Hamilton County Secondary Science District Professional Development

Middle School Science

Tier I, Part 2

Tuesday, January 7, 2014

Reading Standards for Literacy in Science and Technical Subjects 6–12

RST

Grades 6–8 students:	Grades 9–10 students:	Grades 11–12 students:
Key Ideas and Details		
1. Cite specific textual evidence to support analysis of science and technical texts.	1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.	1. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.	2. Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.	2. Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.	3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.	3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
Craft and Structure		
4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6–8 texts and topics.*	4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics.*	4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics.*
5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.	5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).	5. Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.	6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.	6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.
Integration of Knowledge and Ideas		
7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).	7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
8. Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.	8. Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.	8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.	9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.	9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Range of Reading and Level of Text Complexity		
10. By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text	10. By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text	10. By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text

College and Career Readiness Anchor Standards for Writing

The grades 6–12 standards on the following pages define what students should understand and be able to do by the end of each grade span. They correspond to the College and Career Readiness (CCR) anchor standards below by number. The CCR and grade-specific standards are necessary complements—the former providing broad standards, the latter providing additional specificity—that together define the skills and understandings that all students must demonstrate.

Text Types and Purposes*

1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details and well-structured event sequences.

Production and Distribution of Writing

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.
6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

Research to Build and Present Knowledge

7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

Range of Writing

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 tasks, purposes, and audiences.

*These broad types of writing include many subgenres. See Appendix A for definitions of key writing types.

Note on range and content of student writing

For students, writing is a key means of asserting and defending claims, showing what they know about a subject, and conveying what they have experienced, imagined, thought, and felt. To be college and career ready writers, students must take task, purpose, and audience into careful consideration, choosing words, information, structures, and formats deliberately. They need to be able to use technology strategically when creating, refining, and collaborating on writing. They have to become adept at gathering information, evaluating sources, and citing material accurately, reporting findings from their research and analysis of sources in a clear and cogent manner. They must have the flexibility, concentration, and fluency to produce high-quality first-draft text under a tight deadline and the capacity to revisit and make improvements to a piece of writing over multiple drafts when circumstances encourage or require it. To meet these goals, students must devote significant time and effort to writing, producing numerous pieces over short and long time frames throughout the year.

Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6–12

WHST

The standards below begin at grade 6; standards for K–5 writing in history/social studies, science, and technical subjects are integrated into the K–5 Writing standards. The CCR anchor standards and high school standards in literacy work in tandem to define college and career readiness expectations—the former providing broad standards, the latter providing additional specificity.

Grades 6–8 students:	Grades 9–10 students:	Grades 11–12 students:
Text Types and Purposes		
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.	1. Write arguments focused on *discipline-specific content.* a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence. b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns. c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. e. Provide a concluding statement or section that follows from or supports the argument presented.	1. Write arguments focused on *discipline-specific content.* a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence. b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases. c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. e. Provide a concluding statement or section that follows from or supports the argument presented.

Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6–12

WHST

Grades 6–8 students:	Grades 9–10 students:	Grades 11–12 students:
Text Types and Purposes (continued)		
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. f. Provide a concluding statement or section that follows from and supports the information or explanation presented.	2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. a. Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension. b. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic. c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts. d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers. e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).	2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension. b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic. c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts. d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers. e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).
3. (See note; not applicable as a separate requirement)	3. (See note; not applicable as a separate requirement)	3. (See note; not applicable as a separate requirement)

Note: Students' narrative skills continue to grow in these grades. The Standards require that students be able to incorporate narrative elements effectively into arguments and informative/explanatory texts. In history/social studies, students must be able to incorporate narrative accounts into their analyses of individuals or events of historical import. In science and technical subjects, students must be able to write precise enough descriptions of the step-by-step procedures they use in their investigations or technical work that others can replicate them and (possibly) reach the same results.

Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6–12

WHST

Grades 6–8 students:	Grades 9–10 students:	Grades 11–12 students:
Production and Distribution of Writing		
4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.	5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.	5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.	6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.	6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
Research to Build and Present Knowledge		
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.	7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.	7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
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.	8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.	8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
9. Draw evidence from informational texts to support analysis reflection, and research.	9. Draw evidence from informational texts to support analysis, reflection, and research.	9. Draw evidence from informational texts to support analysis, reflection, and research.
Range of Writing		
10. Write routinely over extended time frames (time for 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.	10. Write routinely over extended time frames (time for 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.	10. Write routinely over extended time frames (time for 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.

Task Sheet

Questions, Tasks, and Talk

Part I—Publishers' Criteria

1. Individually read *Revised Publishers' Criteria for the Common Core State Standards in English Language Arts and Literacy, Grades 3-12* sections II and III (Packet 3, pink, pages 16-18).
2. Discuss with a partner what the authors mean by
   a. high-quality text-dependent questions and tasks and
   b. academic (and domain-specific) vocabulary. For more information about tier vocabulary, see Packet 3, blue, pages 32-35.
3. Be prepared to share your thoughts with the whole group.

Part II—Speaking and Listening: The Key Role of Evidence

1. Watch the video. As you watch, listen for insights that Susan Pimentel shares about speaking and listening.
2. With a partner, discuss benefits of speaking and listening in science. Compare and discuss your analysis of each text.

Part III—Preparing for Talk

1. Take a few minutes to collect your thoughts and note (from the text and video) what the authors say about the role of questions, tasks, and talk in learning.
2. Be prepared to cite evidence as you engage in the upcoming discussion.

Part IV—Whole Group Discussion

1. Engage in a discussion around what the authors say about the role of questions, tasks, and talk in learning.
2. Cite evidence as you engage in the discussion.

