



This guide walks you through presenting the ***Engaging Interactions: Using the Scientific Method*** in-service suite. This in-service suite includes PowerPoint slides and supporting materials.

MATERIALS NEEDED:

- Presenter PowerPoint slides (16)
- Optional slide: *Video: Coconuts*
- Projector and audio equipment
- Optional Learning Activities:
 - » *Video Review of Coconuts*
 - » *Discussion of Classroom Scenarios*
 - » *Planning in Your Classroom*
- Tips for Teachers
- Tools for Supervisors
- Helpful Resources
- Flip chart or similar large paper and markers for writing participant ideas

BEFORE YOU BEGIN:

- The purpose of this presentation is to identify and describe the steps of the scientific method that teachers can incorporate into their practice.
- This is one in a series of in-service suites on *Engaging Interactions*.
- The five steps discussed are: Question, Observe, Predict, Experiment, and Discuss.
- The presentation includes video clips that illustrate examples of teachers using the *Scientific Method*.
- Optional learning activities offer participants opportunities to discuss and practice using these strategies.

NOTE

The Supervisor Planning Guide is an overarching tool that applies to multiple suites in the *Engaging Interactions* series.



SLIDE 1: USING THE SCIENTIFIC METHOD

Introductions:

- Begin the training by giving participants background information on yourself.
- Provide an opportunity for participants to introduce themselves (e.g., where they are working, their current roles, etc.).

Introduce the topic:

- *Using the Scientific Method* focuses on steps teachers can use to expand children's understanding of the world around them.



SLIDE 2: FRAMEWORK FOR EFFECTIVE PRACTICE

Introduce NCQTL.

Framework for effective practice supporting school readiness for all children (House structure):

- Consists of four components for quality teaching and learning.
- All four components interact with each other and are essential for effective everyday practices for all children.
- This presentation fits into the foundation of the House.

Connect NCQTL Framework to participant's everyday work:

- A visual way to provide the Head Start community with a framework for effective teaching practices in classrooms.
- A way to think about all the practices that support school readiness.
- A way to organize training and professional development.

Introduce Instructional Interactions.

Research shows that interactions are the classroom processes that are important for children's social and academic development.

- When teachers create positive emotional relationships, organize the learning environment, and focus on cognitive and language development, children make greater gains that help them succeed in school and life.
- There are three broad blocks to the foundation, and we are talking about the area of *Engaging Interactions*, specifically using the scientific method, as one example of these interactions.



OBJECTIVES

- Provide a **definition** for scientific method.
- Give **examples and strategies** for using the scientific method in early childhood classrooms.
- Connect** to the Head Start Child Development and Early Learning Framework.
- Provide **suggestions** for improving teachers' abilities to incorporate the scientific method.


SLIDE 3: OBJECTIVES

Outline objectives for presentations:

- **Provide a definition** of scientific method.
- **Give examples and strategies** for how teachers can use the scientific method in their classrooms.
- **Connect** *Using the Scientific Method* to the Head Start Child Development and Early Learning Framework
- **Provide suggestions** for teachers on how to improve their ability to incorporate the scientific method into their everyday practice.

SCIENTIFIC METHOD

- The scientific method is a series of steps that help children understand their world.
- Teachers use the scientific method when they:
 - Help children **question**.
 - Ask children to **observe** the world around them.
 - Encourage children to **predict** during activities.
 - Create opportunities for children to **experiment**.
 - Allow children to **discuss** the results of their experiment.



SLIDE 4: SCIENTIFIC METHOD

Introduce the slide.

The scientific method is a series of steps that helps learners of all ages to investigate the world. Teachers incorporate the scientific method into their practice when they encourage children to **question, observe, predict, experiment, and discuss** during classroom activities.

NOTE

Remind participants that these steps do not necessarily need to occur in this order. Often times observing and predicting occur multiple times, as we will see in video examples.



QUESTION

Help children form their own questions related to their world.

A child is playing outside and exclaims:
"Oh no! The plant! What happened?"



