



Germination Research

Middle School Food and Agricultural Literacy Curriculum

Precepts

- D. Character
- D4. Respect others

National Standards

- CS.11.01.01.b. Design an experiment to test a hypothesis.
- CS.11.02.01.b. Implement an experimental design to test a formulated hypothesis.
- PS.03.01.02.c. Conduct tests associated with seed germination rates, viability and vigor.
- PS.03.02.04.a. Observe and record environmental conditions during the germination, growth and development of a crop.
- NL-ENG.K-12.5 – Communication Strategies
- NS.5-8.1 – Science as Inquiry
- NS.5-8.3 – Life Science

Student Learning Objectives

- As a result of this **unit** the students will...
- Discuss agricultural research.
- As a result of this **lesson** the students will ...
- Apply research methods to investigate an agricultural problem.

Content Outline

- I. **Apply research methods to address an agricultural problem.**
 - A. Discuss factors which affect the amount of time it takes a seed to germinate. Germination: when a sprout is seen coming out of a seed.
 - B. Students will perform a mini experiment involving the steps of the scientific theory.
 1. Tape a cotton ball containing two seeds to the inside of a plastic cup.
 2. Place another cup inside the first to further secure the seeds.
 3. Tape the inside cup in place.
 4. Use a dropper to add liquid as needed.

Time

Instruction time for this lesson: 45 minutes

Resources

National FFA Organization. (2009). LifeKnowledge Online. Retrieved July 9, 2009, from — <http://agedlearning.org> — National FFA Organization. (2003). LifeKnowledge Precepts and Signs of Success. — Saunders, Walter L. (2003). Integrated Science Program, Utah State University. Retrieved August 20, 2009, from Exploration, Invention, Expansion Learning Cycle, Student Centered Labs for Middle School Science. Web site: http://books.google.com/books?id=p8ji6YAHrf4C&pg=PA13&lpg=PA13&dq=middle+school+seed+germination+lab&source=bl&ots=MUKXKeib2z&sig=I_FCGlqoGwaxvedvaz7cMCQlhCA&hl=en&ei=xyCKSuPAElWesgOij_3KDQ&sa=X&oi=book_result&ct=result&resnum=7#v=onepage&q=&f=false

Tools, Equipment, and Supplies

Overhead projector/transparencies
Clear plastic cups
Cotton balls
Pea seeds
Bean seeds
Radish seeds
Corn seeds
Water droppers
Thermometers
Various fluids
Various lights (grow light, incandescent, fluorescent, halogen)
MS.AST.2.6.TM.A – one per teacher
MS.AST.2.6.TM.B – one per teacher
MS.AST.2.6.TM.C – one per teacher
MS.AST.2.6.TM.D – one per teacher
MS.AST.2.6.ASSESS.A – one per student

Key Terms

Germination

5. Make observations each day.
- C. Incorporate the five steps of the Scientific Method when writing your nursery rhyme.
 1. Five Steps of the Scientific Method
 - a. Observation
 - b. Question
 - c. Hypothesis
 - d. Test
 - e. Conclusion



Lesson Number: MS.AST.2.6

Middle School Food and Agricultural Literacy Curriculum

Germination Research

Interest Approach

Welcome students to class and introduce today's lesson with a short story that ties in the first three steps of the scientific method.

Thank you for coming to class on time today. We have a fun lab planned that is going to have you applying the scientific method and growing plants. Let's get our minds focused. Here we go.

Think about a dying house plant. As you observed this yellowish/brown and wilted plant you might have started to ask questions: How did it become wilted? What caused it to turn brown? Your family members may have wondered the same thing. As you observed this gloomy-looking plant, your questions became a hypothesis for why the plant is dying. This is the simple start to what process?

Elicit student responses.

Correct! The scientific method.

Summary of Content and Teaching Strategies

Objective 1: Apply research methods to investigate an agricultural problem.

Utilize **MS.AST.2.6.TM.A** for students to capture the definition of germination in their notes.

Today, we are going to be conducting the first few steps of the scientific method while carrying out a seed **germination** lab. First, we must know what **germination** is. Please capture this definition in your notes.

A. Germination: when a sprout is seen coming out of a seed.

When a seed is planted, the goal is for it to sprout and grow into a plant. However, there are many things that can either stop or enhance the sprouting of a seed. Let's look at some different types of seeds.

Lay out five to ten different seeds on a display table or pass them around for students to observe. Pictures of seeds could be used in place of real seeds.

When I say GO, write down three to five observations about the seeds. They may be individual observations or comparable. Be prepared to share your observations with the class. We will have one minute to do this. Questions? GO.

Very good. Let's share our observations.

Students' observations may include seed size, shape, color, texture, etc.

After many observations of different types of seeds, we must pose a question. Before we do this, let's review. We all have the same goal for a seed. From our previous discussion in the lesson, can you tell me what that goal is?

Elicit student responses.

Excellent. We want the seed to sprout. The question we are asking today is, "What factors affect the amount of time it takes for a seed to germinate?"

Display **MS.AST.2.6.TM.B** for students to write down. Start a classroom discussion that evaluates what factors affect seed germination rate. Ask questions such as: What factors make a seed germinate? What would stop a seed from germinating? What is the ideal condition for a seed to germinate the quickest?

Utilize **MS.AST.2.6.TM.C** for student notes.

Now that we understand the definition of **germination**, have a goal for our plant, and a question in place, let's discuss what factors may influence the time it takes for a seed to germinate.