Standards might require students to compare their own experimental results to results about which they have read, and integrate information from video or other media with what they learn from text.

II. Questions and Tasks

1. **High-Quality Text-Dependent Questions and Tasks:** Among the highest priorities of the Common Core State Standards is that students be able to read closely and gain knowledge from texts.

   A. ***Curricula provide opportunities for students to build knowledge through close reading of a specific text or texts.*** As in the ELA Reading Standards, the large majority of the Literacy Standards for History/Social Studies, Science, and Technical Subjects require that aligned curricula include high-quality questions and tasks that are text dependent. Such questions should encourage students to "read like a detective" by prompting relevant and central inquiries into the meaning of the source material that can be answered only through close attention to the text. The Literacy Standards therefore require students to demonstrate their ability to follow the details of what is explicitly stated, make valid inferences that logically follow from what is stated, and draw knowledge from the text. Student background knowledge and experiences can illuminate the reading but should not replace attention to the text itself.

   Materials should design opportunities for close reading of selected passages from extended or longer texts and create a series of questions that demonstrate how close attention to those passages allows students to gather evidence and knowledge from the text. This text-dependent approach can and should be applied to building knowledge from the comparison and synthesis of multiple sources in science and history. (It bears noting that science includes many non-text sources such as experiments, observations, and discourse around these scientific activities.) Once each source is read and understood carefully, attention should be given to integrating what students have just read with what they have read and learned previously. How does what they have just read compare to what they have learned before? Drawing upon relevant prior knowledge, how does the text expand or challenge that knowledge? As students apply knowledge and concepts gained through reading to build a more coherent understanding of a subject, productive connections and comparisons across texts and ideas should bring students back to careful reading of specific texts. Gathering text evidence is equally crucial when dealing with larger volumes of text for research or other purposes.

   B. ***All activities involving text require that students demonstrate increasing mastery of evidence drawn from text.*** The Common Core State Standards require students to become more adept at drawing evidence from the text and explaining that evidence orally and in writing. Aligned curriculum materials should include explicit models of a range of high-quality evidence-based answers to questions — samples of proficient student responses — about specific texts from each grade. Questions should require students to demonstrate that they follow the details of what is explicitly stated and are able to make nontrivial inferences beyond what is explicitly stated in the text regarding what logically follows from the evidence in the text. Gathering text evidence

is equally crucial when dealing with larger volumes of text for research or other purposes.

C. ***Questions and tasks require careful comprehension of the text before asking for further evaluation and interpretation.*** The Common Core State Standards call for students to demonstrate a careful understanding of what they read before engaging their opinions, appraisals, or interpretations. Aligned materials should therefore require students to demonstrate that they have followed the details and logic of an author's argument before they are asked to evaluate the thesis or compare the thesis to others. Before students are asked to go beyond the text and apply their learning, they should demonstrate their grasp of the specific ideas and details of the text.

2. **Cultivating Students' Ability To Read Complex Texts Independently:** Another key priority of the Common Core State Standards is a requirement that students be able to demonstrate their independent capacity to read at the appropriate level of complexity and depth. Aligned materials therefore should guide teachers to provide scaffolding to students but also gradually remove those supports by including tasks that require students to demonstrate their independent capacity to read and write in every domain at the appropriate level of complexity and sophistication.

   A. ***Scaffolds enable all students to experience rather than avoid the complexity of the text.*** Many students will need careful instruction — including effective scaffolding — to enable them to read at the level of text complexity required by the Common Core State Standards. However, the scaffolding should not preempt or replace the text by translating its contents for students or telling students what they are going to learn in advance of reading the text; the scaffolding should not become an alternate, simpler source of information that diminishes the need for students to read the text itself carefully. Effective scaffolding aligned with the standards should result in the reader encountering the text on its own terms, with instructions providing helpful directions that focus students on the text. Follow-up support should guide readers in the use of appropriate strategies and habits when encountering places in the text where they might struggle. When productive struggle with the text is exhausted, questions rather than explanations can help focus the student's attention on key phrases and statements in the text or on the organization of ideas in the paragraph or the work as a whole.

      When necessary, extra textual scaffolding prior to and during the first read should focus on words and concepts that are essential to a basic understanding and that students are not likely to know or be able to determine from context. Supports should be designed to serve a wide range of readers, including those English language learners and other students who are especially challenged by the complex text before them. Texts and the discussion questions should be selected and ordered so that they bootstrap onto each other and promote deep thinking and substantive engagement with the text.

   B. ***Design for whole-group, small-group, and individual instruction cultivates student responsibility and independence.*** It is essential that questions, tasks, and activities are designed to ensure that all students are actively engaged in reading. Materials should

provide opportunities for students to participate in real, substantive discussions that require them to respond directly to the ideas of their peers. Teachers can begin by asking the kind and level of questions appropriate to the reading and then students should be prompted to ask high-quality questions about what they are reading to further comprehension and analysis. Writing about text is also an effective way to elicit this active engagement. Students should have opportunities to use writing to clarify, examine, and organize their own thinking, so reading materials should provide effective ongoing prompts for students to analyze texts in writing. Instructional materials should be designed to devote sufficient time in class to students encountering text without scaffolding, as they often will in college- and career-ready environments. A significant portion of the time spent with each text should provide opportunities for students to work independently within and outside of class on analyzing the text because this independent analysis is required by the standards.

III. Academic (and Domain-Specific) Vocabulary

Materials focus on academic vocabulary prevalent in complex texts throughout reading, writing, listening, and speaking instruction. The Common Core State Standards require a focus on academic vocabulary that is prevalent in more complex texts as well as domain-specific words. Academic vocabulary (described in more detail as Tier 2 words in Appendix A of the Common Core State Standards) includes those words that readers will find in all types of complex texts from different disciplines. Materials aligned with the Common Core State Standards should help students acquire knowledge of general academic vocabulary in addition to domain-specific words because these words will help students access a range of complex texts in diverse subject areas.

