INTRODUCTION

At first glance, it might seem odd to have an English/Language Arts educator’s guide for a book of science experiments. Yet, the communication of methods, outcomes, and conclusions is a key aspect of science investigation. Indeed, the Common Core State Standards even include a section for grades 6+ focusing on ELA for disciplines including science and history.

Learning and practicing good communication—specifically writing and presenting skills—is necessary across all disciplines, including science. This teacher’s guide focuses on applying Common Core standards to discipline-specific communication.

As you conduct each activity, you may wish to consult the differentiation suggestions within the activity and the grade-specific standards found on pages 3-5 of this guide to tailor the activities to your students’ specific needs.

Note: See pages 150-153 in the book for science standards correlations.
Ready, Set, Investigate!

Divide students into small groups, and invite students to choose an experiment from the book, such as the Ghost Glove experiment on page 88. You may wish to preview the activities in the book and give students a list of which activities they can choose from.

Differentiation suggestion: For younger readers, you may wish to assign the same experiment to all small groups. For more advanced readers, you may wish to allow students to work in pairs or individually.

PREVIEW THE EXPERIMENT

Once students have decided on the experiment they would like to conduct, have students preview the activity. Encourage students to:
- preview the photos in the activity
- read the activity introduction, including the CONCEPTS and the introduction text
- read the HOW LONG IT TAKES, WHAT YOU NEED, and WHAT TO DO sections
- review the photos and reread WHAT TO DO text to note which steps are illustrated
- read the WHAT TO EXPECT and WHAT’S GOING ON? sections
- read any sidebars, quotes, or questions on the activity pages

You may also wish to encourage students to:
- identify words or terms in the WHAT TO DO, WHAT TO EXPECT, and WHAT’S GOING ON sections that are unfamiliar. Have students discuss the terms in their groups or look up the definitions. For more difficult words, you may wish to open the discussion to the class or consult individually with each group.
- discuss the WHAT TO EXPECT and WHAT’S GOING ON sections in their groups. Have students share what they already know about the topic, about previous experiences with the topic or outcome.
- summarize the WHAT TO EXPECT and WHAT’S GOING ON sections in their own words.

Remind students that they may not yet understand the information in the WHAT’S GOING ON section, and that’s ok!

PREPARE FOR THE EXPERIMENT

In their groups, have students each prepare their lab notebook. If you don’t use an established lab notebook in your classroom, have your students set up a document or photocopy the lab sheet on page 7 of this guide. You may wish to have students refer to pages 142-145 in the book for tips on setting up and using a lab notebook.

When students have finished preparing their lab book, be sure they have filled in everything except for the RESULTS and CONCLUSION sections. If students will need to bring materials from home, discuss with them what they will need to bring in and what you will supply. If you wish, photocopy the letter on page 11 of this guide and have students fill it out and bring it home to their parents.
NAME OF THE EXPERIMENT: Tell what the experiment is.

PEOPLE IN MY GROUP: Tell who will be working on the experiment with you. Don't forget your own name!

HYPOTHESIS: What I expect will happen when I do the experiment, such as what I will see or hear.

BACKGROUND: What I already know about this topic. Be sure it's relevant to the experiment!

MATERIALS: What I need for this experiment. Note that some of the materials are already listed in the book. Think about what other materials or workspaces you might need: a flat table? a sink?

PROCEDURE: What the steps are that I need to do. Most are listed already in the book. Make notes about what steps might take more than one person, need to happen at the same time, or any other special information.

RESULTS: Leave this area blank to fill in what you observe.

CONCLUSION: Tell what actually happened and why you think it happened. It's ok if your experiment doesn't have the same results the book said will happen! Take an educated guess as to why your experiment turned out as it did.
CONDUCT THE EXPERIMENT

Have students conduct their experiment in their groups. Be sure students follow all proper safety precautions, such as wearing goggles and gloves.

Remind students to take careful notes as to what they did and what they observed. You may also wish to invite students to take photos of each step and the results as they work with a digital camera to be used in their write-up. Older students may wish to take a digital video of their results.

If you wish, invite students to conduct their experiment three times, noting their method and observations each time.

DRAW CONCLUSIONS

After students have finished their experiment, encourage them to discuss their observations in their group. Have them refer again to the WHAT TO EXPECT and WHAT’S GOING ON sections in their book. Did students get the same results? Why or why not? As a group, have students write a conclusion for their experiment.

Differentiation suggestion: For younger readers, you may wish to join each group as they discuss their results to lead the discussion and help them understand the information in the WHAT’S GOING ON section. Encourage especially struggling students to rephrase the group’s conclusion in their own words to ensure understanding or clarify questions. For more advanced readers, have students write their own conclusion after their group discussion, and then share their conclusions with the group. Did everyone have the same response? Encourage groups to address any misconceptions or misunderstandings that come to light.

