Lesson 15 – Repeat After Me

Overview

This lesson is about **replication**. In research, when we repeat an experiment or observational study to see whether results are the same, we call that replication. There are two types of replications: **direct** replication and **systematic** replication. Direct replication involves repeating an experiment or observational study in exactly the same way. Systematic replication involves repeating an experiment or observational study but changing a few parts for the purpose of testing whether the change makes a difference in the results. This practice is important because scientists replicate their research to strengthen the evidence for their findings and generalize across populations, time, or situations.

UQUEST scientists will learn about replication by systematically replicating an earlier experiment. Previously, scientists made their own glow-in-the-dark glitter slime. In this systematic replication, UQUEST scientists will make fluffy slime with different ingredients. Scientists will learn how different ingredients can change the texture, viscosity. After completing the lesson, UQUEST scientists will understand that replicating an experiment is important to generalize results.

Science Objectives:
UQUEST scientists will…

- Understand what it means to replicate an experiment.
- Understand why replication is important.

Health Messages:

- Squeezing/squishing slime can help reduce tension and manage stress.

Reinforcement of previous messages:

- Measurement (Lesson 5) - We can use tools like scales to measure the weight of an object.
- Hypothesis (Lesson 6) - Replication can add or remove support for our original hypothesis.
- Experimentation (Lesson 7) - Replication can also involve changing one variable in an experiment.

Vocabulary

Science Vocabulary

- **Replication** – the process of repeating a study to support results
- **Direct replication** – when an experiment or study is repeated in the exact same way
- **Systematic replication** – when an experiment or study is repeated but a specific variable is changed

Materials

- UQUEST Kit
- Elmer's glue
- Baking soda
- Contact solution (Renu fresh)
- Water
- Shaving cream
- Food coloring
- Bowls
- Normal spoons
- Measuring spoons
- Ziploc bags
- Wipes
- crayons

Preparation

- At UM:
  - Gather correct quantities of all necessary materials
  - Add food coloring to the water bottles

- At OYC:
  - Place ingredients on each group's table

Introductory Script:

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. E*ach 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

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

Question Formulation Technique (~5 mins)

a. Question focus
   i. *Hi everyone! To start off our Quest for today, we are going to play the question game. The question game has 4 rules. I will say each rule and ask you to repeat after me.*
      1. *First rule is: ask many questions*
         a. *Everyone repeat after me: "Ask many questions."*
      2. *Second: do not discuss or answer questions.*
         a. *Repeat after me: "Do not discuss or answer questions."*
      3. *Third: take turns asking questions*
         a. *Repeat after me: "Take turns asking questions."*
      4. *Fourth: change statements into questions*
         a. *Repeat after me: "Change statements into questions."*
   ii. *Alright, is everyone ready to play?*
   iii. **Show image below:**
   1.

b. *Now, I would like to know all of your questions. When you have a question raise your hand and I will call on you. Please state your question slowly so I can write it down exactly how you said it.*
   i. **Set a timer for approximately 5 minutes**
   ii. **REMEMBER the rules for the scribe/guide:**

1. **Write questions word for word, numbered, and (in discussion only), with scientist initials**
2. **Monitor student adherence to the process**
3. **Do not give examples**
4. **Do not get pulled into group discussion**
5. **Acknowledge all contributions equally: "thank you"**

c. *Thank you for all your questions! We will go back to your questions at the end of the day today. Think if you can answer these questions as we go through the activity.*

1. **Introduction**

a. *You've probably heard that practice makes perfect? Well, the same applies to science! Sometimes we need to do experiments many times so we can be sure about our conclusions.*

b. *By repeating, or **replicating**, an experiment many times, we can be sure of our results.*

i. *Who knows Serena Williams?*

1. **Note: you can provide example of other athletes too**

ii. *When Serena Williams won the Grand Slam title in the US Open (tennis competition) for the first time in 1999, would you say that she was the greatest tennis player in the world?*

1. *She beat the rest of the best tennis players in the world by winning the competition.*

iii. *Before we make that decision, we may want to see if she won more than once.*

iv. *Well, Serena Williams won over and over, at many tennis competitions. In total she won 23 grand slam singles titles.*