Aligned materials should guide students to gather as much as they can about the meaning of these words from the context of how they are being used in the text, while offering support for vocabulary when students are not likely to be able to figure out their meanings from the text alone. As the meanings of words vary with the context, the more varied the context provided to teach the meaning of a word is, the more effective the results will be (e.g., a state was admitted to the Union; he admitted his errors; admission was too expensive). In alignment with the standards, materials should also require students to explain the impact of specific word choices on the text. Materials and activities should also provide ample opportunities for students to practice the use of academic vocabulary in their speaking and writing.

Some students, including some English language learners, will also need support in mastering high-frequency words that are not Tier 2 words but are essential to reading grade-level text. Materials should therefore offer the resources necessary for supporting students who are developing knowledge of high-frequency words. Since teachers will often not have the time to teach explicitly all of the high-frequency words required, materials should make it possible for students to learn the words' meanings on their own, providing such things as student-friendly definitions for high-frequency words whose meanings cannot be inferred from the context. It also can be useful for English language learners to highlight explicitly and link cognates of key words with other languages.

An Overview of Accountable Talk® Practices

An excerpt from IFL's *Accountable Talk® Sourcebook: For Classroom Conversation That Works* with updated sections by Sarah Michaels and Mary Catherine O'Connor.

1. Why Talk? How Might Talk Promote Learning?

We have achieved a national consensus regarding the importance of academically productive talk in school. We are told it is important to promote talk in all instructional domains — at all grade levels, across all subject areas. All of the major teacher organizations and all of the recent National Research Council consensus reports highlight and emphasize the need to involve students actively in "communication" about their thinking and investigations, encouraging students to use evidence to support their claims, conjectures, predictions, and explanations (reports from NCTM, NSTA, NRC). Why this emphasis on talk? How might talk promote learning? What kind of talk might promote learning?

ACADEMIC BENEFITS OF TALK

There are many ways in which talk promotes learning in school. Some of the benefits relate directly to learning academic content.

Talk—discussion, theorizing, student presentations, and argument—helps make thinking visible and serves as a window on student understanding and learning.

If students talk about the content they're studying, teachers can see what they don't understand...and what they do understand. And students, themselves, may realize what they don't understand and what they do understand. In this way, talk about academic content helps teachers and students "take stock" of where they are and assess on-going learning, so that instruction can be tailored to build on students' current understandings and advance their thinking in productive ways.

Talk supports robust learning by boosting memory.

Talk is a rich source of information, and plays a part in developing almost every memory we form. By hearing about (and talking about) concepts, procedures, representations, and data, our memories have more to work with than from simply reading textbooks and listening to lectures. Talk provides food for thought. Humans learn by observing, listening, and doing. If students listen to other students talk about reasoning and problem solving, it gives them more to think about. By hearing about how others think, and by listening to what others say, our view of the problem at hand expands. By talking about and hearing others talk about academic content, we begin to see these concepts, procedures, and representations from more angles, and make links to other concepts and meanings we already have. This helps us remember new ideas, terms, or concepts, and develop a richer set of associations with them, so that we can remember and use them in new contexts.

Talk supports language development.

When talk is used intensively in classes, students may get a richer sense of what words and phrases mean, and when and how to use them. By using academic terminology,

students build their own ability to remember new "ways with words" and to participate actively and thoughtfully when others use them.

Productive talk helps students to develop their ability to reason well, using evidence.

Children come to school as adept language users, able to think abstractly, and argue for what they think is right. But not all children have been exposed to the kind of reasoning and explaining that is valued in school and later in public life. This kind of talk requires that speakers explicate their thinking clearly so that others can hear and understand their ideas and that they use evidence that others have access to in order to support their claims. Engaging in talk in school where students are encouraged to explain their ideas and support their ideas with evidence gives students practice doing this: explicating claims, providing evidence, and linking their claims and evidence so that others can see that their evidence is relevant and credible. With guided practice, students' logical and evidence-based reasoning improves. This improvement in reasoning with evidence is also reflected in students' writing and performance on standardized tests.

Productive talk apprentices students to practice in the disciplines.

Different disciplines have their own norms and valued forms of talk, presentation, and writing. The disciplines differ with respect to what counts as evidence, and how to organize an argument or procedure so that others in the discipline recognize it as cogent and credible. Norms for evidence in history — for example, the importance of sourcing and corroboration in evaluating primary source documents — differ from norms of evidence and standards of reasoning in a Language Arts discussion about an interpretation in a short story. Similarly, different kinds of evidence are required and valued in explaining a conjecture, or generating a proof in mathematics as opposed to explaining a phenomenon in science. Even though both mathematics and science require evidence and logical reasoning, it is sometimes said that mathematics is about managing certainty while science is about managing uncertainty! The point here is that all academic domains require argument with warranted evidence, but the nature of the evidence and goals of reasoning and forms of persuasion differ.

SOCIAL BENEFITS OF ACADEMICALLY PRODUCTIVE TALK

In addition to these academic or content-related learning benefits, talk is also important in helping students develop socially, becoming productive and collaborative members of a group.

Students learn to listen carefully to their peers, take their ideas seriously, and challenge ideas respectfully and constructively.