SLIDE 5: QUESTION

The Scientific Method – Step 1:

- The first step of the scientific method is to form a question about the world. Teachers encourage children to do this by allowing children time to express the questions that arise from their natural curiosity. This Question Step is important because it sets the stage for the Experiment Step later on.
- Teachers encourage children to ask questions when they model curiosity and questioning throughout the day. Children are full of questions. Listen closely, and take advantage of opportunities to pursue answers using the scientific method.
- Example: A child is playing outside and exclaims, "Oh no, the plant! What happened to it?" The teacher uses this child's question to create a classroom project around the question, "What do plants need to grow?" In this example, the teacher creates an activity from a child's question about plants, providing an opportunity for the class to explore their curiosity of how plants grow.

Another example:

During gym time, a teacher may have children talk about how their bodies feel before and after they run around. She can prompt them to question how bodies that run differ from bodies that walk.



OBSERVE

Ask children to use their senses and closely **observe** the world around them.



"Let's look at some of the plants that are growing around our school. What do you notice about places where they are growing? How does the soil feel around them?"
(Encourage children to think about water.)

SLIDE 6: OBSERVE

The Scientific Method – Step 2:

- The second step of the scientific method is for children to use their senses and closely **observe** the world.
- Before forming a hypothesis, encourage children to wonder, explore, ask questions, and gather as much information as possible related to their initial question. This information can be gathered through personal observation, books, and other resources brought in by the teacher and children. A variety of sources, including technology and other mediums, can be used to support the observation step.
- Example: Children are encouraged to share with one another what they already know about plants in their environment. They are also given ample opportunity to explore and express their curiosity about plants and how they grow. They are encouraged to go on nature walks around the school's outdoor space. The teacher brings in books and shares educational web-based sources related to the natural process of plant growth. Children are also encouraged to document their observations of things that are growing in their home environment(s) as well as at school and on the playground through photos. Using digital cameras, drawings, acting, three dimensional creations, and back-and-forth discussions, children extend their observations. Teachers use guiding questions to encourage children to think about what plants need to grow, like water and sunlight.

Another example:

During the gym time activity mentioned above, children can observe how they breathe and what their hearts feel like when they are not moving.




PREDICT

Encourage children to **predict**, or guess, the answer to the initial question.

“What do you think plants need to grow?”

What do you think would happen if we gave water to some plants but not others?”



SLIDE 7: PREDICT

The Scientific Method – Step 3:

- The third step of the scientific method is to **predict**, or guess the answer to the initial question.
- Help children to form a prediction or hypothesis (“best guess”) based on the information they have gathered through their exploration and observations.
- Example: The teacher asks the children what they have learned about what a plant might need to grow, and they formulate a hypothesis/prediction that plants need water to grow.
- This example highlights how the teacher asks the children to form a guess about what plants need to grow, rather than just continuing with the activity without asking children to guess.

Another example:

During the gym activity, the teacher can ask students what they think will happen to their bodies after a minute of walking and then after a minute of running.





SLIDE 8: EXPERIMENT

The Scientific Method – Step 4:

- The fourth step of the scientific method is to **test** the prediction.
- Help children to set up an experiment that allows them to test their hypothesis or prediction. Using guiding questions as needed, such as “How can we test this?” or “What could we do to see if this is true?”
- Example: Ideally, the children determine the course of the experiment. One design might be that each child plants two of the same type of seed in two different pots. One pot gets water each day and the other does not. Information is collected over the course of a few days (i.e., written narrations of children’s observations, photos with digital cameras, three-dimensional models, comparison drawings of each pot, etc.). This example highlights how the teacher asks the children to decide how to test their ideas, rather than just telling them how plants grow best and not providing an opportunity to test their predictions.

NOTE

Sometimes prediction may occur in several parts of the scientific method.

Another example:

During the gym activity, the teacher will first have children walk around the playground slowly. After about a minute, the children will be asked to run around the playground. Before the children start to run, the teacher asks the children what they think will happen to their bodies.



DISCUSS

Allow children to **discuss** the results of their experiment.

"Let's look at our two plants. Remember we treated each plant differently? The first plant got water and the second plant did not get water. What happened to the plants in our experiment? Which plant grew the most?... What do plants need to grow?"