1. *Serena's wins were replicated many times!*
2. *Because she won on different days and in different competitions, we can be more confident that she won because she was the best tennis player in the world and not just because of luck.*

c. *In science, we must have many repetitions, or replications, to be confident that our results are real, and not just a coincidence or that it happened by chance.*

d. *We can repeat the experiment in exactly the same way. This is called **direct replication**.*

e. *We can also repeat the experiment but change one thing.*

i. *For example, we can change a variable.*

f. *When we change one part of the experiment, but still test the same hypothesis, we call that **systematic replication**.*

i. *It is important to change only one variable to test the effect that it has on our results.*

2. **Activity**

<u>Direct Replication</u>

a. *First, we will do a direct replication of our slime experiment where we mixed several ingredients to make glow-in-the dark glitter slime.*

b. *We will use the same ingredients and follow the same instructions as the first time we made slime together.*
    i. *This is why this experiment is a direct replication – we're repeating the experiment in exactly the same way.*
c. **Each team will first make ONE original slime as a group (without shaving cream).**
d. **Slime Instructions (original slime)**
    i. *First get a bowl and a spoon to mix your slime ingredients in*
    ii. *Pour 3 tablespoons of Elmer's glue into the bowl*
    iii. *Add ⅛ teaspoon of baking soda*
    iv. *Add food coloring to 1 tablespoon of water. Add water.*
    v. *Mix the ingredients thoroughly with the spoon until the water is mixed completely with the glue*
    vi. *Add the 3 teaspoons (or ½ tablespoon) of contact solution and mix with a spoon until the slime begins to form. Add a little more if too sticky.*
    vii. *Once the slime has some formation, use your hands to knead and stretch the slime to make it less sticky.*
    viii. *Add small amounts of contact solution (about ¼ or ½ a teaspoon) if the slime is still too sticky (be careful to not add too much or it will turn hard)*
e. Discuss direct replication
    i. *Direct replication helps scientists be more confident in their hypotheses and results.*

<u>Systematic Replication</u>

f. *Next, we will do a systematic replication of our slime experiment where we mixed several ingredients to make glow-in-the dark glitter slime.*
g. *We will once again mix glue, water, baking soda, and contact solution to make slime, BUT we will change some things.*
    i. *Instead of making glitter slime, we will add a special ingredient to see how it changes the texture of the slime. And we will use white glue instead of glitter glue.*
    ii. *This is why this experiment is a systematic replication. We are changing a specific variable.*
h. *When we do a systematic replication of an experiment, it is important that we try to keep everything the same as the original experiment, except changing a variable so that we can see if that change affects our results.*
    i. *Today we will test how adding shaving cream to our slime affects the texture.*
    ii. *We want to understand how important this one variable (i.e., whether or not we add shaving cream to our slime) is.*
i. *In our experiment, we have an independent variable and a dependent variable.*
j. *Remember the independent variable is the variable we choose to manipulate (or change) in order to affect another variable. So, in this experiment, which variable will we choose to manipulate in order to affect another variable?*
    i. *We manipulate whether or not we add shaving cream to the slime! So, that is the independent variable because we manipulated it.*

