Lesson Number: MS.AST.2.4

Practicing the Scientific Method

Middle School Food and Agricultural Literacy Curriculum

Precepts

M. Communication

M4. Communicates appropriately with co-workers and supervisors.

National Standards

CS.11.01.01.c. Demonstrate procedures and a conceptual understanding of scientific investigation.

CS.11.02.01.b. Implement an experimental design to test a formulated hypothesis.

NL-ENG.K-12.4 – Communication Skills

NS.5-8.1 – Science as Inquiry

Student Learning Objectives

As a result of this **unit** the students will…

Discuss agricultural research.

As a result of this **lesson** the students will …

Explain the five steps involved in scientific research method.

Content Outline

I. Explain the steps in the scientific research method.

A. Scientific Method: a method of research in which a problem is identified, relevant data is gathered, a hypothesis is formulated from these, and the hypothesis is tested.

1. Observation: Noticing an instance and occurrence for scientific purposes.
2. Question: a statement written about what you observe.
3. Hypothesis: Educated guess on how things work.
4. Test: Experiment to determine if your hypothesis is false or true.
5. Conclusion: Formation of a theory based on observations and data.

Interest Approach

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

Time

Instruction time for this lesson: 60 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. — Science @ a Distance. (2003). Retrieved August 6, 2009, from e-learning module. Web site: http://www.brooklyn.cuny.edu/bc/ahp/AVC/SciMeth/VCB_SM_HP.html — www.dictionary.com — Scientific Method Lab Using Bubble Gum. (2009). Retrieved August 6, 2009, from Minnesota's Science Teachers Education Project (MnSTEP). Web Site: http://serc.carleton.edu/sp/mnstep/activities/27600.html — Steps of the Scientific Method. (2002-2009). Retrieved August 5, 2009, from Science Buddies. — Web site:http://www.sciencebuddies.org/mentoring/project_scientific_method.shtml

Tools, Equipment, and Supplies

Overhead projector/transparencies
Small pieces of wax paper – two per group
Meter long piece of string – one per group
Meter stick – one per group
Two different pieces of bubble gum labeled A and B per group
MS.AST.2.4.AS.A – one per student
MS.AST.2.4.TM.A – one per teacher
MS.AST.2.4.TM.B – one per teacher
MS.AST.2.4.TM.C – one per teacher
MS.AST.2.4.RUBRIC.A – one per teacher

Key Terms

Scientific Method
Observation
Question
Hypothesis
Test
Conclusion

Good morning, class. Today we are going to look at the steps of science that have led us to the great inventions of today. Let's put our minds in the correct setting with a story. Listen carefully:

Matt and Joe were neighbors and best of friends who relied on each other for everything. One day Joe walked over to Matt's house and said, "Matt, I have a question for you." "What's that?" Matt said. "Matt, do your feet hurt?" "Why?" Matt replied back. "Because every time your feet hurt, it rains

the next day and I'm going on a trip and I want to know what the weather is going to be like while I am away." While Matt thought this was very funny, he was intrigued by the idea that Joe believed that the condition of his feet could predict totally different events, such as the weather.

Summary of Content and Teaching Strategies

Objective 1. Explain the steps involved in scientific research methods.

We live in the day and time of modern science. In this short story, Joe's idea that Matt's feet could predict the weather is a result of a science concept. It is the same science concept that has led to the great inventions of today. What science concept is this?

Elicit answers from students.

Correct! It is the ***scientific method***.

Display the definition of scientific method from **MS.AST.2.4.TM.A**.

The subject for today's lesson is the ***scientific method*** or what scientists do all day to create inventions. The ***scientific method*** is made up of five steps. Let's explore each one in our next lab.

In this lab, students will learn the steps of the scientific method by identifying each step and applying each through the comparison of two types of bubble gum. Students will be asked to hypothesize, collect and organize data, and use scientific measurement. Utilize **MS.AST.2.4.TM.A**, **MS.AST.2.4.TM.B** and **MS.AST.2.4.AS.C** for this lab.

In today's lab, we will learn the steps of the ***scientific method*** by comparing the variables between two different types of bubble gum. When I say GUM, one person from each table will collect the items listed on the overhead from the front table. That person should retrieve those items and return to their seat. We will have one minute to retrieve our materials. What questions do you have? GUM!

Place **MS.AST.2.4.TM.B** on the overhead for students to identify the materials they should retrieve.

