

Lesson 8 – Grade and physical activity

Overview

This lesson is about **observational studies**. In an observational study, a sample of participants or things is measured on two variables. This type of study differs from an experiment in that the independent variable is not changed. Rather, the independent variable is only observed (but we still call it an independent variable). When comparing groups, the grouping variable is the independent variable. Observational studies are widely used by scientists to gather data when manipulation is not possible. Observational studies help scientists answer questions about the world.

To learn about observational studies, UQUEST scientists will compete to see which grade has longer or faster physical reactions when doing jumping jacks, standing on one leg, and doing a reflex test. After completing the lesson, UQUEST scientists will be able to distinguish between an observational study and an experiment as well as understand the utility of a spreadsheet to record and organize data.

Science Objectives

UQUEST scientists will:

- understand the difference between an observational study and an experiment.
- use a spreadsheet to record and organize data.

Health Messages:

- Doing physical activity is a healthy and fun way to spend time.

Reinforcement of previous messages:

- Observation (Lesson 1) - We can use data that we observe to learn about our health habits.
- Hypothesis (Lesson 6) - Scientists make hypotheses

Vocabulary

- **Observational study:** A study where the independent variable cannot be changed.
- **Sample:** A sample is a group of people or things. It could be everyone that is available or it could be selected from a larger group.
- **Tally chart:** a table with tally marks

Materials

- UQUEST kit
- Tally chart laminated
- Many rulers
- Speakers for music (optional) - eye of the tiger during each of the activities

Preparation

- At UM:
 - Gather all materials
- At OYC:
 - Prepare tables

Introductory Script (~3 mins):

Welcome UQUEST scientists.

Remember the lab notebook is an important tool that scientists use to record their observations and the results of their experiments.

Let's open up your lab notebooks to the second page. Like all scientists, UQUEST scientists pay attention to the world around them. They create an environment that helps them to learn about the world. They listen to each other. They communicate with each other. And they treat each other with respect.

Let's review the values of a UQUEST scientist. Each UQUEST scientist reads OUT LOUD one value.

1. **Pay attention** when others are talking.
2. **Speak in a low voice.** Do not scream.
3. **Respect each other.** Do not push or shove each other. **Be sure to praise the students when they do well.**

Relaxation (~2 mins)

Before we begin the lesson, we'd like to start off by doing a relaxation activity. When scientists are relaxed, they do better science.

For today's relaxation activity we will practice belly breathing.

- Guide the UQUEST scientists, through some belly breathing for ~1 minute.

Instructions for UQUEST Guides

1. Introduction (~5 minutes)

- a. *Remember in lesson 7 when we changed the water temperature used in the elephant toothpaste experiment? The temperature used was the independent variable. Do you remember what was the dependent variable?*
 - i. *The dependent variable was thickness of the toothpaste.*
- b. *It was easy for us to change the temperature for the elephant toothpaste activity. But sometimes, we cannot change the independent variable. For example, if I want to know if children or adults run faster, I have to have a sample of children and a sample of adults. I cannot change a child into an adult or an adult into a child – that would be impossible! A **sample** is a group of people or things.*
- c. *An **observational study** is when the independent variable cannot be changed so different **samples**, or groups, are used at the same time. For example, we can observe all the*

children running and all the adults running and then we measure the dependent variable, or the speed. We see if children ran faster, or if adults ran faster.