As students participating in discussions are guided to listen attentively (indeed, listen hard enough so that they could repeat what another classmate has just said), they learn the practices and habits of mind of good "colleagues" and collaborators. They take one another seriously as thinkers, and evaluate the content of others' contributions, challenging ideas not people. Students learn to take their turns, to wait patiently while others work to explicate their ideas, and they learn to work hard at explaining their thinking so that others can hear and understand what they're saying. This takes time, practice, and effort, but students become skilled at presenting complex ideas so that others can build on them and improve them. These social skills are, of course, also intricately related to learning. A group of skillful, engaged, and respectful communicators become better learners over time. It takes time to induct students into this kind of "talk culture," but once developed, the entire group learns more effectively and efficiently.

Students learn that thinking and talking about complex ideas takes time and effort, but that they can do it.

Over time, this builds confidence in one's ability to explain one's ideas, to figure things out with others, and a willingness to persist in the face of intellectual challenges. Students learn that it pays to put in effort, to ask questions when something is unclear, and that everyone can get smarter with effort and practice. These ideas about effort help them become better learners over time.

Students learn to take risks and are motivated to go public with their ideas, even if they are not sure that they are correct.

When students believe that others are interested in their ideas, and believe that reasoning with evidence is more important than simply having the correct answer, they become motivated to engage in exploratory reasoning talk. They are willing to try out ideas before they are fully formed, so that others can hear them and think with them. They become motivated to hear others' views so that they can, in turn, think with them. This promotes a classroom culture that values effort (over ability), and students come to feel as if they have a stake in the conversation, and are legitimate contributors and "players" in the game. Students begin to realize that everyone (they as well as their peers) can get smarter with effort, and students begin to speak up when they don't understand something. This, in turn, motivates others to explain their thinking more clearly, so there is a spiraling effect in which additional effort increases everyone's motivation to participate, think hard, and take risks. The group effect makes for productive learning and benefits individuals.

2. What Talk Is Not Academically Productive?

All of the previous material on how talk supports learning assumes that the talk is what we call "academically productive" talk or *Accountable Talk* practices. But what does that mean? What are the characteristics of talk that promotes learning? Isn't all talk academically productive? Unfortunately there is a great deal of research on classroom talk that robustly and reliably demonstrates that the answer to this question is no! Not all talk is academically productive.

There is an extensive research base on classroom discourse which examines the nature of classroom talk and the relationship between talk and learning in school. Researchers and experienced classroom teachers alike know that simply getting students to talk out loud or talk to one another does not necessarily lead to learning. What matters is what students are talking about and how they talk. When students are merely chatting about social events and personal matters—or if they are simply going through the motions of discussion without really working on a learning problem—the talk distracts from their learning rather than advancing it.

Teachers in the US, at all grade levels (Pre-K through university) have a hard time leading productive discussions, in which students explicate their positions with evidence, and other students build on or critique these ideas, and the group, together, develops complex conceptual understanding, interpretations or explanations, bolstered with evidence. Teachers tend, instead, to do something we might call "group recitation." Extensive research shows that this is the most common (default) pattern of talk in classrooms throughout the country, and it's a very familiar scene: The teacher asks a question, (typically a question the teacher knows the answer to), a student replies (usually a short reply) and the teacher evaluates, (saying, "Right," or "not quite," or "who else has an idea?"). Some people have talked about this as a teacher lecture elicited out of the mouths of the students.

This is often called the IRE pattern:

I – Initiation

R – Response

E – Evaluation

(Chances are great that this is the kind of classroom talk most teachers experienced when they were students.) Many have noted that the recitation, or the IRE, can be very helpful for reviewing material, or checking to see what the students recall, and it does give the teacher a great deal of control over the topic and who speaks.

However, the IRE pattern does not support complex reasoning, or the building and weighing of arguments. It emphasizes correctness over reasoning, and once the correct answer is offered, the conversation is closed down, rather than opened up. The teacher then moves on to a different question and a different student. The conversation proceeds with the teacher holding a series of exchanges with individual students — Teacher-Student-Teacher-Student-Teacher-Student — without cross-talk among the students in which they consider others' ideas, agree or disagree, and explain their own reasoning. Indeed, in recitation, there is rarely any overt linkage between the ideas or answers of different students. Moreover, within each IRE segment, the teacher is always positioned as the final authority, the one who HAS the answer. The student is positioned as the "getter" of the answer in the teacher's head. Students are either correct or incorrect and thus publicly shown to be either right or wrong (which often is interpreted as either smart or not smart). Typically only a few students (and usually the same few) students volunteer to take a turn. Because of the emphasis on correctness over reasoning, the IRE pattern has been linked in research on student motivation to "performance goals" (whereby students act in such a way as to look smart) rather than to "learning goals" (whereby students participate so as to really understand and learn).

In short, the IRE format doesn't create a classroom culture that promotes risk-taking or effort, where students work hard at explicating their ideas, at requesting clarification of others, responding to or building upon the ideas of others, or building and weighing complex arguments with evidence.

While the IRE is often used in reviewing material (such as what was done the day before) or checking to see what students recall about a topic or remind them what they have already learned it, is not the most effective way to do this. Students who do not feel confident do not participate, so their understanding is not assessed. Students who give correct answers might have serious misconceptions that are never voiced because their responses are not probed more deeply. Students, especially older students, who are independent-minded and self-respecting, often withdraw from talk in which they feel they are being "used" to make a teacher's point, or appear as "model students" in the eyes of the rest of the class. Finally, IRE talk reveals answers but it does not reveal and recall students' knowledge nearly as well as more open-ended talk in which students draw upon their prior knowledge to offer predictions or conclusions about a new problem. As Bloom notes in his Taxonomy, lower-level factual knowledge is involved in, and therefore revealed in, higher-level thinking activities.