If more than one group did the same experiment, invite those groups to join together to discuss their observations and conclusions.
Write It Up!

Remind students that an essential part of science research is communicating results with other scientists, news organizations, and the public. Scientists often submit papers to scientific journals to share their results and conclusions. Sometimes they share their results online or in a news article. For each different audience, scientists must be sure to present information that is appropriate and useful for the readers.

In any write-up, topics should include: a title, a short description of the experiment and the results, background information the reader should know to understand the experiment, the methods used, the observations, and the conclusions that were drawn from the observations combined with the background knowledge.

To gather background information, invite students to write questions they have about what they observed. Be sure questions are direct and pointed so that they can be used as the basis for further research.

Give students time in the library or with other resources to further research the concepts behind their experiment. If needed, help students identify key words they can use as effective search terms on the Internet. Remind students to note their findings, including the source, carefully. They will need to cite their sources later on.

Differentiation suggestion: For younger readers, you may wish to have each student in the group research a different question related to their experiment. Then have students share their findings. For more advanced readers, have students research their questions individually. Then have students share and compare their findings.

When students feel they have gathered enough information to add to their understanding of the experiment, give them time to do a full write-up. Depending on your classroom objectives, you may wish to:

- refer to the grade-level Writing and Language standards on pages 1-5 of this guide to provide students with a structure and rubric for their write-ups;
- use your established school or classroom lab write-up approach; or
- refer to page 146 in the book for a suggested write-up approach.

Be sure to clearly establish the audience and purpose for students’ writing, such as a science night for parents or a science journal to be read by other students. If you wish, bring in examples of science journals to share with students.

As students write, remind them to use appropriate content vocabulary. Encourage students to use multimedia as appropriate to aid their write-up, including any photos they took during the experiment or drawing diagrams. Remind students to use information from their additional research and to cite the information properly.
Show and Tell!

Tell students that in addition to writing up their experiments, scientists often share their findings through presentations at conferences for other scientists, on TV or online for the general public, and through lectures sponsored by universities or other organizations. As with the write-up, the presentation style and information included needs to be appropriate for the audience.

With students, decide on a format for your presentations. As you discuss the options, be sure to talk about what kind of information would need to be presented for each audience. Possibilities include:

- a traveling lecture series to other classrooms
- TED Talk-style presentations for parents or other invited guests
- science conference-style presentations and panel discussions
- online videos to share information with the general public

When the class has decided on the format, lead a discussion about what information should be included in the presentation. Ask questions such as:

- What information do we want our audience to walk away with? How do we communicate that to them most effectively?
- How much background information will the audience already know? What background will we need to give them?
- What vocabulary does the audience already know? What words should we use, not use, or define for them?
- How much detail do we need to give the audience about our methods?
- What words can we use to describe our observations so that the audience can imagine what we saw, heard, smelled, etc.?

In their experiment small groups, give students time to prepare their presentations, including appropriate visuals and scripts. Encourage students to practice their presentations for other groups, making adjustments as necessary based on their test audience’s feedback.
If you wish, create a rubric from the Speaking and Listening and Language standards on page______ of this guide to help focus students’ feedback.

A sample grade 4 rubric might look like this:

<table>
<thead>
<tr>
<th></th>
<th>3 points</th>
<th>2 points</th>
<th>1 point</th>
</tr>
</thead>
<tbody>
<tr>
<td>INFORMATION</td>
<td>The speaker:</td>
<td>The speaker:</td>
<td>The speaker:</td>
</tr>
<tr>
<td></td>
<td>Shared facts, details, and main ideas that were appropriate for the intended audience. The facts were complete, and provided important, information and were shared in an organized way.</td>
<td>Shared facts, details, and main ideas that were mostly appropriate for the intended audience. Most of the facts were complete and provided important information. Some facts and details were not needed or were not organized.</td>
<td>Shared facts, details, and main ideas, but they were not appropriate for the intended audience. Few of the facts were complete or provided important information. The facts that were shared were not organized.</td>
</tr>
<tr>
<td>PRESENTATION</td>
<td>Made eye contact with the audience, spoke clearly, and talked at an understandable pace. The speaker used words that communicated the intended information clearly.</td>
<td>Made little eye contact with the audience, spoke somewhat clearly, and talked at an understandable pace. The speaker used some words that communicated the intended information clearly.</td>
<td>Did not make eye contact with the audience, spoke too quietly, and talked too fast or slow. The speaker did not use words that communicated the intended information clearly.</td>
</tr>
<tr>
<td>VISUALS</td>
<td>Displayed visuals, including photos, audio, or other multimedia to support the ideas he or she was presenting.</td>
<td>Displayed some visuals, including photos, audio, or other multimedia. Some supported the ideas he or she was presenting, but some did not.</td>
<td>Did not display any visuals or displayed visuals that did not support the ideas he or she was presenting.</td>
</tr>
</tbody>
</table>
Dear Parent,

On ______________________________ your student will be conducting the National Geographic Kids Try This! experiment ________________________________.

