stay in their formation while the **air** over water group should spread out slightly. Note: The **air** over water group should not be at a much higher level than the water group.
    - Reverse the movement using the prompt *cooler*.
    - Perform both warming and cooling, cooling and warming.
- Have all four groups perform at the same time with vocal prompts. Repeat several times.
    - Videotape the demonstration.

DEBRIEF & REFLECT *(Identify problems encountered, ask and answer questions, discuss solutions and learning that took place. Did students meet outcomes?)*
(3 minutes)

- Have students respond in their science notebooks to the following exit questions:
    - Describe what happens to **air molecules** when they are heated?
    - How did dancing and learning about **contrast** help me understand the **uneven heating** of the Earth and **energy transfer**?

EXTENSION *(Expectations created by the teacher that encourage students to participate in further research, make connections, and apply understanding and skills previously learned to personal experiences.)*

- Watch videotape and discuss the exit questions.
- Rehearse daily, the two dances from this lesson to prepare for lesson #3.
- Think about the following questions for next week:

- Where does wind come from?
- Where will air currents form?
- What is the difference between an air mass and a front?

LAND

Table-top Sign #1

AIR OVER LAND

Table-top Sign #2

WATER

OCEAN

Table-top Sign #3

AIR OVER

WATER

OCEAN

Table-top Sign #4