Another common form of talk is "sharing" or collecting students' evaluative opinions or personal reminiscences related to a topic. Often the goal is the worthwhile one of helping students connect with prior knowledge or promoting students' understanding of each other's background and perspectives. While this kind of talk can be useful, it is not as academically productive as the kinds of discussions featuring *Accountable Talk* practices that we will focus on here. This kind of talk typically begins with teachers asking students what experience they have had with a

topic in general. As students respond, the teacher simply encourages more responses, since there is no logical reason to ask students to clarify or support their accounts of their own opinions or experiences. Sharing is not really discussion, because there is no reasonable way students can challenge, support, or build on each other's opinions; each opinion is equally valid as an expression of the individual's perspective. Even when students go off topic, the teacher can hardly focus the talk without contravening the basic premise, that whatever students say is of value. The sharing session is used by many teachers to "get students talking," but while younger students often participate enthusiastically, older students may feel wary or dismissive of this kind of talk.

As alternatives to whole group recitation or "sharing" of ideas, teachers rely heavily on group work. In unsupervised groups, students are often off task, unproductive, or not nice to one another. Many group tasks are not ideal for groups. The high status students often dominate.

3. What Are *Accountable Talk* Practices? What Do They Look And Sound Like?

In contrast to the IRE recitation format, anything-goes "sharing ideas" talk, or unsupervised (and often dysfunctional) group work, academically productive talk looks quite different. Academically productive talk — or *Accountable Talk* practices — is talk in which students exert effort to explain their thinking with evidence and to listen and respond constructively to others' ideas, in order to make progress in solving a challenging problem, interpreting a text, or conducting an investigation. It is talk that promotes learning.

For classroom talk to promote learning it must be accountable: to the learning community, to accurate and appropriate knowledge, and to rigorous thinking. *Accountable Talk* practices involves talk that seriously responds to and further develops what others in the group have said. It puts forth and demands knowledge that is accurate and relevant to the issue under discussion. This kind of academically productive talk uses evidence appropriate to the discipline (e.g., proofs in mathematics, data from investigations in science, textual references in literature, documentary sources in history) and follows established norms of good reasoning. It sharpens students' thinking by reinforcing their ability to use and create knowledge.

Accountable Talk conversations do not spring spontaneously from students' mouths. It takes time and effort to create a classroom environment in which this kind of talk is a valued norm. It requires teachers to guide and scaffold student participation. Teachers create the norms and skills of academically productive talk in their classrooms by modeling appropriate forms of discussion and by questioning, probing, and leading conversations. For example, teachers may press for clarification and explanation, require justifications of proposals and challenges, recognize and challenge misconceptions, demand evidence for claims and arguments, or interpret and "revoice" students' statements. Over time, students are expected to carry out each of these conversational "moves" themselves in peer discussions. Once the norms for conversation within the classroom have been established, *Accountable Talk* practices are jointly constructed by teachers and students, working together towards rigorous academic purposes in a thinking curriculum.

Conversations in the classroom can take a wide variety of forms: whole class discussion, small group work, partner talk, peer or teacher conferences. But regardless of which form is used, talk should be accountable to the learning community, to knowledge and the standards of evidence that are appropriate for the subject, and to generally accepted standards of reasoning. These forms of accountability can be seen in what the students say and in what the teacher says. They are supported by classroom norms and recurring activities as well as by carefully designed tasks.

All students have a right to engage in *Accountable Talk* practices, not just the "best and brightest," nor only those who are struggling in school. It is not something that should be limited to special times of the day, or to special groups of students. And we should expect to find *Accountable Talk* practices across all grade levels and in all subject areas.

The process of Socializing Intelligence (one of the Institute for Learning's nine Principles of Learning) takes place in and through talk. Intelligence is much more than an innate ability to think quickly and stockpile bits of information. Intelligence is a set of problem-solving and reasoning capabilities along with the habits of mind that lead one to use those capabilities regularly. It is also a set of beliefs about one's right and obligation to understand and make sense of the world and one's capacity to figure things out over time. Intelligent habits of mind are learned through daily expectations placed on the learner. By calling on students to use the skills of intelligent thinking—and by holding them responsible for doing so—educators can teach intelligence.

Accountability to the Learning Community

When classroom talk is accountable to the learning community, students listen to one another, not just obediently keeping quiet until it is their turn to take the floor, but attending carefully so that they can use and build on one another's ideas. Students and teachers paraphrase and expand upon one another's contributions. If speakers aren't sure they understood what someone else said, they make an effort to clarify. They disagree respectfully, challenging a claim, not the person who made it. Students move the argument forward, sometimes with the teacher's help, sometimes on their own.

Obviously, this kind of talk calls for a certain amount of patience, restraint, and focused effort on the part of students and teachers alike. A youngster who experiences a blinding insight in the middle of a discussion may need to be reminded not to trample all over her classmates' talk in her eagerness to express her thoughts. An adolescent trying out a new idea in front of his peers may need encouragement to articulate his position. And educators, with limited time to help their students reach the standards, must skillfully balance unwavering attention to their learning goals with moments where a discussion "takes a detour." There are times when something unplanned but significant happens: an unusual comment by a student, evidence of divergent understandings of a particular term, an unexpected outcome of an experiment. Teachers must make on-the-spot judgments about whether to maintain the focus and coherence of the lesson as planned, or to take advantage of a "teachable moment." They must weigh the costs and benefits of shifting course in mid-stream. They must find ways to balance the challenge of keeping the talk focused and academically rigorous with the challenge of including all members of the classroom community as valued, engaged participants, attending to differences in students' cultural and linguistic backgrounds, previous academic preparation, and interests. Often, those who do not teach fail to realize the complexity of what goes on in the classroom, and thus underestimate the accomplishments of teachers who skillfully use academically productive talk in their classrooms.