For this experiment, your student will need to bring the following from home:

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>ITEM</th>
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<tbody>
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We can’t wait to get experimenting!
Common Core Standards

The following Common Core standards are addressed in these teaching notes:

(W = Writing; SL = Speaking and Listening; L = Language; WHIST = Writing for Technical Subjects)

Grade 4

W.4.2:
Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
   a. Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.
   b. Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.
   c. Link ideas within categories of information using words and phrases (e.g., another, for example, also, because).
   d. Use precise language and domain-specific vocabulary to inform about or explain the topic.
   e. Provide a concluding statement or section related to the information or explanation presented.

W.4.4:
Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

W.4.6:
With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of one page in a single sitting.

W.4.7:
Conduct short research projects that build knowledge through investigation of different aspects of a topic.

W.4.8:
Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

W.4.10:
Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
SL.4.4: Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

SL.4.5: Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes.

L.4.3: Use knowledge of language and its conventions when writing, speaking, reading, or listening.
   a. Choose words and phrases to convey ideas precisely.
   b. Choose punctuation for effect.
   c. Differentiate between contexts that call for formal English (e.g., presenting ideas) and situations where informal discourse is appropriate (e.g., small-group discussion).

L.4.6: Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal precise actions, emotions, or states of being (e.g., quizzed, whined, stammered) and that are basic to a particular topic (e.g., wildlife, conservation, and endangered when discussing animal preservation).

Grade 5

W.5.2: Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
   a. Introduce a topic clearly, provide a general observation and focus, and group related information logically; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.
   b. Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.
   c. Link ideas within and across categories of information using words, phrases, and clauses (e.g., in contrast, especially).
   d. Use precise language and domain-specific vocabulary to inform about or explain the topic.
   e. Provide a concluding statement or section related to the information or explanation presented.

W.5.4: Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

W.5.6: With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of two pages in a single sitting.
W.5.7: Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

W.5.8: Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

W.5.10: Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

SL.5.4: Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

SL.5.5: Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.

L.5.3: Use knowledge of language and its conventions when writing, speaking, reading, or listening.
   a. Expand, combine, and reduce sentences for meaning, reader/listener interest, and style.

L.5.6: Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal contrast, addition, and other logical relationships (e.g., however, although, nevertheless, similarly, moreover, in addition).

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**BONUS:**

What’s a replication? It’s a copy. This experiment shows how to replicate a sample of microbes. Compare the responses of “twin” yeast colonies to different conditions. What you need: ¼ teaspoon (1 mL) active baking yeast, water, eyedropper, four agar petri dishes (these are shallow plastic or glass petri dishes that have a layer of agar, a material that yeast and bacteria can live on, available from a science supply store), two or three beads (these allow you to mix the yeast without touching the agar), spoon or tweezers, flat-bottomed jar, 8- to 12-inch (20- to 30-cm) square of velveteen, rubber band, optional: magnifying lens, microscope.

**HOW LONG IT TAKES**
two to three days

A variation on this experiment focuses on bees. First figure out what colors your bees prefer by following the same steps you followed for butterflies. Then try testing them using symbols. Use jar lids that are painted white, and use a black permanent marker to draw a symbol on each: a circle, a star, a triangle. Put nectar in one jar—the one in the middle, with the star, say. After bees have figured out where the nectar is, remove the bottom part of the jar, and just hang the lid there. Which lid draws visits from the most bees? Will it still be the one with the star?

FAIL! In one sense, this experiment didn’t work for us. Butterflies have been sparse in my garden this spring and summer—even with a gorgeous new butterfly bush to attract them. We didn’t see a single butterfly on our feeders, but we saw a hummingbird and lots of bees. So we switched to the bonus and found that most bees went to the yellow or red jar, not the white one—with or without a star.

**TRY THIS!**
Grade 6

SL.6.4:
Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.

SL.6.5:
Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.

L.6.3:
Use knowledge of language and its conventions when writing, speaking, reading, or listening.
   a. Vary sentence patterns for meaning, reader/listener interest, and style.
   b. Maintain consistency in style and tone.

Grade 7

SL.7.4:
Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.

SL.7.5:
Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.

L.7.3:
Use knowledge of language and its conventions when writing, speaking, reading, or listening. Choose language that expresses ideas precisely and concisely, recognizing and eliminating wordiness and redundancy.