- i. *If we want to compare scientists in different grades, then grade is the independent variable.*
- ii. *Today, we are comparing the older and the younger scientists on their physical activity levels.*
 1. *The independent variable is grade of the scientist: younger or older.*
 2. *The dependent variable is the number of scientists in each grade that can complete the physical activity.*

2. Activity (~15 minutes)

- a. *Today we will collect data to see if the grade of the scientist is related to physical activity levels. We are going to do three activities. We chose these exercises because doing physical activity is a healthy and fun way to spend time and it has some healthy competition.*
- b. *Record hypotheses on page 8B.*
 - i. *Which grade has more scientists that can stand on one foot for one minute?*
 - ii. *Which grade has more scientists that can grab the ruler before 15cm?*
 - iii. *Which grade has more scientists that can do jumping jacks for one minute?*
- c. *We will record our data and observations using a tally chart. A **tally chart** is a way to keep track of multiple scores at the same time.*
- d. *There are three activities we will be competing in: the younger grade vs. the older grade. The first activity is standing on one leg, the second activity is a ruler reflex test, and the third activity is doing jumping jacks.*
- e. **Stand on one leg:**
 - i. All scientists in the room stand up. Once the guide says “start” the scientists will stand on one leg only. At 1 minute, the scientists that are still standing mark a tally for “yes” and the other scientists tally “no.”
 - ii. All scientists return to their seats to record the data. The guide makes one tally mark in the appropriate square for every scientist.
- f. **Reflex ruler:**
 - i. One scientist in each group stands at a time with the guide for that group. The guide holds a ruler and the scientist has thumb and index finger prepared at the 0-centimeter mark on the ruler (see picture below). When the guide releases the ruler without warning, scientist grasps the ruler as fast as possible.
 - ii. The guide makes one tally mark in the appropriate square for every scientist. “yes” if they caught the ruler before 15 centimeters and “no” if they caught the ruler after 15 centimeters.



g. Jumping jacks:

- i. All scientists in the room stand up. Once the guide says “start” the scientists will begin jumping jacks without stopping. At 1 minute the scientists that are still doing jumping jacks mark a tally for “yes” and the other scientists tally “no.”
- ii. All scientists return to their seats to record the data. The guide makes one tally mark in the appropriate square for every scientist.

3. Documentation (~15-20 minutes)

- a. With the scientists, slowly count all the “Yes” and “No” tallies for each activity. Provide this data to the UQUEST supervisor. UQUEST Supervisor will complete the following questions:

- i. Percentage of younger grade that **did** stand on one leg for 1+ minute _____
- ii. Percentage of older grade that **did** stand on one leg for 1+ minute _____
- iii. Percentage of younger grade that **did** catch ruler before 15cm _____
- iv. Percentage of older grade that **did** catch ruler before 15cm _____
- v. Percentage of younger grade that **did** do jumping jacks for 1+ minute _____
- vi. Percentage of older grade that **did** do jumping jacks for 1+ minute _____

- b. Scientists will make 3 bar graphs

- i. *Okay everyone, now that the supervisor has returned the results to us, we will document them using a bar graph to see which grade had more scientists completing the physical activity.*

- ii. *Let’s look at the first graph on page 8C.*

1. *The title is: Which grade had more scientists that stood on one foot for one minute?*
2. *The Y axis is: Percentage of scientists*
 - a. *A percent is a part of a whole. If there are 6 kids, and 6 of them are wearing shoes, then 100% of the kids are wearing shoes. 100% means everyone did it. 0% means nobody did it.*
3. *The X axis is: Grade level*
4. *Ok, ____% of younger graders stood on one leg for one minute. Make a bar for the young grade that reaches the ____ on the y axis.*
5. *____% of older graders stood on one leg for one minute. Make a bar for the older grade that reaches the ____ on the y axis.*