SLIDE 9: DISCUSS

The Scientific Method – Step 5:

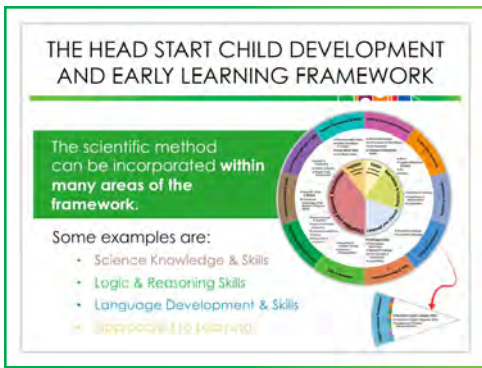
- The final step of the scientific method is to **talk** about the results of their experiments.
- Help children to examine and analyze the information they collected in order to draw a conclusion. Celebrate the children's curiosity and their ability to follow through with their plans and find an answer.
- Example: The teacher facilitates a conversation in which the children's observations and other collected information (drawings, measurements, etc.) are examined and discussed, and a conclusion is drawn.
 - » Accurate prediction: The seeds that were watered grew and the ones without water did not. Children can confirm that plants DO need water to grow. The prediction was right.
- This example highlights how the teacher prompts children to talk about the results of their experiment (Which plants grew best?), rather than not allowing them to discuss what they have learned.

This experiment helps children answer a part of their original question in Step 1 (What do plants need to grow?).

Another example:

After the walking/running experiment, the teacher can have children discuss how their bodies felt different after running (i.e., their breathing was heavier, their hearts were beating faster, they began to sweat, etc.) This discussion can help children answer their original question: How are our bodies different when we walk/run?





SLIDE 10: THE HEAD START CHILD DEVELOPMENT AND EARLY LEARNING FRAMEWORK

The scientific method can be used for several domains in the Head Start Child Development and Early Learning Framework including:

- Science Knowledge & Skills:
 - » Children are using senses and tools to gather information and observe natural processes and transformations related to seed/plant growth.
 - » Children are observing and making comparisons between two seeds/plants.
 - » Children are participating in an investigation to make a prediction, gather and document observations, and draw conclusions.
- Logic & Reasoning Skills
 - » Children are comparing objects and events as they observe and document the differences in the watered and unwatered seeds.
 - » Children can recognize a cause and effect relationship between water and plant growth.
 - » Children can use information they know from home and other experiences about plants and how they grow to form the prediction/hypothesis that plants need water to grow. They can then experiment to confirm or disconfirm this knowledge.
 - » Children can engage in symbolic representation by representing the plant growth through drawings, movement and actions, and three dimensional creations of clay or other mediums.
- Language Development & Skills
 - » A variety of complex and varied vocabulary can be introduced, such as: explore, observe, document, predict, hypothesis, compare, findings, conclusion, and the names of seed parts for children that need more challenge.
 - » Explanations and answers to the children's questions can be phrased in a variety of ways to ensure comprehension and to model a variety of accurate grammatical structures.
 - » Children can tell stories about seeds and plants and how they grow.

SLIDE 10 CONTINUED ON NEXT PAGE



- Approaches to Learning
 - » Children have the opportunity to demonstrate imagination and inventiveness.
 - » Children have the opportunity to demonstrate and follow through by displaying interest, engagement, and persistence until the seed/plant experiment or project is completed over the course of several days.
 - » Children have the opportunity to collaborate with peers through shared materials, large group and small group discussion, and helping one another as they plant their seeds and document their observations throughout the course of the experiment.

In the following video example, we will highlight how the teacher incorporates the **scientific method** into an activity within the Science Knowledge & Skills domain.



Length of video: Approximately 3 minutes and 16 seconds

Video courtesy of The Center for Advanced Study of Teaching and Learning:
<http://curry.virginia.edu/research/centers/cast/>

SLIDE 11: VIDEO: ECO-BOTTLES

Introduce the video.

Inform participant that this video shows a teacher talking with children during a science activity.

Remind participants to look for examples of how the teacher uses the scientific method in her lesson.

VIDEO 

NOTE 

This video is from a public preschool classroom.

Participants may want to discuss various details of this video. For example, participants may notice that the children appear to be wearing a school uniform. Should they bring up unrelated comments, redirect them and explain that this video has been edited to highlight steps of the scientific method.



IN THIS CLIP, THE TEACHER USES THE SCIENTIFIC METHOD

Question	Children question if eco-bottles with worms are different from ones without.
Observe	The children observe worms with magnifying glasses.
Predict	The children predict what the worms will do in the bottle.
Experiment	The children experiment by placing worms in only one of the eco bottles.
Discuss	Later in the week, the children discuss the differences between bottles.