How can we tell whether the talk in a classroom is accountable to the community? There are consistent signs in such classrooms that one can easily spot. Over the course of a few classes we would see students actively participating in talk together. We would probably notice that each student is able to participate in several different kinds of talk activities using appropriate tone and content. We would notice students listening attentively to one another, with a minimum of interruptions. While students would consistently pay attention to other students' contributions, there would be a climate of respect, trust, and risk-taking, with challenges, criticism, or disagreements directed at ideas, not at individuals. We would

see students making sure that they understand the previous contributions, asking for clarification where necessary, and willingly clarifying their own contributions for others, building up an argument or complex idea together.

In classrooms where students engage in this kind of talk, we can be sure that we will find a teacher who has carefully laid the groundwork for classroom norms that support it. We are likely to observe a wide array of teacher moves that support accountability to the community, moves that help students and teachers jointly create talk that is responsive to the community.

Accountability to Accurate Knowledge

Accountability to accurate knowledge means that when speakers make an observation or claim, they try to be as specific and accurate as possible, not just saying anything that comes to mind. Speakers should be concerned that what they are saying is true or supportable, that is, that they have their facts straight. If they make a statement or claim based on a text they have read, their reference to the text must be accurate and appropriate. In classrooms where accountability to accurate knowledge is the norm, students expect to ask and answer challenging questions, to work hard at "getting it right": Are those statistics accurate? Where did they come from? What is your basis for that conclusion? Who said that? When did that event take place? Their responses to such questions may cite a specific passage from a text that they are working with or refer to knowledge built in the course of discussion. Or they might offer an explanation or example grounded in knowledge from outside the classroom. But even this outside knowledge will be accurate, relevant, and accessible to the whole group—that is, something that they can refer to together. Students do not shut down discussion with emotive statements of personal preference or opinion that defy challenge.

How can we tell whether the talk in a classroom is accountable to accurate knowledge? There are consistent signs in such classrooms that both students and teacher consider themselves responsible for the accuracy and truth of their claims. We would see many instances in which students make specific reference to their classroom community's previous "findings" to support their arguments and assertions. Topics they have studied together in the past are referred to in later discussions, where relevant. The learning community builds on the knowledge it has collectively acquired.

Whether in English language arts, mathematics, science or social studies, we will see students make reference to specific information: the source might be textbooks, books they have read inside or outside of class, or other sources including films, television and personal experience. The information—used to support claims and to bolster argument—will be specific and open for verification by others. In classrooms that are accountable to knowledge, we see teachers and students questioning unsupported claims and asking for information, facts or knowledge that could be used to strengthen those claims. Students and teachers ask others to define terms. Finally, students and teachers will be on the lookout for points where additional knowledge is necessary. They will seek to identify factual evidence that is needed to address an issue. And they will frequently discuss how one might find the knowledge needed to make progress in a particular enterprise or problem.

Once again, in classrooms where students engage in this kind of talk, we can be sure that we will find a teacher who has invested time and effort in making sure that students develop and sustain the relevant values and habits. We are likely to observe a wide array of teacher moves that support accountability to accurate knowledge, moves that will

ensure that every discussion and instructional conversation foregrounds accurate and relevant knowledge.

Accountability to Rigorous Thinking

If accountability to accurate knowledge can be thought of as getting the facts straight, accountability to rigorous thinking has to do with building a line of argument. Making cogent and compelling arguments requires linking together claims and evidence (facts) in a logical, coherent, and rigorous manner. When classroom talk is held to rigorous thinking standards, students and teachers consistently push for clear statements of claims (positions, explanations, or predictions) and sound reasoning in backing up those claims with evidence.

Teachers and students examine evidence critically, knowing that just having accurate facts is not, in and of itself, enough. The evidence presented has to be "good" or what is often called "warranted" evidence. Beyond merely being accurate, the evidence has to be sufficient (e.g., a claim about people in North America vs. people in Europe needs to be based on more than an informal survey of a few people from Chicago and an exchange student from Paris). The facts must be credible (information quoted from the Washington Post is more authoritative than information quoted from an unnamed source in the National Enquirer or downloaded from an unrefereed bulletin board on the Web). The facts must be relevant to the claim being made (information about Japan, however accurate and authoritative, will probably not be germane to an argument about North Americans vs. Europeans). And the claim must be appropriately qualified (if all the evidence for a particular claim comes from interviewing people from New York City, it might not be fair to generalize to the entire population of North America).

Distinguishing sharply between accountability to knowledge and accountability to rigorous thinking is not easy because they so often go hand in hand. It is possible, of course, to have rigorous and cogent reasoning, but with a factually false premise. It is possible to have inadequate or incorrect evidence for one's claims. Similarly, it is possible to have well- researched, factually accurate evidence that is not directly relevant to the claim one is making. The evidence, while counting as accurate knowledge, simply does not warrant the conclusion drawn. Thus it is possible to distinguish between factual knowledge and standards of reasoning, but in practice, they are intertwined and both necessary.

Disciplines vary in the types of evidence they value.

When students are digging into a good poem or story, for instance, they might be trying to sense how the words and rhythms create tension or convey emotions. No one expects a student to provide a "proof" for her claim that a verse evoked a particular emotional response. Within a social studies lesson, students may marshal historical facts to support a position that begins as an "opinion." But if a student explaining his thinking about a fractions problem were to say, "I think the 4 stays the same because it just feels right that way," he is not being accountable to the standards of evidence that apply in the discipline of mathematics. That it "feels right" might be recognized as an intuition and valued as such as a starting point. But it would be appropriate to ask the student to examine this intuition and push for a more mathematically relevant basis for it. There are thus different standards of evidence in different fields, and students need to be inducted into those different kinds of academic communities. As early as first grade, we can begin to socialize students into those different worlds.