- iii. *Let’s look at the second graph on page 8D.*

1. *The title is: Which grade had more scientists that grabbed the ruler before 15cm?*
 2. *Ok, ____% of younger graders caught the ruler before 15cm. Make a bar for the young grade that reaches the ____ on the y axis.*
 3. *____% of older graders caught the ruler before 15cm. Make a bar for the older grade that reaches the ____ on the y axis.*
 - iv. *Okay let's look at the third and final graph on page 8D.*
 1. *The title is: Which grade had more scientists that did jumping jacks for one minute?*
 2. *Ok, ____% of younger graders did jumping jacks for one minute. Make a bar for the younger grade that reaches the ____ on the y axis.*
 3. *____% of older graders did jumping jacks for one minute. Make a bar for the older grade that reaches the ____ on the y axis.*
 - c. *Let's go one activity at a time and determine the final outcome:*
 - i. *For standing on one leg, which grade got a higher bar?*
 1. *Okay circle that bar on your bar graph.*
 2. *Were your hypotheses on page 8B supported?*
 - ii. *For catching the ruler fast, which grade got a higher bar?*
 1. *Okay circle that bar on your bar graph.*
 2. *Were your hypotheses on page 8B supported?*
 - iii. *For jumping jacks, which grade got a higher bar?*
 1. *Okay circle that bar on your bar graph.*
 2. *Were your hypotheses on page 8B supported?*
- 4. Discussion (~10 minutes)**
- a. *Now let's discuss what we did today. I will ask some questions, and if you answer, you get a sticker. At the end, the stickers can be traded in for a special prize. Let's GO!*
 - i. **Award sticker for every question answered.**