SLIDE 12: IN THIS CLIP, THE TEACHER USES THE SCIENTIFIC METHOD

Video example of *Using the Scientific Method*:

- Although the children are not seen forming their own questions, this experiment is set out to answer the **question**: Are eco-bottles with worms different from eco-bottles without worms?
- The children **observe** the worms with magnifying glasses and scoop gravel and dirt. The teacher asks questions such as “What do you see?” and “What are the worms doing?”
- The teacher asks the children to **predict** by asking them “What do you think will happen to the lettuce?” and “What do you think the worms will do?”
- The teacher allows the children to **experiment** and create the eco-bottles. The teacher reminds them that only one of the bottles will have worms.
- Although the children are not seen talking about the results of their experiment, the teacher encourages them to **discuss** the differences in eco-bottles later in the week.

WHEN CAN I USE THE SCIENTIFIC METHOD?

Teachers can use the scientific method **throughout the school day** in many classroom activities.



SLIDE 13: WHEN CAN I USE THE SCIENTIFIC METHOD?

Opportunities when teachers can use the scientific method occur throughout the school day in many classroom activities:

- Centers
- Small and whole group instruction
- Meal and snack time
- Transition





SLIDE 14: IMPROVING PRACTICE

Three ways to improve instructional interactions in the classrooms:

Videotape – Teachers can videotape and watch their classroom interactions. This can help them to observe moment-to-moment interactions with students and reflect on their practice.

Example: For example, a teacher videotapes her interactions with children during center time. In the block center, she asks a child, “How many blocks does this tower have?” The teacher notes that this is a good question, because it reinforces the counting skills that the children are learning. However, she realizes that she could have asked the child further questions that would have required more analysis and reasoning. She could have asked, “What do you think will happen if we add more blocks? ... Why do you think that?” Then she could have asked the children to add more blocks and talk about what happens. This would have allowed them to experiment and learn more from the activity.

Practice with a peer – It can also be helpful for teachers to “practice with a peer” by either having a peer teacher conduct a live classroom observation, or watch a video of a teacher’s practice together. Fellow teachers can provide feedback on each other’s behavior and children’s cues and responses. Together, teachers can analyze ways that the focus teacher is interacting in the classroom and brainstorm ways to make improvements to more fully integrate the scientific method.

Example: For example, when observing the focus teacher engaging in book reading, her peer teacher might notice that the teacher asks a lot of questions to the students, but uses mostly close-ended questions that require one word responses, rather than asking questions that require students to analyze, reason, and make predictions. The peer teacher might suggest that the focus teacher try placing sticky notes on certain pages of a book with questions that require elaborated student responses as a reminder to the teacher to ask these types of questions during future book reading.

Watch a “master teacher” – Another way to improve practice is to view examples of a more skilled teacher’s interactions with students, either live or on video. Observing the master teacher’s strategies can provide ideas for how to improve a teacher’s own instructional interactions.



SUMMARY

- Help children form **questions** about their world.
- Ask children to **observe** the world around them.
- Encourage children to **predict** during activities.
- Create experiments for children to further explore and test predictions.
- Allow children to **discuss** the result of their experiments.

The diagram shows five beakers arranged in a circle, each labeled with a step of the scientific method: Question (green), Predict (orange), Observe (yellow), Experiment (grey), and Discuss (blue).

SLIDE 15: SUMMARY

Review the steps of the scientific method:

- Question
- Observe
- Predict
- Experiment
- Discuss

Distribute handouts if not distributed during the presentation.

HANDOUT

Based on the participant roles:

- Distribute and review *Tips for Teachers* handout. This tip sheet provides multiple example strategies that teachers can use.
- Distribute and review *Tools for Supervisors: The Supervisor Planning Guide* provides strategies for coaches, mentors, or supervisors to use to help teachers enact change in their practice.
- Distribute the *Helpful Resources* handout and review key resources, including links to websites, books, and articles that have information on the scientific method.

You may also complete the optional learning activities described below after Slide 16, including *Video Review*, *Discussion of Classroom Scenarios*, and *Planning in Your Classroom*.

