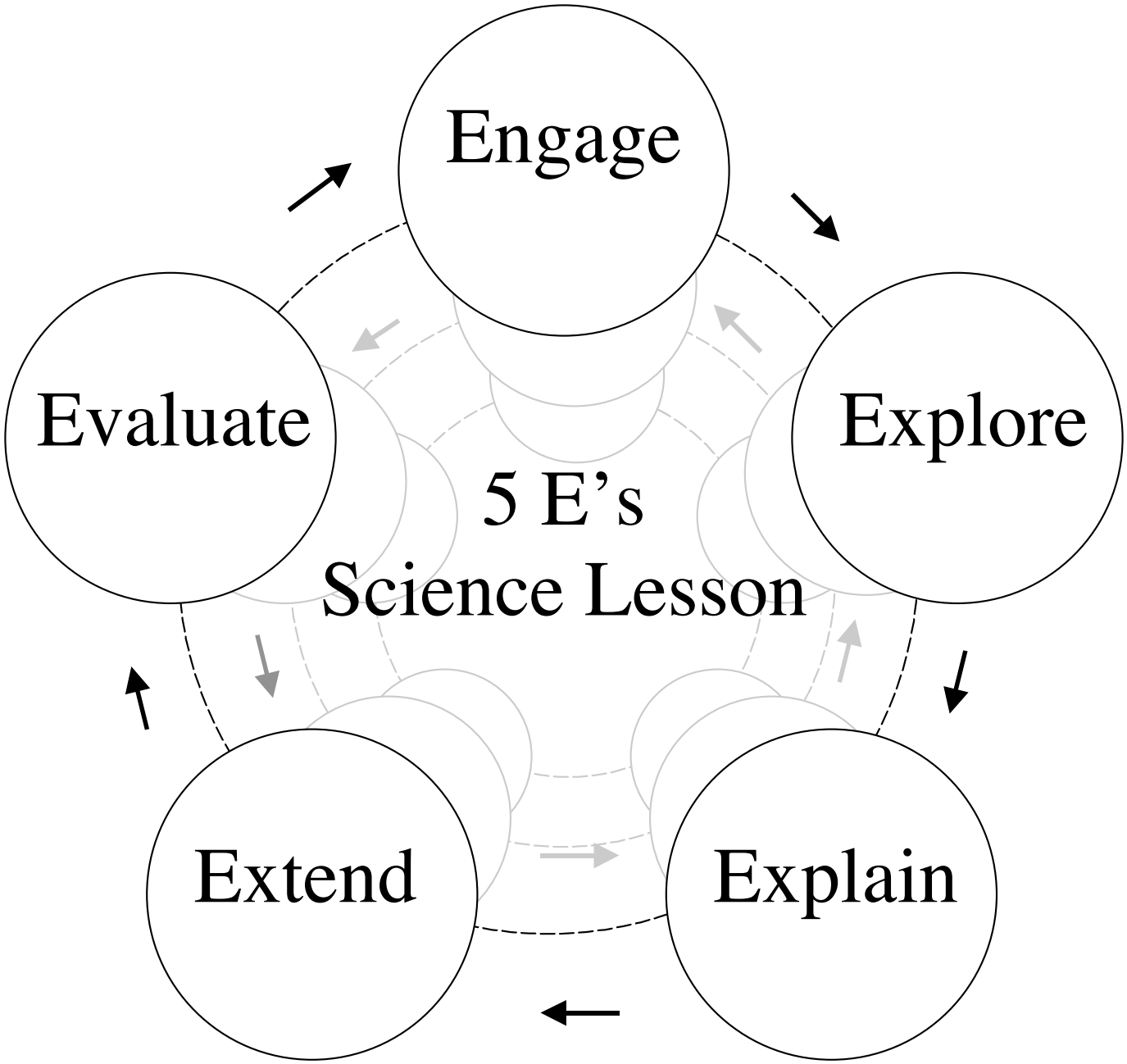
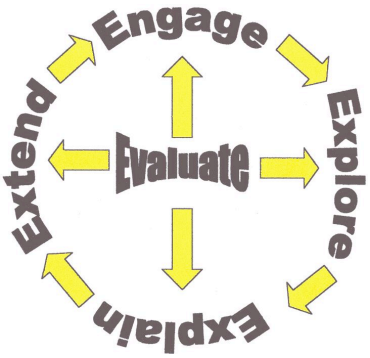


5 E's Lesson Planning Packet
Elementary Science

MCPS Science Office August, 2001
2000



Engage: In most instances you will want to begin with Engage. In this stage you want to create interest and generate curiosity in the topic of study; raise questions and elicit responses from students that will give you an idea of what they already know. This is also a good opportunity for you to identify misconceptions in students' understanding. During this stage students should be asking questions (Why did this happen? How can I find out?) Examples of engaging activities include the use of children's literature and discrepant events.