 - ii. **Note:** below are example questions. You can ask additional questions not listed.
 - b. **What is an independent variable?**
 - i. *Variable that we change.*
 - c. **What was the independent variable of our quest today?**
 - i. *The grade of the scientist: younger or older*
 - d. **What is a dependent variable?**
 - i. *The variable that we observe after changing the independent variable.*
 - e. **What was the dependent variable of our quest today?**
 - i. *The number of scientists in each grade that can complete the physical activity specifically, standing on one leg, catching a ruler fast, and jumping jacks.*
 - f. **What is an observational study?**
 - i. *A study where the independent variable cannot be changed*
 - g. **Why was today's study an observational study?**

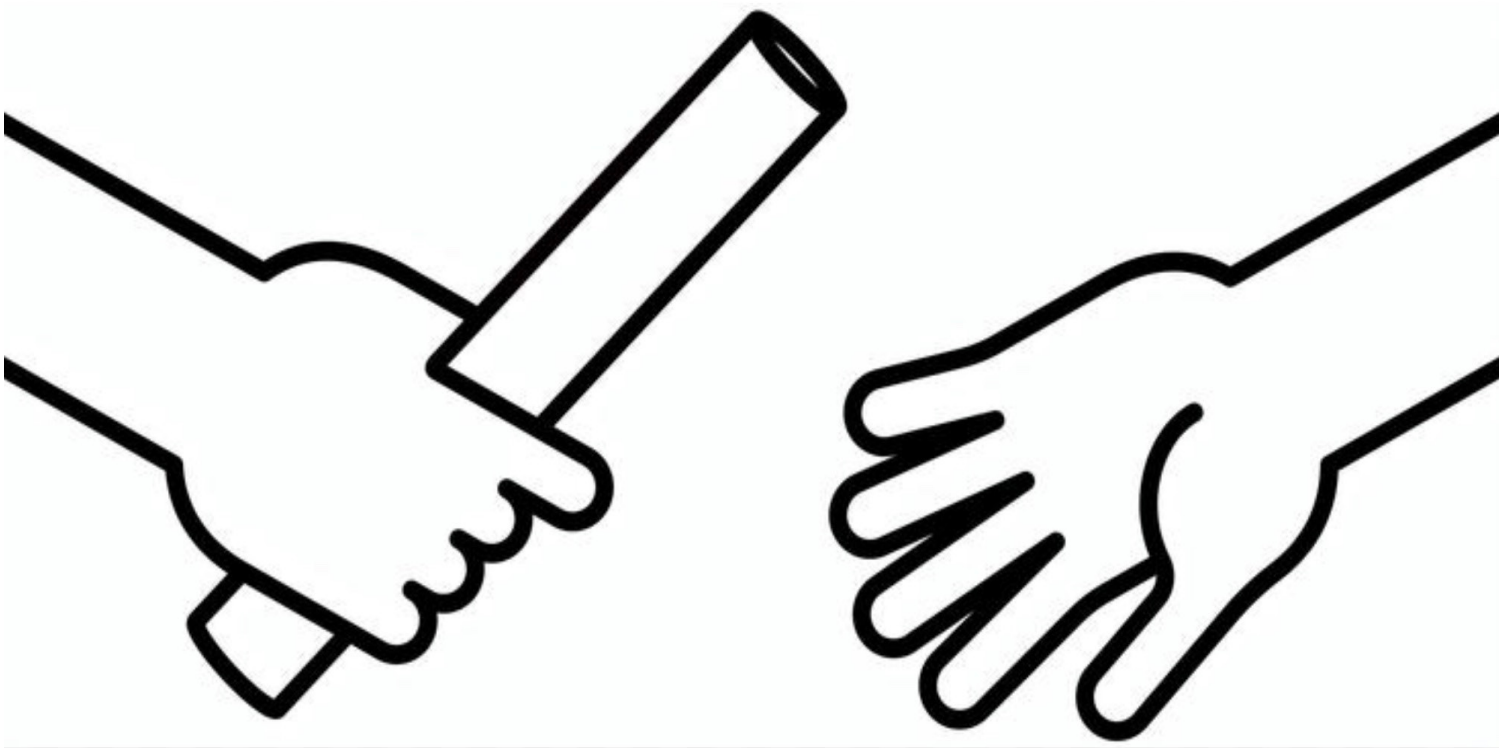
- i. *Because we did not change the independent variable, or the grade. Instead, we sampled younger grades and older grades. It is impossible to change someone's grade.*
- h. What is the difference between an observational study and an experimental study?**
 - i. *In observational, we don't change the independent variable. In an experimental study, like with elephant toothpaste, we change the independent variable, like the temperature of the water.*
- i. In today's quest, who were the people in the sample that we studied?**
 - i. *You were! Anyone who participated in the three activities made up the sample.*
- j. What grade can do jumping jacks longer? Younger or older grade?**
- k. What grade can stand on one leg longer? Younger or older grade?**
- l. What grade has faster reflexes and can hold the ruler faster? Younger or older grade?**