Time's up! Very good. Now that we have all our materials, let's get started. The first part of the ***scientific method*** is ***observation***. When you observe something, what do you do?

Possible answers may include looking at something in detail, looking at the characteristics, identifying differences, etc.

Excellent. An ***observation*** is noticing an instance or occurrence for scientific purposes.

A. Observation: Noticing an instance and occurrence for scientific purposes.

Let's make ***observations*** for gum A and gum B. When I say WRITE, fill in three ***observations*** on your lab sheet that you can make for each piece of gum. Be sure to unwrap your gum first. We have 30 seconds. What questions do you have? WRITE.

The second step in the scientific method is to ask a question based upon your observations. A question is a statement written about what you observe.

B. Question: a statement written about what you observe.

Most of the time, a scientist is looking to answer a question to a problem. Today, for the sake of time and this lab, the question has already been determined for us. Place **MS.AST.2.4.TM.C** on the overhead.

Today's problem is, which piece of bubble gum blows the biggest bubble and why? When I say WRITE, please write this down on your lab sheet. You have 30 seconds. What questions do you have? WRITE.

The third step in the ***scientific method*** is writing a ***hypothesis***. A ***hypothesis*** is an educated guess on how things work.

C. Hypothesis: Educated guess on how things work.

You must state a ***hypothesis*** in a way that can be easily measured.

Place **MS.AST.2.4.TM.C** on the overhead.

A good format to follow is "If _____[I do this] _____, then _____[this]_____ will happen." When I say GUESS, on your lab report please write a hypothesis

that answers the question in step two. We will have two minutes to do this. What questions do you have? GUESS.

The fourth step in the ***scientific method*** is testing our ***hypothesis*** with an experiment by making ***observations*** and gathering data.

D. Test: Experiment to determine if your hypothesis is false or true.

When I say GO, you and your group members at your table will follow the procedures on your lab report to ***test*** your ***hypothesis***. You will have 10 minutes to complete this lab. What questions do you have? GO!

Announce when five minutes have gone by and then make them aware when they have 30 seconds remaining.

The fifth and final step in the ***scientific method*** is forming a ***conclusion***. In your ***conclusion***, we must form a theory of what brand of gum is the best at blowing bubbles and why.

E. Conclusion: Formation of a theory based on observations and data.

Our ***conclusion*** will be supported with our ***observations*** and data from our ***testing*** in step four. When I say CONCLUDE, answer the ***question*** on your lab report. We have one minute. What questions do you have? CONCLUDE.

Now that we are experts in each step of the ***scientific method***, let's apply it without teacher direction for part two of our lab. The ***observations*** are the same and the ***question*** has been given to us.

When I say GO, create a ***hypothesis*** and follow the procedures for the ***test***. Create a data table and form your ***conclusions***. Each group will need to partner with another group in the class to complete part two. We will have 10 minutes to complete part two. Raise your hand if you understand. Excellent, GO!

As students complete the lab, assist groups with guiding questions for appropriate hypothesis and test procedures. Watch student groups and remind them to work together and include each person in the group.

Fantastic job. I am impressed with how well each of you did at following the directions and steps correctly. I would assume the second part of the lab was a bit harder since you had more people to work with. Why does a task become more difficult when there are more people involved?

Elicit student responses.

Who has an example of a situation when appropriately communicating with others is challenging.

Student responses may include work, family, school, and friends.

Sometimes we have many different types of personalities and working styles that will clash, but it's important to try. Why is it important to try to work with those who may be unwilling?

Students' responses may include to get things done, have success, and to be productive.

It's very important that each of us work together in class so that we can learn and achieve the most that we can. If we don't try to work together, everyone suffers, including you. However, if we try, no matter how challenging the situation may be, most of the time we will get a positive result – just as we did in today's group lab.

Review/Summary

Utilize the *Party Host e-Moment® for review*.

To reinforce that each of us learned how each step works, let's play a game. It's called Party Host. We need six volunteers.

Hand five students a card and one a microphone who will be the party host as they come to the front of the class. Tell them not to reveal their identity. Send them outside and bring them in one at a time. It's recommended to have students not act in order of the five steps of the scientific method.

Here's how it works. If you received a card you are a guest and if you received the microphone you are the party host. The party host will greet each guest as they come into the classroom and ask them to act out their part. What questions do you have? Ready, set, go!