The logo for the National Center for Quality Teaching and Learning (NCQTL) is displayed. Below the logo, the text reads: "For more information, contact us at NCQTL@WVU.EDU or 877-731-0764." At the bottom, there is a small line of text: "We are proud to be a part of the WVU system. WVU is a Division of the West Virginia Department of Education. WVU is an Equal Opportunity Institution. © 2014 West Virginia University. All rights reserved." The slide also features a decorative graphic of colored squares at the bottom.

SLIDE 16: CLOSING

Provide participants with NCQTL contact information and encourage them to visit our website for additional resources on effective teaching practices.



Length of video: Approximately 3 minutes and 50 seconds

Video courtesy of The Center for Advanced Study of Teaching and Learning:
<http://curry.virginia.edu/research/centers/cast/>

OPTIONAL

LEARNING ACTIVITY: VIDEO REVIEW OF COCONUTS

The *Video Review of Coconuts* learning activity can be used to discuss steps of the scientific method with participants.

This video shows an example of a science lesson on coconuts. The teacher encourages children to explore the coconut. Refer to the *Video Review of Coconuts: Facilitator Guide* for specific details.

NOTE

Depending on the number of participants, this activity can be done in the large group or participants can be divided into smaller groups of 3–4.

Directions: Inform participants they will review the video, look for and write down examples of what the teacher says or does related to a specific step of the scientific method. For steps that are not observed in the video, participants will describe how they would continue the lesson to address each step of the method.

HANDOUT

Distribute the *Video Review of Coconuts* handout and review directions.

VIDEO

Explain that the teacher is conducting a lesson on coconuts.

OPTIONAL SLIDE PPT

Show optional video slide *Coconuts*.

Participants record examples of steps of the scientific method as they watch the *Coconuts* video. They then work together to identify ways to incorporate all steps of the scientific method into the rest of the lesson.

Strategies: Participants discuss examples of steps directly in the large group or share back after discussion in the smaller groups.

NOTE

Participants can share examples of steps observed in the video and steps they would use in the rest of the lesson at the same time. Another option is for participants to first share steps observed in the video before they work on identifying additional steps.

Connecting strategies to domains

Participants share examples of domain and domain elements from the *Head Start Child Development and Early Learning Framework* they observed being supported in the video. Participants discuss examples directly in the large group or share back after discussion in the smaller groups.



OPTIONAL



LEARNING ACTIVITY: DISCUSSION OF CLASSROOM SCENARIOS

This learning activity provides an opportunity for participants to expand their understanding of the scientific method by discussing and possibly role playing how they might use these steps in their own classrooms.

This activity offers four options: Identifying strategies, generating statements/questions, creating a script, and role play. The facilitator may use any number and combination of the four options.

Refer to the *Discussion of Classroom Scenarios: Facilitator Guide* for specific details.

NOTE

Depending on the number of participants, this activity can be done in the large group or participants can be divided into smaller groups of 3–4.

HANDOUT

Distribute the *Discussion of Classroom Scenarios* handout and review directions:

- Each group identifies steps of the scientific method and possibly role plays and creates detailed scripts.

DISCUSSION

Have small groups share back with the larger group.

For the role-play option:

Encourage participants to comment based on their assigned role of teacher, child, or observer.

Possible questions to ask:

- What did you notice the teacher doing?
- How did the children respond?
- What other ways could teachers implement this strategy?



OPTIONAL



LEARNING ACTIVITY: PLANNING IN YOUR CLASSROOM

This learning activity provides an opportunity for participants to develop a plan for how they might use the steps of the scientific method in their own classrooms. This activity works best when there are multiple participants working in the same classroom or program. Refer to the *Planning to Use the Scientific Method in Your Classroom: Facilitator Guide* for specific details.

Have participants form small groups comprised of staff who work in the same classroom or program, if possible.

HANDOUT

Distribute the *Planning to Use the Scientific Method in Your Classroom* handout.

- Each group selects a learning domain and develops an activity plan incorporating steps of the scientific method.

DISCUSSION

Ask participants to implement the activity in their classrooms and to discuss how the activity went at a staff meeting, and/or share back information with the larger group at the next in-service meeting.

Possible questions to ask:

- What was your experience of the activity?
- How did the children respond?
- What went well?
- How might you do things differently in the future?