Wrap up:

- m. *What did you learn today? Write that down on the lines on page 8E.*
- n. *How much did you like today's lesson on scale from strongly agree to strongly disagree.*
- o. Award prize at the end based on number of stickers.**

Lesson 8

Grade and physical activity



Date: _____

Hypotheses

Instructions: Circle your hypotheses.

Which grade has more scientists that can stand on one foot for one minute?
Circle one.

Younger grade



Older grade

Which grade has more scientists that can grab the ruler before 15cm?
Circle one.

Younger grade



Older grade

Which grade has more scientists that can do jumping jacks for one minute?
Circle one.

Younger grade



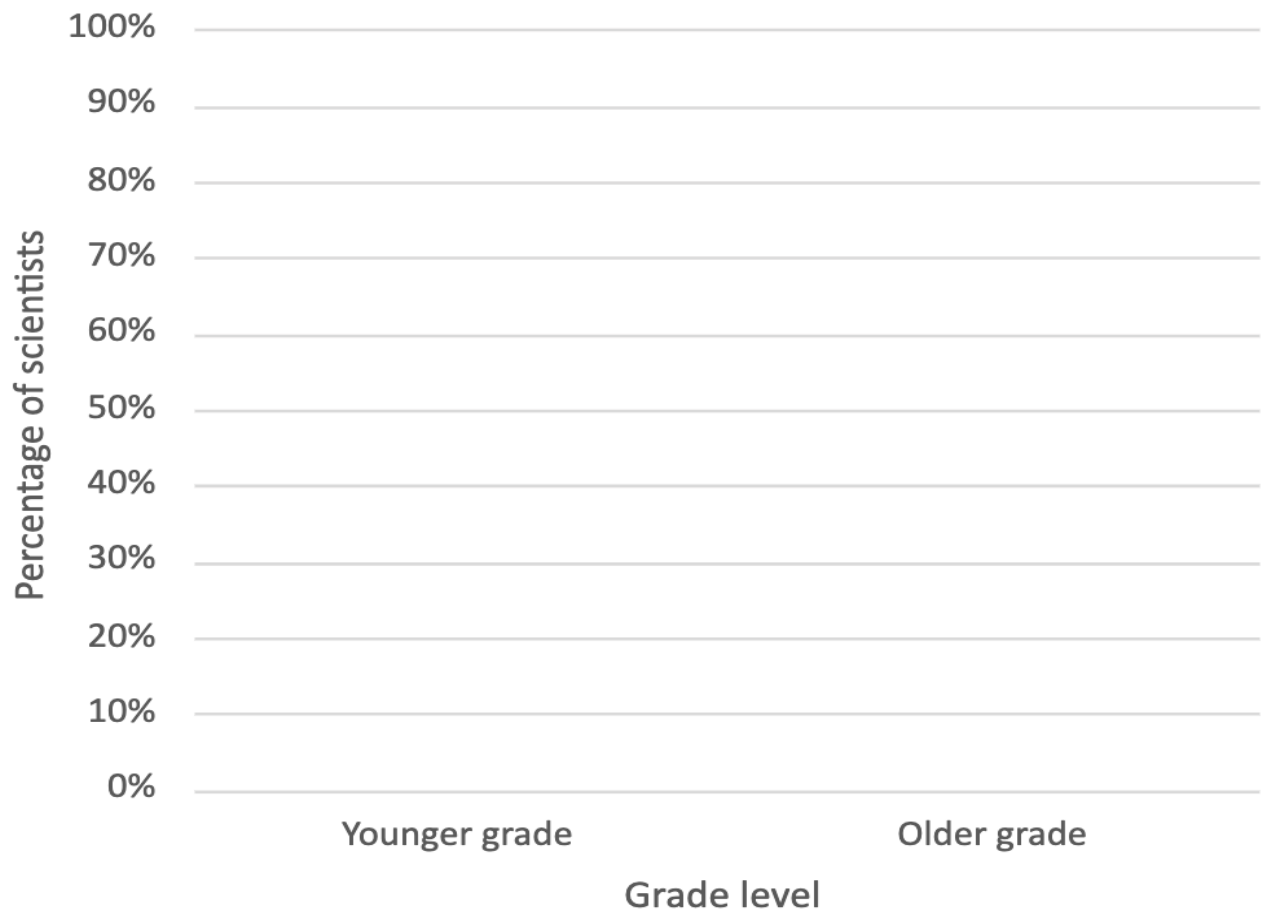
Older grade

Date: _____

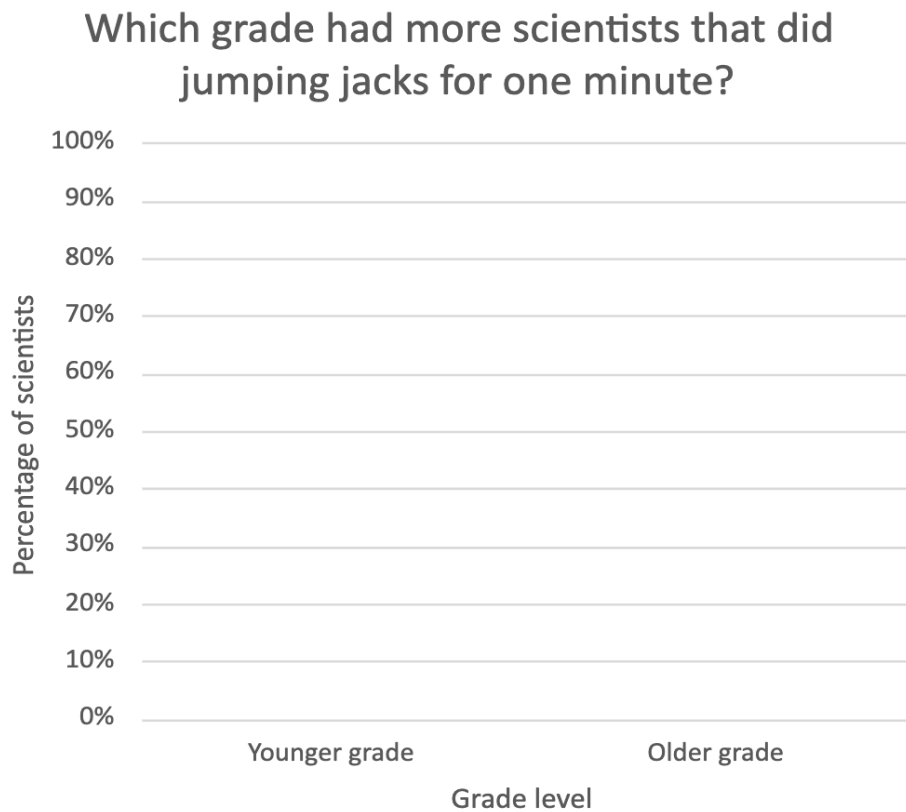
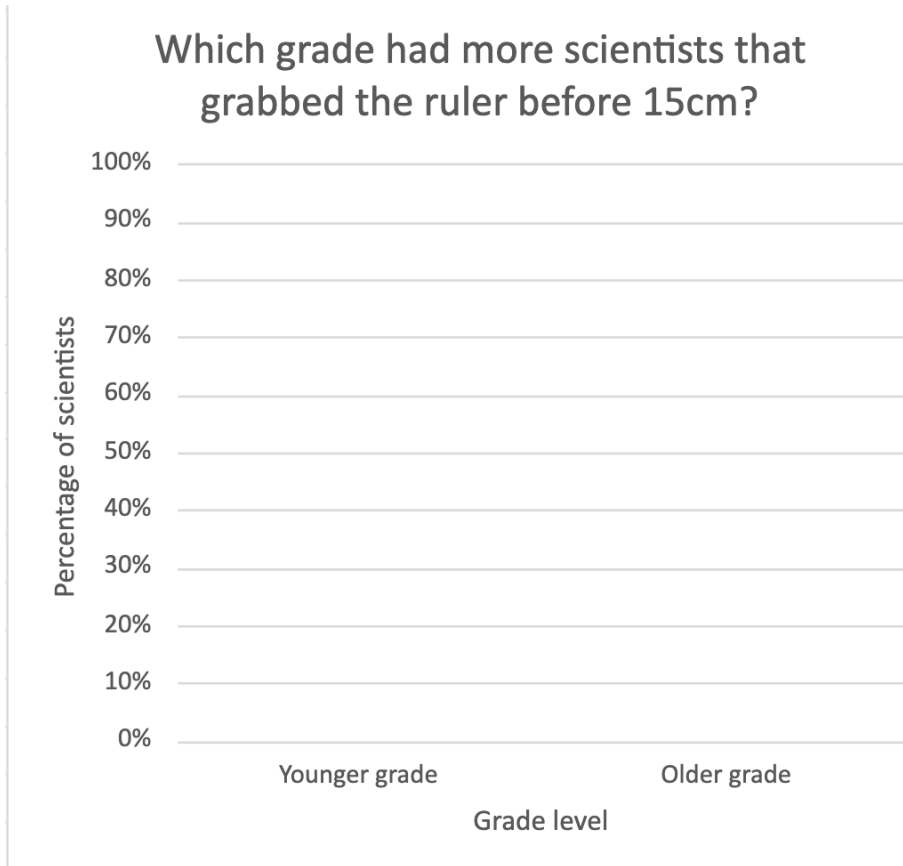
Graphing



Which grade had more scientists that stood on one foot for one minute?



Date: _____



Date: _____

Lesson 8

What did I learn today?

I liked this lesson (circle one):

**Strongly
Agree**



Agree



Disagree



**Strongly
Disagree**