It takes effort and time to teach students to adhere to rigorous thinking standards. In a classroom that is accountable to rigorous thinking, we may not always see perfectly

structured arguments and reasoning. What we will see, however, is consistent attention to the quality of claims and arguments: How well supported is a claim? Is the evidence good? Sufficient? Authoritative? Relevant? Unbiased? In seeking to build sound and rigorous arguments, students and teachers ask questions that test their own understanding of concepts, redefine or change explanations as needed, and identify their own biases. They draw comparisons and contrasts among the ideas presented as evidence and indicate to what degree they accept the evidence and claims.

In classroom talk that is accountable to generally accepted standards of reasoning, students use data, examples, analogies, and hypothetical "what-if" scenarios to make arguments and support claims. Students are encouraged to seek out different kinds of supporting evidence, strengthening an argument by using a variety of sources to support it. Students and teachers assess and challenge the soundness of each other's evidence and quality of reasoning, often posing counter-examples and extreme case comparisons to illustrate a point. Hidden assumptions are uncovered and examined. Students and teachers consistently ask one another to show why the evidence used to support a claim is accountable to rigorous thinking.

In emphasizing accountability to rigorous thinking in classrooms, regardless of content area, one central purpose is to create a public arena where arguments can be explicated more fully and made public, looked at by others, interrogated, and developed further. We want students to learn ways to expand and improve their reasoning, making their ideas clear and compelling to others, in part by making their contributions elaborated and explicit. We want students to dig deep, to question their underlying assumptions, to evaluate the adequacy of their evidence, and to see things from a variety of perspectives. Explicating one's reasoning in words or in writing makes it public and available for others (or oneself) to assess, critique, question, or challenge.

4. How Does An Understanding Of Accountability To The Learning Community, Accurate Knowledge, And Rigorous Thinking Help Practitioners Institute Or Improve *Accountable Talk* Practices?

Think of the accountabilities to the learning community, to accurate knowledge, and to rigorous thinking as the conceptual underpinning or framework for what *Accountable Talk* practices look like in the classroom. Determining the extent to which each of these are visible in any classroom will help a practitioner take the "talk temperature" of a classroom. But these different kinds of accountability are not the most useful tools for changing practice. It is often difficult to distinguish between talk that is accountable to knowledge and talk that is accountable to rigorous reasoning, because they are so often intertwined. And some talk moves can support accountability to community, knowledge, and reasoning all at the same time. Thus the accountabilities are often hard to keep separate in one's mind in the fast pace of classroom talk, and are not the best level to concentrate on in action.

Part III—What do *Accountable Talk* practices look and sound like?

1. As you watch the following video clips, look for evidence of student learning and what promoted it (Accountability to the Learning Community, Knowledge, and Rigorous Thinking).
2. Take notes in the left-hand column as you watch the video.

Accountability to the Learning Community	**What is different from common current practices?**
Accountability to Knowledge	**What is different from common current practices?**
Accountability to Rigorous Thinking	**What is different from common current practices?**

Task Sheet

Setting the Stage for Academically Productive Talk

Part I—Norms for Equitable and Respectful Participation

1. Take 10 minutes to individually read and reflect on Setting the Stage for *Accountable Talk* Practices: Norms for Equitable and Respectful Participation (Packet 2, gray) focusing on these questions:
    a. What evidence do the authors provide for establishing and maintaining norms and ground rules?
    b. Which of the three types of wait time seems most powerful? Why?
    c. How did the authors' inclusion of research effects of wait time strengthen the argument for paying attention to wait time?
2. Be prepared to engage in a learning conversation to share your understanding as well as your questions.

Part II—Preparing for Talk

1. Take 10 minutes to reflect on your responses to the three questions above with a partner.
2. Be prepared to engage in a whole group discussion about the questions.

Part III—Whole Group Discussion

- How do these practices aid in setting the stage for a classroom culture and interactions that promote rich discussions and deeper understandings?
- Be sure to consider the evidence (descriptions and research) you read in the text around establishing and maintaining norms, ground rules, and wait time.

Setting the Stage for Accountable Talk® Practices: Norms for Equitable and Respectful Participation

This reading combines excerpts from the IFL's *Accountable Talk Sourcebook®: For Classroom Conversation That Works* and *Talking Point Primer: An Overview of Academically Productive Talk* by Sarah Michaels and Mary Catherine O'Connor.

Although academically productive conversations are valuable for promoting student learning, at first these classroom conversations may be frightening or uncomfortable for students. In academically productive conversations, we ask students to expose their thinking to all of their student colleagues and to make themselves vulnerable to disagreement, challenge, or criticism. We ask students to put their best thinking on the line, before they are expert in a domain or certain they are correct. We ask them to respond to fellow students and challenge their ideas in ways that might be construed as critical or unfriendly. We pose challenging problems, with no obvious or simple answer. We ask students to offer multiple solutions, to develop alternative approaches, and to argue with one another and with text. This kind of "exploratory" talk requires trust and respect.

How does one go about setting up the conditions for trust and respect? How does one make the classroom a safe place for students to tackle complex problems through *Accountable Talk* conversations? To establish a "trusting culture," the teacher must put in place certain norms and practices to ensure that students allow others to speak without interruption and that they will treat each contribution as important: No one can ridicule or attack another student's contribution. The focus must be on the ideas, not the person articulating them. In addition to injunctions against disrespectful talk, positive examples of respectful ways of talking must be explicitly modeled and practiced by the teacher.