Explore: During the Explore stage students should be given opportunities to work together without direct instruction from the teacher. You should act as a facilitator helping students to frame questions by asking questions and observing. Using Piaget's theory, this is the time for disequilibrium. Students should be puzzled. This is the opportunity for students to test predictions and hypotheses and/or form new ones, try alternatives and discuss them with peers, record observations and ideas and suspend judgment.

Explain: During Explain, you should encourage students to explain concepts in their own words, ask for evidence and clarification of their explanation, listen critically to one another's explanation and those of the teacher. Students should use observations and recordings in their explanations. At this stage you should provide definitions and explanations using students' previous experiences as a basis for this discussion.

Extend: During Extend students should apply concepts and skills in new (but similar) situations and use formal labels and definitions. Remind students of alternative explanations and to consider existing data and evidence as they explore new situations. Explore strategies apply here as well because students should be using the previous information to ask questions, propose solutions, make decisions, experiment, and record observations.

Evaluate: Evaluation should take place throughout the learning experience. You should observe students' knowledge and/or skills, application of new concepts and a change in thinking. Students should assess their own learning. Ask open-ended questions and look for answers that use observation, evidence, and previously accepted explanations. Ask questions that would encourage future investigations.

From: http://www.coe.ilstu.edu/scienceed/lorsbach/257lrcy.htm

The 5E Model of Instruction

Engage

The first phase is to engage the student in the learning task. The student mentally focuses on an object, problem, situation, or event. The activities of this phase should make connections to past and future activities. The connections depend on the learning task and may be conceptual, procedural, or behavioral.

Asking a question, defining a problem, showing a discrepant event, and acting out a problematic situation are all ways to engage the students and focus them on the instructional activities. The role of the teacher is to present a situation and identify the instructional task. The teacher also sets the rules and procedures for the activity.

Student Behavior	Engage	Teaching Strategy
Asks questions such as, Why did this happen? What do I already know about this? What can I find out about this? How can this problem be solved? Shows interest in topic.	**Initiates the learning task. The activity should make connections between past and present learning experiences, and anticipate activities and organize students' thinking toward the learning outcomes of current activities.**	Generates interest. Generates curiosity. Raises questions and problems. Elicits responses that uncover students' current knowledge about the concept/topic.

Explore

Once the activities have engaged students, they need time to explore their ideas. Exploration activities are designed so that all students have common, concrete experiences upon which they continue building concepts, processes, and skills. This phase should be concrete and meaningful for the students.

The aim of exploration activities is to establish experiences that teachers and students can use later to formally introduce and discuss scientific and technological concepts, processes, or skills. During the activity, the students have time in which they can explore objects, events, or situations. As a result of their mental and physical involvement in the activity, the students establish relationships, observe patterns, identify variables, and question events.

The teacher's role in the exploration phase is that of facilitator or coach. The teacher initiates the activity and allows the students time and opportunity to investigate objects, materials, and situations based on each student's own ideas and phenomena. If called upon, the teacher may coach or guide students as they begin constructing new explanations.

Student Behavior	Explore	Teaching Strategy
Thinks creatively within the limits of the activity. Tests predictions and hypotheses. Forms new predictions and hypotheses. Tries alternatives to solve a problem and discusses them with others. Records observations and ideas. Suspends judgment. Tests ideas.	**Provide students with a common base of experiences which current concepts, processes, and skills are identified and developed.**	Encourages students to work together without direct instruction from the teacher. Observes and listens to students as they interact. Asks probing questions to redirect student's investigations when necessary. Provides time for students to puzzle through problems. Acts as a consultant for students.