1. Amount of light
2. Temperature
3. Type of moisture applied
4. Type of seed
5. Time of day planting occurred
6. Orientation of seed
7. Type of gas exposed to the seed (i.e. carbon dioxide, oxygen)

So far, we have observed seeds and asked a question. Who can guess what our next step is in the scientific method?

Elicit student responses.



Lesson Number: MS.AST.2.6

Middle School Food and Agricultural Literacy Curriculum

Germination Research

Excellent! Create a hypothesis. Remember a hypothesis is an educated guess.

When I say GO, create a hypothesis about seed germination. What is your educated guess about seed germination? Utilize the knowledge we learned in our discussion. Remember that a hypothesis must be in the form of a question. We have three minutes to complete this task. What questions do you have? GO.

After students create a hypothesis, have them follow the steps on **MS.AST.2.6.TM.C** to start their lab. It is best if students are able to plant their seeds on a Monday so they have 24-hour intervals to watch their seeds germinate.

Very good. We will now make a test for our hypotheses. Although everyone's hypothesis may be slightly different, we will need to complete the first three basic steps of the procedure. When I say GO, retrieve your lab materials from the display table and return to your seat. Next, follow steps one through five that are listed on the overhead, or modify these steps based on your hypothesis. If your hypothesis is that your seed will germinate best totally submerged in water, then do so in your procedure.

Procedure:

1. Tape a cotton ball containing two seeds to the inside of a plastic cup.
2. Place another cup inside the first to further secure the seeds.
3. Tape the inside cup in place.
4. Use a dropper to add liquid as needed.
5. Make observations each day.

Students should modify their procedure depending on the factors they chose to influence their hypothesis.

Fantastic job! I am impressed with how well each of you did at following the directions and steps correctly.

Review/Summary

Utilize the *Mother Goose e-Moment*®.

Thinking back to when you were a kid, what was your favorite Mother Goose rhyme?

Elicit student responses.

Great. Today we are going to create our own nursery rhyme with the use of our knowledge about the scientific method. When I say CREATE, re-write the words with your newly learned knowledge about the scientific method to the rhyme of "Mary Had a Little Lamb."

Display **MS.AST.2.6.TM.D**.

Be sure that your rhyme has a title and includes all five steps of the Scientific Method. Any group who shares their rhyme with the class at the end will receive bonus points. We will have five minutes to write our rhymes in pairs or trios. What questions do you have? CREATE!

Time's up! Now before we go any further, there is one simple rule we must all know. When you are asked to get up in front of the class and speak, it's important that everyone be respectful. What does it mean to be respectful?

Elicit student responses.

Good job. It means to be quiet, to listen, and not to be mean, hurtful, or rude to others. When are times that you should be respectful?

Student responses may include when others are speaking, when the teacher is speaking, when working with others, etc.

Why do we show respect to others?

Students may respond that we should be helpful, that kindness is a courtesy, and that we can expect to receive the same treatment in return.

Good answers. Today as groups get up and present their rhymes, remember why we respect people and respect your classmates.

Let's hear your rhymes!

If student groups are unwilling to share, be sure to have an example to show your own involvement. Remind students that this will be turned in for a grade.

Those rhymes were great. Thanks for sharing. Now that you have these rhymes, you can use them to help you remember the steps of the scientific method and how to use it.



Lesson Number: MS.AST.2.6

Middle School Food and Agricultural Literacy Curriculum

Germination Research

Application

Extended Classroom Activity:

Take students out to the greenhouse and have them work on planting seeds of bedding plants for the FFA greenhouse plant sale.

Or create a magnet (size of business card) with the scientific method on it that they can turn into a magnet to place in lockers.

FFA Activity:

Introduce students to the agriscience CDE and what opportunities there are for students interested in this topic.

SAE Activity:

Students could pursue an exploratory SAE project investigating an agriculture question and create an agriscience project.

Evaluation

MS.AST.2.6.ASSESS.A

Answers to Evaluation

1. D
2. A
3. B
4. C
5. B



Definition

A. Germination: when a sprout is seen coming out of a seed.



Question:

**“What factors affect the
amount of time it takes
for a seed to germinate?”**



Laboratory Steps and Set-Up

Procedure:

- 1. Tape a cotton ball containing two seeds to the inside of a plastic cup.**
- 2. Place another cup inside the first to further secure the seeds.**
- 3. Tape the inside cup in place.**
- 4. Use a dropper to add liquid as needed.**
- 5. Make observations each day.**



Incorporate the five steps of the Scientific Method when writing your nursery rhyme.

Five Steps of the Scientific Method

- 1. Observation**
- 2. Question**
- 3. Hypothesis**
- 4. Test**
- 5. Conclusion**



Multiple Choice Quiz

Name: _____

Directions: circle the correct answer.

1. **Which answers best represent observations of a seed?**
 - a. Shape
 - b. Size
 - c. Color
 - d. All of the above
2. **The definition of germination is?**
 - a. When a sprout is seen from a seed
 - b. When a seed grows
 - c. When a plant produces flowers
 - d. When a seed is planted in soil
3. **Observations and hypothesizing are the first steps in what process?**
 - a. Scientific process
 - b. Scientific method
 - c. Scientific theory
 - d. Scientific steps
4. **An educated guess is a**
 - a. Observations
 - b. Test
 - c. Hypothesis
 - d. Conclusion
5. **After creating a hypothesis, you must examine what _____ may influence it.**
 - a. Steps
 - b. Factors
 - c. Observations
 - d. People