k. *And the dependent variable is the result that we are measuring. What will be the result that we are measuring?*
    i. *The fluffiness of the slime (scale of 1-5) is the dependent variable! Because the fluffiness of the slime will DEPEND on the special ingredient, shaving cream.*
l. *Let's come up with a hypothesis.*
    i. *How would you describe the texture of shaving cream? What does it feel like?*
        1. **Example: foamy, creamy, or fluffy**
    ii. *How do you think adding shaving cream to slime would affect the texture? How fluffy would the slime feel?*
    iii. *Who has a hypothesis that they would like to share?*
    iv. **Example**: *My hypothesis is that the shaving cream will make the slime very fluffy (**5** on 1-5 scale).*
m. **Each scientists will their own slime individually (with shaving cream).**
n. **Slime Instructions (slime with shaving cream)**
    i. *Get another bowl and spoon to mix your slime ingredients in*
    ii. *Pour 3 tablespoons of Elmer's glue into the bowl*
    iii. *Add ⅛ teaspoon of baking soda*
    iv. *Add 1 tablespoon of pre-colored water.*
    v. *Mix the ingredients thoroughly with the spoon until the water is mixed completely with the glue*
    vi. Add 1/2 cup shaving cream and mix
    vii. *Add the 3 teaspoons (or ½ tablespoon) of contact solution and mix with a spoon until the slime begins to form. Add a little more if too sticky.*
    viii. *Once the slime has some formation, use your hands to knead and stretch the slime to make it less sticky.*
    ix. *Add small amounts of contact solution (about ¼ or ½ a teaspoon) if the slime is still too sticky (be careful to not add too much or it will turn hard).*
o. Discuss systematic replication
    i. *Systematic replication can help scientists figure out if changing a variable in their experiment produces the same or different results.*
p. Complete lab notebook page 15B
    i. *On page 15B of your lab notebook, rate the fluffiness (from 1 to 5) of each slime. Then, circle whether the slime with or without shaving cream made the slime more fluffy.*
q. **Clean up materials**

<u>Stress and Relaxation</u>

r. **Introduce the scientists to the topic of stress. Let them know that we've all had times when our bodies react to stress and we can feel it.**
    i. *Stress is the sensation also known as "flight or fight." Our bodies' natural way of coping with being frightened or challenged is to release certain chemicals into our bloodstream that provide extra short-term energy and alertness. Our instincts take*

over and "tell" us that we are facing danger and we either need to defend ourselves (fight) or get away (flight).

s. **Example:** *if you found yourself face to face with a bear in the woods your brain and entire body would get into "fight or flight" mode. This means that your brain is sending a message that you either must run away as fast as you can or stand and fight. You are feeling frightened, anxious and on alert. You know you're in danger and this response is healthy and needed to escape harm. Once you get away from the bear you can calm down.*

t. *When we fight, we confront the thing that is making us stressed.*

u. *While flight means that we remove ourselves from the situation.*

v. **Ask for a few descriptions of what stress looks and feels like.**
   i. *Where in your body do you typically feel stress?*
      1. **Examples:** *heart pounds faster, hands feel sweaty and cold, face flushes (gets hot and red), "butterflies" in your stomach, dry mouth*

w. **Then explain that when this happens the options for what a person can do to respond become very limited because instinct takes over and we lose our ability to fully use the part of our brains that makes rational decisions.**
   i. *Fortunately, by understanding what triggers our "fight or flight" reaction and learning skills to deal with it, we can learn to prevent some stress responses and calm ourselves down from those that do happen.*

x. **Introduce the slime as a way to help deal with stress.**
   i. *Squeezing the slime in your hand helps reduce tension throughout your body. It may be even more effective if you pay attention to your breath as you squeeze: breathe in as you squeeze the slime, breathe out as you relax your hand.*

y. *We're now going to do a relaxation activity with your slime.*

z. **UQUEST guide will guide scientists through a mindfulness exercise using the script below**
   i. **Note: The exercise will be done altogether as a class**

aa. Mindfulness Script (5 min)

bb. ***Introduction***
   i. *Sit down and get comfortable. Close your eyes. Try to make sure your feet, legs, hands, and arms are relaxed. Squeeze and move the slime in your hands as I talk.*
   ii. *Imagine a bucket of slime. This slime is your favorite color. It also smells really good. See yourself putting your hands in the slime. What does it feel like? Squishy? Sticky? Slippery? What does it look like? Is it glittery? Does it have anything inside of it?*
   iii. *Now, imagine that this is a special puddle of slime that can harden, and become a stiff block. When you take a deep breath in and hold it, the slime turns into the block. When you breath out and count to 4, it slowly turns back into slime. Let's practice. Take a deep breath in and hold (pause), and let the breath out 1, 2, 3, 4. Now, your slime should be a puddle.*

cc. ***Legs and feet***
   i. *First, focus on your legs and feet. Take a deep breath in and curl your toes and tense your foot. Hold your breath. Now, breathe out and let your feet and toes slowly melt into slime – 1, 2, 3, 4. Your legs are now two big, relaxed puddles of slime.*