Explain

Explanation means the act or process in which concepts, processes, or skills become plain, comprehensible, and clear. The process of explanation provides the students and teacher with a common use of terms relative to the learning experience. In this phase, the teacher directs student attention to specific aspects of the engagement and exploration experiences. First, the teacher asks the students to give their explanations. Second, the teacher introduces scientific or technological explanations in a direct and formal manner. Explanations are ways of ordering and giving a common language for the exploratory experiences. The teacher should base the initial part of this phase on the students' explanations and clearly connect the explanations to experiences in the engagement and exploration phases of the instructional model. The key to this phase is to present concepts, processes, or skills briefly, simply, clearly, and directly, and then continue on to the next phase.

Student Behavior	Explain	Teaching Strategy
Explains possible solutions or answers to other students. Listens critically to other students' explanations. Questions other students' explanations. Listens to and tries to comprehend explanations offered by the teacher. Refers to previous activities. Uses recorded observations in explanations.	**Focus students' attention on a particular aspect of their engagement and exploration experiences, and provide opportunities to demonstrate their conceptual understanding, process skills, or behaviors. This phase also provides opportunities for teachers to introduce a concept, process, or skill.**	Encourages students to explain concepts and definitions in their own words. Asks for justification (evidence) and clarification from students. Formally provides definitions, explanations, and new vocabulary. Uses students' previous experiences as the basis for explaining concepts.

Elaborate

Once the students have an explanation of their learning tasks, it is important to involve them in further experiences that apply, extend, or elaborate the concepts, processes, or skills. Some students may still have misconceptions, or they may only understand a concept in terms of the exploratory experience. Elaboration activities provide further time and experience that contribute to learning.

Student Behavior	Elaborate	Teaching Strategy
Applies new labels, definitions, explanations, and skills in new, but similar, situations. Uses previous information to ask questions, propose solutions, make decisions, design experiments. Draws reasonable conclusions from evidence. Records observations and explanations.	**Challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills.**	Expects students to use vocabulary, definitions, and explanations provided previously in new context. Encourages students to apply the concepts and skills to new situations. Reminds students of alternative explanations. Refers students to alternative explanations.

Evaluate

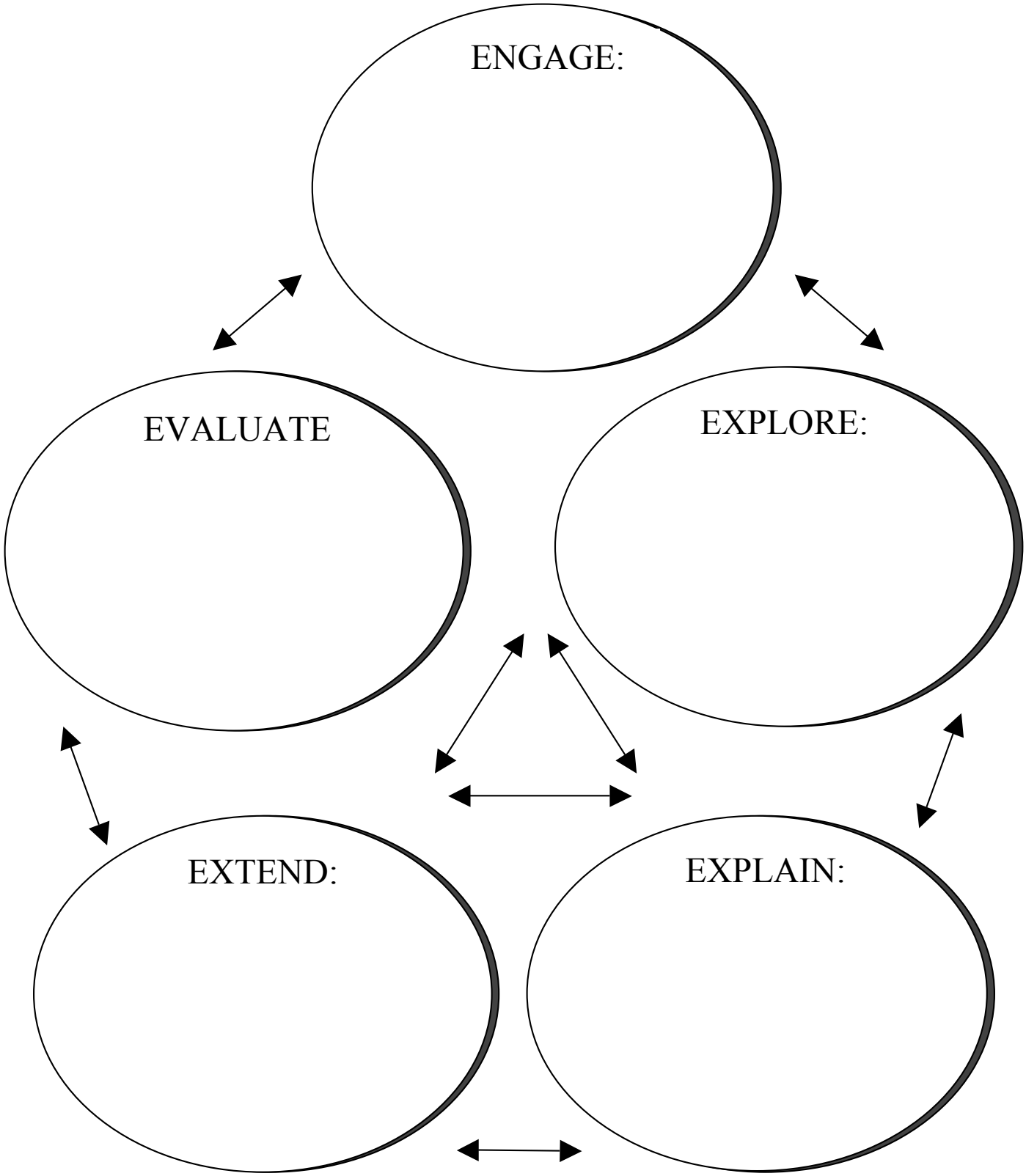
At some point, it is important that students receive feedback on the adequacy of their explanations. Informal evaluation can occur from the beginning of the teaching sequence. The teacher can complete a formal evaluation after the elaboration phase. As a practical educational matter, science teachers must assess educational outcomes. This is the phase in which teachers administer tests to determine each student's level of understanding. This also is the important opportunity for students to use the skills they have acquired and evaluate their understanding.