WHAT TO EXPECT
People will probably be pretty good judges of real and fake smiles.

WHAT’S GOING ON?
Researchers have learned that a facial expression is actually made up of microexpressions, fleeting glimpses of a subject’s true feelings. A still photograph may provide a quick, focused look that clues you in to how genuine each smile is.

Smiles: fake or real?

WHAT YOU NEED
- camera (the one on a smartphone is fine)
- computer or computer tablet to show your photographs on
- optional: You can also print out photographs and show the prints to your subjects.
- three actors
- as many subjects as you wish
- optional: a partner to film while you interview your subjects.

HOW LONG IT TAKES
two or more days

Phony Smiles

Day One:
1. Prepare your photographs.
   - Photograph each actor separately. For each actor, do the following:
     a. Select three jokes. Try to find one that is really hilarious, one that’s kind of lame, and one that is somewhere in the middle.
     b. Take four photographs of each actor, one of his response to each of the three jokes, plus one more. For the last photograph, ask the actor to smile as if he were hearing a hilarious joke.

Day Two:
2. You’ll have 12 photographs, four for each of your three actors. Show them to your subjects. Ask them to guess real (R) and fake (F) smiles for each actor. The score sheet might look like this when filled in. The response column is for the subject’s assessment of the actor’s four smiles.

How often do you really smile, and how often do you fake it? Often enough to be able to tell the difference when other people do it? This study lets you see how well people read others.

Our Jokes

How does the man in the moon cut his hair? Eclipse it.
Why did the cookie cry? Because his mother was a wafer so long.
Why are all the frogs around here dead? Because they keep croaking.
What happened when the butcher backed into his meat grinder? He got a little behind in his work.*
What did one hat say to the other? You stay here. I’ll go on ahead.
What’s brown and sticky? A stick.

* Nobody laughed at this joke.

How often do you really smile, and how often do you fake it? Often enough to be able to tell the difference when other people do it? This study lets you see how well people read others.

Researchers trying to get better at reading facial expressions sometimes watch video with the sound off. Why would this help?

Are some people better than others at fake smiles?

How about those jokes? How can you explain why different people respond to them in different ways? Did your actors agree with you about which joke was funniest?

Question this!

“This is hard! Is a laugh the same as a smile?”
—Bailey

People and Other Animals

Interpretation, observation, technology, behavior

Concepts

What to Do

Try This!

Try This!
Grade 8

SL.8.4:
Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

SL.8.5:
Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

L.8.3:
Use knowledge of language and its conventions when writing, speaking, reading, or listening. Use verbs in the active and passive voice and in the conditional and subjunctive mood to achieve particular effects (e.g., emphasizing the actor or the action; expressing uncertainty or describing a state contrary to fact).

Grades 6–8

WHIST.6–8.1:
Write arguments focused on discipline-specific content.
  a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
  b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
  c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
  d. Establish and maintain a formal style.
  e. Provide a concluding statement or section that follows from and supports the argument presented.
  f. Provide a concluding statement or section that follows from and supports the information or explanation presented.

WHIST.6–8.2:
Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
  a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.
  b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
  c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
  d. Use precise language and domain-specific vocabulary to inform about or explain the topic.
  e. Establish and maintain a formal style and objective tone.
WHIST.6-8.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHIST.6-8.6: Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

W.6-8.7: Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

W.6-8.8: Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

WHIST.6-8.9: Draw evidence from informational texts to support analysis reflection and research.

WHIST.6-8.10: Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
HANDS-DOWN HANDS-ON FUN!

TRY THIS!

50 Insanely Fascinating Experiments!
Toothbrush robots dancing Ooblecks, rain clouds in a bottle! Show your students the fun side of science. Includes: step-by-step instructions, science fair tips and tricks, and National Science Standards correlations for each project.

What’s Up With the Weather?
Black ice, white outs, droughts, derechos, heat waves, and hurricanes! Get in on the science behind today’s wild weather. Includes: expert safety tips, first-hand accounts, cutting-edge science, and “you are there” photos.

What’s Up With the Weather?

“STEM-TASTIC” NEW TITLES!

50 Insanely Fascinating Experiments!

Calling All Junior Foodies!
Join Master Chef and NG Explorer Barton Seaver on a year-round adventure to explore the science, sustainability, and creativity behind delicious food. Includes: 50 recipes, oodles of activities, kitchen basics, and fun food facts.

“Hands-on kids will find much to appreciate in this compendium of fun and food with an Earth-friendly focus.”—Kirkus

Available at ngchildrensbooks.org or from your library wholesaler. Call 1.877.873.6846 or fax 1.515.699.3738