dd. ***Arms and hands***

i. *Focus on your arms and hands. Take a deep breath and make a fist with both hands. Squeeze and tighten your arms so they are very stiff. (pause). Now, slowly count to 4 in your head and relax your hands. Now let them relax and let them turn into slime– 1, 2, 3, 4. Your fingers, hands, and arms are all completely relaxed.*

ee. ***Shoulders and neck***

i. *Now focus on your shoulders and neck. Breathe in. Pull your shoulders up to your ears (like you're shrugging "I don't know") and squeeze. Now let them relax and let them turn into slime while counting to 4 in your head. (pause)*

ff. ***Wrap up***

i. *Your whole body should be a puddle of slime right now. All of your muscles should be relaxed.*

ii. *Now, on the count of 10, imagine the slime leaving your body so that your hands, feet, arms, legs, shoulders, and neck all go back to normal. They should not be as stiff as the block of slime, but not as gooey as the melted slime. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.*

iii. *Any time you feel stressed or tense, remember that you can turn that part of your body back into slime by taking a deep breath holding it, and then slowly counting to 4 until you feel relaxed.*

3. **Documentation**

a. *Now we're going to create a bar graph to present our data on the difference in fluffiness between the two slimes.*

b. **Instruct scientists to turn to page 15C of lab notebooks.**

c. **<u>Note:</u> Graph will be done individually on lab notebook because data will differ by scientist.**

d. **Review title, horizontal and vertical axes, and their respective labels**

i. **Title:** How does adding shaving cream affect the fluffiness of our slime?

ii. **X axis:** "no shaving cream and shaving cream."

iii. **Y axis:** "fluffiness of slime"

e. **Complete graph**

i. *Find the number on the Y or vertical axis that represents the level of fluffiness (1-5) for the slime without shaving cream. Remember you wrote down this number earlier in your lab notebooks.*

ii. **Repeat for slime with shaving cream**

f. **Analyze graph**

i. *Which bar is taller? What does that mean?*

4. **Discussion (~10 mins)**

a. Let's do a quick recap before our next question game:

b. *Today the health message was: "*Squeezing/squishing slime can help reduce tension and manage stress.*"*

c. *The science concept was: "i*n science, when we repeat an experiment or observational study to see whether results are the same, we call that replication.*"*

d. *Now that we have finished our activity, we are going to play the question game AGAIN! As a reminder, the question game has 4 rules. (Show rules poster).*
e. *Alright, is everyone ready to play?! If you had any questions during the activity, now is a great time to raise your hand and ask. I want to know what questions you have about this picture that are related to the science concept or health message* **(even if they ask non-science or health questions, still write it down and provide a sticker)**
f. **Encourage questions that are related to the science concept -- "could you try to ask a question a little bit more related to the activity or to science?"**
g. Set a timer for approximately 5 minutes
h. **Select 2-3 questions from either the beginning or end of the lesson that you can answer (that are relevant to the lesson)** and answer them with the scientists.
i. **Before answering, see if they can answer.**

Wrap-up

a. *What did you learn today? Write that down on the lines on page 15D.*
b. *How much did you like today's lesson on scale from strongly agree to strongly disagree.*
c. **Award prize at the end based on number of stickers.**

References

https://www.thebestideasforkids.com/fluffy-slime-recipe/

Lesson 15
Repeat After Me

Doodle Art Alley ©

Date: _____

Results

Rate the fluffiness of the slime on a scale of 1-5 when we did NOT use shaving cream. Circle a number:

1 2 3 4 5

Not fluffy Very fluffy

Rate the fluffiness of the slime on a scale of 1-5 when we DID use shaving cream. Circle a number:

1 2 3 4 5

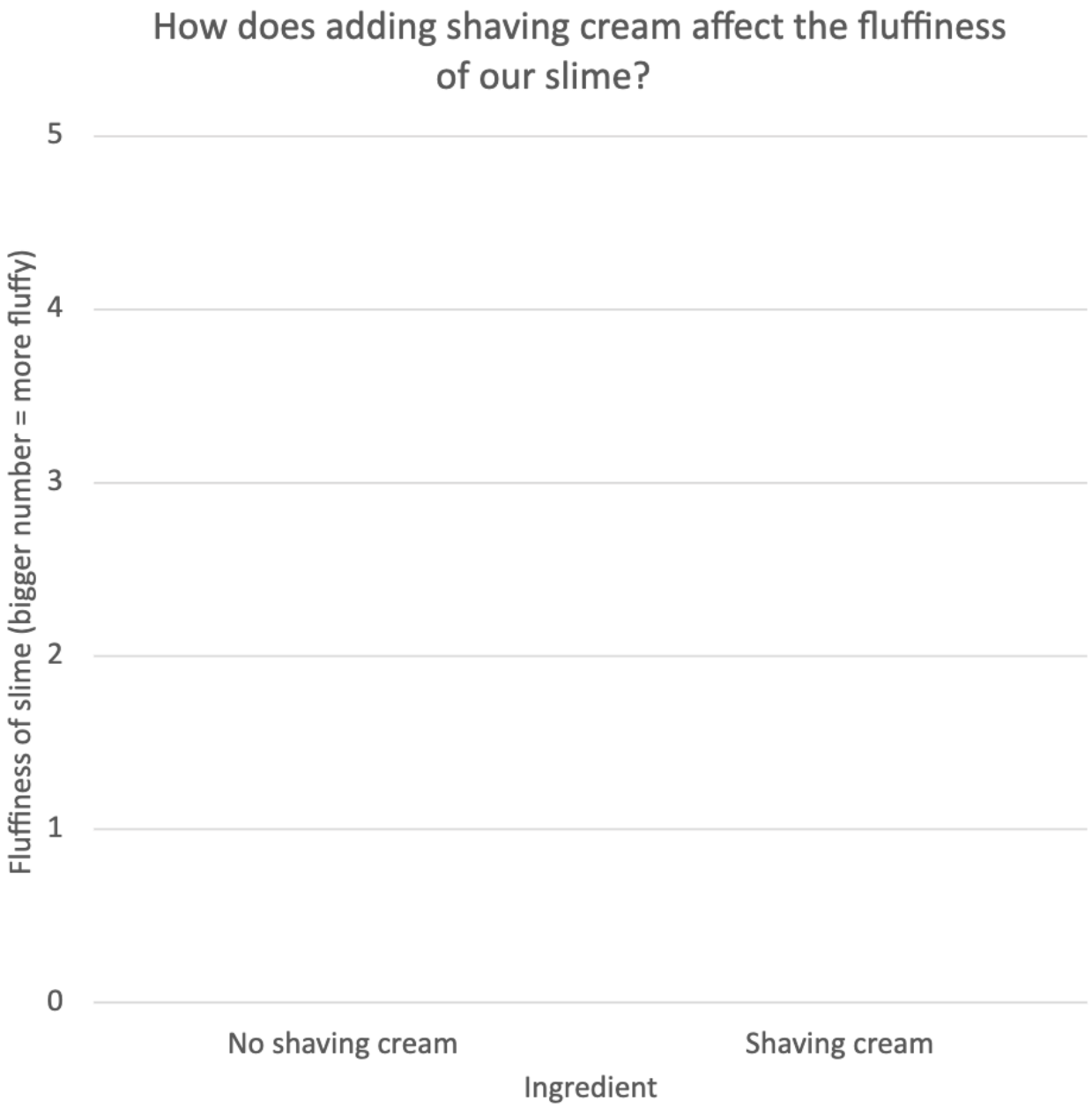
Not fluffy Very fluffy

Was the slime fluffier when we used shaving cream or when we did not? Circle one:

No shaving cream Shaving cream

Date: _____

Graphing



Date: _____

Lesson 15

What did I learn today?

_____

_____

_____

I liked this lesson (circle one):

Strongly Agree	Agree	Disagree	Strongly Disagree

Question Game Rules

1. Ask many questions about the lesson
2. Do not discuss or answer questions
3. Take turns asking questions
4. Change statements into questions

<u>DON'T FORGET YOUR QUESTION WORDS!</u>

WHO? WHAT? WHERE?

WHEN? WHY? HOW?

Butter
Icee
Jelly
DYI Clay
Cloud
Crunchy