Student Behavior	Evaluate	Teaching Strategy
Checks for understanding among peers. Answers open-ended questions by using observations, evidence, and previously accepted explanations. Demonstrates and understanding or knowledge of the concept or skill. Evaluates his or her own progress and knowledge. Asks related questions that would encourage future investigations.	**Encourage students to assess their understanding and abilities and provide opportunities for teachers to evaluate student progress.**	Refers students to existing data and evidence and asks, What do you already know? What do you think...? Observes students as they apply new concepts and skills. Assesses students' knowledge and/or skills. Looks for evidence that students have changed their thinking. Allows students to assess their learning and group process skills. Asks open-ended questions such as, Why do you think...? What evidence do you have? What do you know about the problem? How would you answer the question?

5 E's Activities

5 E's	Suggested Activity	What the Teacher Does	What the Student Does
Engage	• Demonstration • Reading • Free Write • Analyze a Graphic Organizer • KWL • Brainstorming	• Creates interest. • Generates curiosity. • Raises questions. Elicits responses that uncover what the students know or think about the concept/topic	• Asks Questions such as, Why did this happen? What do I already know about this? What can I find out about this? • Show interest in the topic.
Explore	• Perform and Investigation • Read Authentic Resources to Collect Information • Solve a Problem • Construct a Model	• Encourages the students to work together without direct instruction from the teacher. • Observes and listens to the students as they interact. • Asks probing questions to redirect the students' investigations when necessary. • Provides time for students to puzzle through problems.	• Thinks freely but within the limits of the activity. • Tests predictions and hypotheses. • Forms new predictions and hypotheses. • Tries alternatives and discusses them with others. • Records observations and ideas. • Suspends judgment.
Explain	• Student Analysis & Explanation • Supporting Ideas with Evidence • Structured Questioning • Reading and Discussion • Teacher Explanation • Thinking Skill Activities: compare, classify, error analysis	• Encourages the students to explain concepts and definitions in their own words. • Asks for justification (evidence) and clarification from students. • Formally provides definitions, explanations, and new labels. • Uses students' previous experiences as basis for explaining concepts.	• Explains possible solutions or answers to others. • Listens officially to others' explanations. • Questions others' explanations. • Listens to and tries to comprehend explanations the teacher offers. • Refers to previous activities. • Uses recorded observations in explanations.
Extend	• Problem Solving • Decision Making • Experimental Inquiry Think Skill Activities: compare, classify, apply	• Expects the students to use formal labels, definitions, and explanations provided previously. • Encourages the students to apply or extend the concepts and skills in new situations. • Reminds the students to existing data and evidence and asks, What do you already know? Why do you think…? • Strategies from Explore apply here also.	• Applies new labels, definitions, explanations, and skills in new, but similar situations. • Uses previous information to ask questions, propose solutions, make decisions, and design experiments. • Draws reasonable conclusions from evidence. • Records observations and explanations. • Checks for understandings among peers.
Evaluate	• Any of the Above • Develop a Scoring Tool or Rubric • Test (SR, BCR, ECR) • Performance Assessment • Produce a Product • Journal Entry • Portfolio	• Observes the students as they apply new concepts and skills. • Assesses student's knowledge and/or skills. • Looks for evidence that the students have changed their thinking or behaviors. • Allows students to assess their own learning and group-process skills. • Asks open-ended questions, such as: Why do you think..? What evidence do you have? What do you know about x? How would you explain x?	• Answers open-ended questions by using observations, evidence, and previously accepted explanations. • Demonstrates an understanding or knowledge of the concept or skill. • Evaluates his or her own progress and knowledge. • Asks related questions that would encourage future investigations.

