

**ITQ ARTS AND SCIENCE INTEGRATION
GRADE 5
DANCE AND EARTH SCIENCE**

**The One and Only, Lonely Variable
Lesson #1**

FOSS California, Grade 5, Water Planet, Investigation 2, Swingers, Parts 2 and 3

CONTENT STANDARDS

Dance Grade 5

- 1.4** Incorporate the principles of variety, contrast, and unity with dance studies.
- 2.2** Invent multiple possibilities to solve a given movement problem and analyze problem-solving strategies and solutions.

Science Grade 5

I&E6d Identify the dependent and controlled variables in an investigation.

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

- What is a variable and why are they important in an experiment?
- How can I make a dance phrase more interesting?

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

- create variety and contrast in a generic movement phrase by applying a single element of dance.
- describe the effect the variable had on the movement.

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

- **Feedback for Teacher**
 - Student performance
 - Student response to inquiry
- **Feedback for Student**
 - Teacher Feedback
 - Peer feedback

WORDS TO KNOW

Dance

- **Contrast:** To set side-by-side to emphasize differences.
- **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

- **Controlled experiment:** An experiment in which one, and only one, variable is changed in order to assess its effect.
- **Dependent Variable:** Changes in response to changes in the independent variable.
- **Experiment:** Is an investigation designed to find out how variables affect outcomes.
- **Independent Variable:** Is changed in an experiment to find out how it affects the experiment outcome.
- **Standard:** The basic procedure used in a controlled experiment, before changing any of the variables.
- **Variable:** Anything you can change in an experiment that might affect the outcome of the experiment.

MATERIALS

- “Try if Yourself Experiments: Independent and Dependent Variables” Worksheet #1 (included)
- “Q & A: Variables” handout (included)
- Formation Chart
- Rubber ball
- Ladder or step stool
- CD Player and music
- Science notebooks (1/student)

RESOURCES

- FOSS California, Grade 5, *Water Planet*, Investigation 2, *Swingers*, Parts 2 and 3
- FOSS California, Grade 5-6, *Variables*, <http://www.fossweb.com/modules3-6/Variables/index.html>
- Internet, *Variables in Your Science Fair Project*, http://www.sciencebuddies.org/science-fair-projects/project_variables.shtml

PREPARATION

- Present vocabulary from FOSS California, Grade 5, *Water Planet*, and teach Investigation 2, *Swingers*, Parts 2 and 3

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

(10 minutes)

- Ask: What are **variables**? Pair- share with a partner. [Expected student response: Things that change. Things that change as a result of something we do.]
- Have students walk across the floor in a forward direction with a normal gait, two times.
 - Say: To make this more interesting, we are going to change how we use **space**. Each time I change one thing, I will refer to that as the **independent variable**. I change the **independent variable** in an **experiment**.
 - Prompt students to walk with the following spatial changes:
 - Say: I change the **independent variable** of...
 - *Direction*: walk backward, sideways
 - *Pathway*: walk in curved lines and zigzag lines
 - *Relationship*: walk connected to a partner; with a partner, one walks forward and one walks backward (mirroring), walk shoulder to shoulder with a partner
 - *Level*: high, medium and low level
 - *Size*: large steps, small steps, large shapes, small shapes
 - Ask: How does changing the element of **space** change our walk? [Accept student responses.]
 - Say:
 - Changing one element of space makes an ordinary walk look more interesting. In science, when something changes as a result of the **independent variable**, the result or outcome is called the **dependent variable**. In dance we say that changing the element of **space** creates **contrast** between the walks. **Contrast** is the **dependent variable**.
 - Today we are going to discuss the role **variables** play in **experiments**. We are going to learn a short dance combination and conduct an **experiment** using the element of **space**.

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

(15 minutes)

- Say: Let's apply this idea of **contrast** and **variables** to an actual experiment you might discuss during your science time.
- Demonstrate the following experiment with students.
- Note: Hold the ball at your waistline each time you drop the ball. Begin standing on the floor or using a stepladder if you have access to one.
 - Say:

1. *Let's make believe that I am standing on the first step of a ladder. If I (emphasize the word I) stood on the first step and dropped a rubber ball, what would happen?* [The ball will bounce]. We call this the **standard** of a **controlled experiment**. A **controlled experiment** means we are changing one thing or one **variable** in an **experiment**. All other parts of the **experiment** are measured against this **standard**.
- Let the ball drop. Ask the students to pay special attention to how high the ball bounces and repeat this step again.
- *Say: You are going to imitate how the ball moves and the height of your jump will represent the height the ball bounces.*
- Have students start at a low, crouched level and execute a very small jump with his/her head staying at a low level.
 2. Step up a step, or up on a chair, or other platform.
 - *Say: If I move up a step on the ladder and drop the ball again, what is the **independent variable**? What did I change?* [The **independent variable** is the step you took up the ladder, chair, etc.]. *Can you predict what will happen to the ball when I drop it?* [The ball will bounce.]
 - *Ask: What do you think will happen to the height of the ball bounce?* [Accept student answers.] Ask students to compare the height of the ball bounce to the **standard**.
 - Drop the ball and *say: What happened to the height of the ball bounce as compared to the first time I dropped the ball?* [Guide students to see that the ball bounced higher than the **standard**.]
 - Have the students stand at a middle level (head about waist height). Have students drop all the way down to the floor and jump so that their head does not pass beyond a middle level.
 - *Say: When you imitate the ball, the height of your jump represents the **dependent variable**. The change in the height of the ball bounce is called the **dependent variable**. Why?* [The height of the ball bounce is the result or outcome of the **independent variable** being changed.]
 3. Step up onto a higher platform, e.g., from a chair to a desk if you do not have a ladder.
 - *Say: If I move up to the third step and drop the ball again, what is the **independent variable** and what is the **dependent variable**?* [The **independent variable** is the number of steps you took up the ladder. The **dependent variable** is the height of the ball bounce.]
 - Drop the ball again and have the students observe the difference in bounce height from the **standard** and from step two.
 - *Ask: What did you observe when I dropped the ball this time?* [The ball bounced higher than the last two times.]
 - Have the students stand at a high level. Have students drop all the way down to the floor and jump as high as they can. Remind students they are imitating the ball and the height of their jump represents the **dependent variable**.
 4. *If I change the **independent variable** one more time, what do you predict will happen to the **dependent variable**?* [If you take another step up, the height of the ball bounce will be higher.]
 - *I am in control and I make the change, therefore the **independent variable** is the number of steps I take up the ladder. The **dependent variable** is the result of the change I made.*
- *Ask/Say:*
 - *Which of these actions, me climbing up the ladder step by step, or the bouncing of the ball, is the **dependent variable**?* [The height of the ball bounce is the **dependent variable**. The height of the ball's bounce depends on how high up the ladder the person is who's dropping the ball.]
 - Use thumbs up/down to answer this question: *Would you say all three of your jumps and the height of all three bounces were different? The answer is yes! The fact that the height of your last two jumps was different from the **standard** demonstrated **contrast**. Comparatively placed side-by-side, all three jumps were different.*

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

(10 minutes)

- *Say: Now we're going to create another **controlled experiment** but this time it will be in dance. I will*

teach you a dance combination that will be the **standard**. You will apply an **independent variable**.

- Teach the class an eight-beat combination. Students will move their feet only keeping arms by their sides. Do not permit any arm, hand or other body movement.
 - The double basic jazz step:
 - Step to the right with the right foot. Step left closing feet together. Step to the right with the right foot and touch the left foot close to the right foot (beats 1-4).
 - Repeat the step on the left (beats 5-8).
 - Say: *Step-together-step-touch. Step-together-step-touch.*
- Arrange students in five small groups standing side by side and rehearse the eight-beat combination several times with and without music until students can execute from memory.
 - Note: Remind students they are not to add any extraneous movement. They may want to clap, snap, use arms, torso, but discourage all other movement except that of the legs and feet.

(10 minutes)

Dance as an **experiment**

- Say: *This eight-beat dance combination will be referred to as the **standard** in our **experiment**. We will measure all the changes we make to our dance combination against this **standard**.*
- For the ball bounce **experiment**, we measured the **dependent variable** or the height of the bounce. In our dance **controlled experiment** we will use **space** as the **independent variable**. The **dependent variable** is the **contrast** we observe. We will measure that by assigning a level of proficiency to each dance **experiment**. The **standard** eight-beat combination is proficient. A combination that shows **contrast** is advanced.
- Procedure
 - Say: *I will break you into groups and assign each group an **independent variable**. I will give you an element of **space** to change in your dance **experiment**. This change will create **contrast** that is the **dependent variable**.*
 - You will perform the **standard** combination for eight beats and then perform the **contrasting** combination for eight beats for a total of 16 beats.
 - Assign each group an element of **space** to change:
 1. Direction: perform the combination backward or sideways
 2. Pathway: perform the combination in curved or zigzag lines
 3. Relationship: walk connected to a partner; with a partner, one walks forward and one walks backward (mirroring), walk shoulder to shoulder with a partner
 4. Level: high, medium or low level
 5. Formation: perform with dancers arranged in different places: a wedge, window, V, or circle formation, etc. (see diagram #1 attached).
 - Give students three to five minutes to apply the **variable** and rehearse. Move around the room making certain that students make only one change to the **standard** combination.
 - Ask the students to sit and perform each dance combination (**standard** and with the change). Have the audience observe the change that was made.
 - Have each group perform with the same music.
 - Videotape each group
- Ask: *What did choosing and applying this **variable** (direction, pathway, relationship, level and formation) do to the **standard** dance combination? [Accept student answers. Students should say the combination looked better, different, or more interesting, etc.]*
 - Say: *The **independent variable** created a change in the dance **standard** and as a result the **dependent variable** created **contrast** in the dance.*