Thanks for playing. Everyone did a great job. Now let's see how comfortable we feel with today's lesson.

When I say HANDS, if you didn't understand anything today keep your hands down. If you feel like you kind of understand what we did, raise one hand. If you feel very comfortable with what you learned today, raise both hands. HANDS! Great! Looks like to me that we know our ***scientific method!*** Well done.

Application

Extended Classroom Activity:

Take the class on a tour of a seed plant and discuss the new science research being done on genetic seed engineering, or research famous scientists and their impacts on agriculture.

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

Utilize lab report MS.AST.2.4.AS.A

Answers to Evaluation

MS.AST.2.4.RUBRIC.A

Key Terms

A. Scientific Method: A method of research in which a problem is identified, relevant data is gathered, a hypothesis is formulated from these, and the hypothesis is tested.

B. Observation: Noticing an instance and occurrence for scientific purposes.

C. Question: A statement written about what you observe.

D. Hypothesis: Educated guess on how things work.

E. Test: An experiment to see if your test is false or true.

F. Conclusion: Formation of a theory based upon observations and data.

LAB MATERIALS

- **Every person needs a lab report.**
- **Every group needs the following items.**

2 small pieces of wax paper

1 meter long piece of string

1 meter stick

2 different pieces of bubble gum labeled A and B

QUESTION

Which piece of bubble gum blows the biggest bubble and why?

Good Hypothesis Format: A good format to follow is

"If _____[I do this] _____, then _____

[this]_____ will happen."

Scientific Method Lab Using Bubble Gum

Lab Report

Scientific Method Step One

Observation: Noticing an instance and occurrence for scientific purposes.

Observations

Gum A and Gum B

1._____	**1.**_____
2._____	**2.**_____
3._____	**3.**_____

Scientific Method Step Two

Ask a question.

Question: _____

_____

Scientific Method Step Three

Hypothesis: Predict which piece of gum will blow the biggest bubble and why.

_____

_____

Scientific Method Step Four

Test: Test the hypothesis with a controlled experiment by making observations and gathering data.

Follow the steps to test your hypothesis.

1. The person with brand A will chew their piece of gum for three minutes. The person with brand B does not begin chewing until all the tests on brand A are completed.
2. Blow a bubble.
3. Using a string, your partner will measure the diameter (distance across) the bubble. Put the string on the meter stick to measure the distance in centimeters (cm).
4. Record the measurement in a data table in the space provided. Repeat the process for trials two and three.
5. Find the average bubble size for brand A (add all the distances up and divide by 3) and put in the data chart.
6. Repeat steps one through five with brand B gum.

Data Table:

Design a data collection table in the space below to fit the data you will be investigating.

Scientific Method Step Five

Conclusion: Forming a Theory

What brand of gum is best at blowing bubbles and why? Support your answer with observations and your data.

_____

_____

_____

_____

PART 2

Now that you are familiar with the scientific method, complete this second part of the lab with your knowledge of each step. Combine with another group to complete this part of the lab.

Problem: How does gum's stretchability relate to bubble size?

Hypothesis: Make an educated guess that would answer the above question.

Test:

1. The person with brand A will roll their gum into a ball.
2. Hold the gum (brand A) by using the piece of wax paper. Another person in the group would hold the same piece of gum with another piece of wax paper.
3. The third person in the group should hold the meter stick and measure the distance in centimeters of the gum stretched before breaking.
4. Record the measurement in the data chart. ONLY DO ONE TRIAL
5. Repeat numbers 1 – 4 for brand B gum.

Data Table:

Create a data table in the space below to fit the data you will be gathering.

Conclusion:

How does gum stretchability relate to bubble size?

With your lab partner, list five variables that may affect the outcome of this experiment.

List any questions you still have about the scientific method.

Scientific Method Laboratory	Lab Part One	Lab Part Two
Step One – Observation **Are observations complete?** **Do the observations indicate careful thinking and analysis?** **5 pts. possible**		
Step Two – Question **Is the question written completely?** **Does it have correct grammar?** **5 pts. possible**		
Step Three – Hypothesis **Is the statement written completely?** **Does it have correct grammar?** **5 pts. possible**		
Step Four – Test **Is the data reflective of the testing within the scientific method?** **Is the data complete?** **10 pts. possible**		
Step Five – Conclusion **Is the conclusive statement written completely?** **Does it have correct grammar?** **5 pts. possible**		
Total Points Earned =		