The 5 E's Lesson Organizer



Elementary Science Lesson Planning Sheet

Grade: Unit:

CONCEPT STANDARD:

☐ Earth/Space Science ☐ Chemistry ☐ Environmental Science
☐ Life Science ☐ Physics

Indicator:

ENDURING UNDERSTANDING:

ESSENTIAL QUESTION:

SKILLS AND PROCESSES STANDARD:

Students will demonstrate the thinking and acting inherent in the practice of science.

***Scientific Inquiry*:** Demonstrates the ability to employ the language, instruments, methods, and materials of science.

Indicator:

***Critical Thinking*:** Demonstrates the thinking and acting inherent in the practice of science.

Indicator:

***Applications of Science*:** Demonstrates the ability to apply science information in various situations.

Indicator:

***Technology*:** Demonstrates the ability to use the principles of technology when exploring scientific concepts.

Indicator:

Well–Designed Science Investigation
Grades preK- 3

Questions – Who, what, why, where, when, how?

Testable Question(s) – A question that can be answered through an investigation.

Prediction – A statement about what may happen in the investigation based prior knowledge and/or evidence from previous investigations.

Well–Designed Procedure

Directions – A logical set of steps followed while completing the procedure.

Materials – All materials needed for completing the investigation are listed.

Variable(s) – Factors in an investigation that could affect the results. Controls and control groups are used for comparisons.

Data Collection – The results of the investigation usually recorded on a table, graph, chart, etc.

Repeated or Multiple Trials – Repeating the investigation several times and using the collected data for comparing results and creating reliability.

Conclusion

1. A statement about the trend (general drift, tendency, or direction of a set of data) from analyzing the data collected during the investigation (*form a conclusion*).
2. The closing paragraph of a report including at least the investigative question, hypothesis, and the explanation of the results (*write a conclusion*).

Communicate Results - Share your findings.

Communicate and Discuss Results

Share your findings with others for critical analysis (peer review, conference, presentation, etc.). Discuss conclusions with supporting evidence to identify more investigative questions.

Well–Designed Science Investigation
Grades 4 - 5

Testable Question(s) – A question that can be answered through an investigation.

Prediction – A statement about what may happen in the investigation based on prior knowledge and/or evidence from previous investigations.

Hypothesis – A testable explanation (if-then statement) based on an observation, experience, or scientific reason including the expected cause and effect in a given circumstance or situation.

Well–Designed Procedure

Directions – A logical set of steps followed while completing the procedure.

Materials – All materials needed for completing the investigation are listed.

Variable(s) – Factor in an investigation that could affect results. The independent variable is the one variable the investigator chooses to change. Controls and control groups are used for comparisons.

Data Collection – The results of the investigation usually recorded on a table, graph, chart, etc.

Repeated or Multiple Trials – Repeating the investigation several times and using the collected data for comparing results and creating reliability.

Conclusion

1. A statement about the trend (general drift, tendency, or direction of a set of data) from analyzing the data collected during the investigation (*form a conclusion*).
2. The closing paragraph of a report including at least the investigative question, hypothesis, and the explanation of the results (*write a conclusion*).

Communicate and Discuss Results

Share your findings with others for critical analysis (peer review, conference presentations, etc.). Discuss conclusions with supporting evidence to identify more investigative questions.