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

(5 minutes)

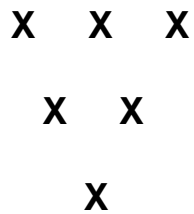
- Fill in the boxes for items 1 and 7 on "Try it Yourself Experiments: Independent and Dependent Variables" (worksheet #1)
- Respond to the following questions in student science notebooks:
 - *How did dance help me to understand the concept of **experiments** and **variables**?*

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.*)

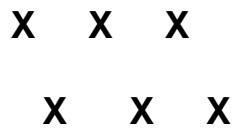
- Predict which of the changes made in the dance combination would be of most interest to an audience. Test your prediction by performing the top five combinations and give a questionnaire to the audience members. Compile and report results. Confirm or deny predictions.
- Use the supplementary material “**Try it Yourself Experiments: Independent and Dependent Variables**” for practice and familiarization with **independent** and **dependent variables**. Consider blotting out one of the columns and see if students can determine what information is missing.
- Use the “Q & A: **Variables**” handout for Further Discussion. Have students explore changing the dance combination’s intention, mood, or feeling.

Formation Diagrams

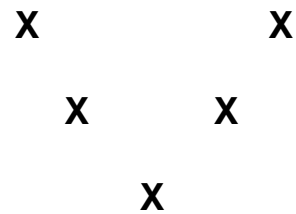
Formations can also be done inverted



1. Wedge



2. Windows



3. V Formation

Try it Yourself Experiments: Independent and Dependent Variables

Have students fill in the boxes for problems 1 and 7. As an extension, use items 2-6 as an iCheck.

Question #	Independent Variable (What I can change)	Dependent Variables (What I observe)	Controlled Variable (What I keep the same)
1. How can I create contrast in dance?			1. 2.
2. Is a classroom noisier when the teacher leaves the room?	Teacher location: either present in the room, or not.	Loudness measured in decibels	Same classroom Same students Same time of day
3. Do bicycle fenders keep the rider dry when riding through a puddle?	Fenders No fenders	The rider either gets wet or not	Same type of bike and tires Riding at the same speed Same size and depth of puddle
4. Does heating a cup of water allow it to dissolve sugar more quickly?	Temperature of the water measured in degrees Celsius	The amount of sugar, measured in grams, that dissolves in a time period.	Stirring Amount of sugar
5. Does the amount of fertilizer affect the growth of a plant?	Amount of fertilizer measured in grams	Growth in the height of the plant Growth in the number of leaves	Same type of plant Same type of fertilizer Same size pot Same soil and amount Same amount of water and light Measurements made at the same time each day
6. How does the height of a ramp affect the speed of a ball rolled down the ramp?	The height of the ramp measured in centimeters	Speed in seconds measured from start to finish	Start and finish line How the ball is released The ball The material, surface, and length of the ramp
7. How high will a ball bounce if it is dropped from a ladder at different heights?			

Answers: #1

- Independent Variable: The element of space that was changed
- Dependent Variable: Describe how the combination changed
- Controlled Variable: 1. The dance combination, and 2. the music

Answers: #7

- Independent Variable: The number of steps up the ladder
- Dependent Variable: The height of the bounce
- Controlled Variable: The place where the ball was held, the same ladder, the same person holding and dropping the ball

Q & A: Variables

Question: What's a variable?

Answer: A variable is an object, event, idea, feeling, time period, or any other type of category you are trying to measure. There are two types of variables-independent and dependent.

Question: What's an independent variable?

Answer: An independent variable is exactly what it sounds like. It is a variable that stands alone and isn't changed by the other variables you are trying to measure. For example, someone's age might be an independent variable. Other factors (such as what they eat, how much they go to school, how much television they watch) aren't going to change a person's age. In fact, when you are looking for some kind of relationship between variables you are trying to see if the independent variable causes some kind of change in the other variables, or dependent variables.

Question: What's a dependent variable?

Answer: Just like an independent variable, a dependent variable is exactly what it sounds like. It is something that depends on other factors. For example, a test score could be a dependent variable because it could change depending on several factors such as how much you studied, how much sleep you got the night before you took the test, or even how hungry you were when you took it. Usually when you are looking for a relationship between two things you are trying to find out what makes the dependent variable change the way it does.

Many people have trouble remembering which is the independent variable and which is the dependent variable. An easy way to remember is to insert the names of the two variables you are using in this sentence in the way that makes the most sense. Then you can figure out which is the independent variable and which is the dependent variable:

(Independent variable) causes a change in (Dependent Variable) and it isn't possible that (Dependent Variable) could cause a change in (Independent Variable).

For example:

(Time Spent Studying) causes a change in (Test Score) and it isn't possible that (Test Score) could cause a change in (Time Spent Studying).

We see that "Time Spent Studying" must be the independent variable and "Test Score" must be the dependent variable because the sentence doesn't make sense the other way around.