Establishing Ground Rules

How do teachers succeed in creating a classroom culture that supports productive talk and reasoning? Not everyone's classroom looks the same. Successful teachers respond to the unique needs of their classes and schools, and establish norms and ground rules in a wide variety of ways. However, all successful classrooms share two common elements: (1) teachers convey clear expectations, and (2) students share an understanding about why these rules are important. Teachers who are successful thus work hard to make the rules for talk explicit and public. But beyond establishing the rules (and charting them or handing them out to students), they take ample time to make sure that the students themselves can articulate what the rules mean, getting the students themselves to explain why these are reasonable, good rules for everyone.

What does this look like in practice? Some teachers give a speech of some sort – laying out the rules and justifying them. Other teachers opt to create a class chart together, allowing students to propose rules and discuss among themselves which ones they want and why. Some teachers develop a handout of rules, pass them out to the students and go over them, asking the students to provide reasons that these rules are important. Whichever method a teacher chooses, it is important that great care is taken to make the norms clear, public, and collectively "owned."

What will work best for a particular teacher will likely depend on a number of things: the age of the students, their previous experiences with talk (from earlier grades), the time of the year (i.e., how socialized the students already are to certain ways of talking), and the general climate of the classroom (i.e., how respectful the students normally are in discussions with one another). Teachers need to think carefully about their own group or groups of students.

Questions and suggestions teachers might consider: Do you want your students to participate in generating the rules? If you teach a number of sections of the same class, do you want to create a common list so that each group is held to the same standards? In some cases, it is helpful to meet with colleagues and talk about establishing a shared set of ground rules for all students at that grade level or even across the entire school so that students encounter the same expectations throughout the day and from teacher to teacher. In these cases, it is important to take the time to make these "common rules" clear and applicable to your particular situation.

As with most things, there are trade-offs with each option—having the rules come from the teacher or from the students. Teacher-generated rules may create more overall consistency for students from class to class, and be more quickly internalized by students who move around from class to class (in middle and high school). Student-generated rules may create more of a sense of involvement, buy-in, and agency on the part of the students in creating a positive classroom culture for talk.

Establishing reasonable and realistic consequences for breaking the rules

In all classrooms – in even the most cooperative and well-behaved of groups – there will be occasional violations of the rules. What teachers do in the face of a violation, whether major or minor, is critical to the success of your efforts to establish a culture conducive to academically productive talk. For this reason, from the outset, teachers need to think carefully about the consequences for any instance of breaking the rules.

This may sound obvious and easy, but in practice it is a complex undertaking. Various conditions need to be met. **The consequences should be logical and appropriate to the seriousness of violation and they should make sense to the students.** The consequences must be made explicit in advance of sanctions; they must be understood and agreed upon collectively. When a violation occurs, the violation should be obvious to all. Consequences must be enforced consistently so that students do not perceive the teacher as selective (picking favorites) or as mercurial (sometimes strict, sometimes "nice"). Finally, the consequences should be clear and understood by all so that the teacher will know precisely what to do, as she is thinking on her feet, on the fly, in the midst of a discussion of complex ideas. This is indeed a tall order!

When these criteria are met, the students will know exactly what to expect. They will see that their teacher is fair and that all students are held to the same standard. By invoking the rules consistently, a teacher makes it clear that he is creating a safe and predictable environment for the free flow of ideas. All students will have the right to be heard, the right to be listened to, and the right to be responded to respectfully. By the same token, all students will have the obligation to not interrupt classmates, to listen hard and build on one another's ideas, and to challenge or critique *ideas* rather than an individual person.

Because establishing consequences for breaking the rules is both difficult AND critical to your success, it is helpful to unpack the crucial components that make for reasonable and realistic consequences.

- **Consequences should be compatible with the behavioral system that is already in place in a classroom or school.**

  Many schools and classrooms already have in place a system for dealing with behavioral infractions. Whether this is called a classroom management system, a behavioral system, or a code of conduct, it contains a series of steps, some minor and some more serious, for dealing with various kinds of infractions. When you institute explicit classroom norms for classroom talk, it will be very helpful to use the same system.

- **If students are new to this kind of talk, bear in mind that early on, they will need reminders, clarifications, and encouragement.**

  It is important to let students know from the beginning that their teacher will hold them accountable to listen to others, to make themselves heard, to address one another respectfully, and so on. However, if this is the first time that students have encountered such rules, it may be very difficult for them to adhere to *Accountable Talk* practices. Good humor and persistence will be needed by the teacher to bring things along in a friendly and positive manner.

- **Be prepared to continue reinforcing the new norms consistently throughout the school year.**

  Every teacher we know says that although many students take to these discourse norms enthusiastically, the teacher must remain vigilant throughout the year. Even if it is February or March, an increase in disrespect may have a negative impact on classroom work throughout the rest of the school year.

Turn-Taking Norms

In order for everyone to have a turn to speak, there must be orderly and equitable norms for getting a turn at talk. Different teachers handle this in different ways. Some teachers call on students themselves, so as to be able to control the distribution of turns at talk, strategically calling on quiet students or students they know have something important to contribute. They can make sure that both boys and girls participate equally. Other teachers set up different turn-taking norms, such as "handing off" (where the last student to speak selects the next speaker) or rely on a student moderator (who selects student speakers). These latter approaches give students more control over speaker rights to the floor. Others will institute (when needed) the "gender rule," requiring boys and girls to alternate speaking turns.

There are positive and negative aspects to all of these approaches and teachers must decide for themselves which ones will work best in their classrooms, given their students and their particular academic purposes. All of these means and methods are merely tools for teachers; they should be used strategically and thoughtfully.

Of course, turn-taking norms and rules do exist in most classrooms, but orderly turn-taking is only the first step. The eventual goal is for students to incorporate and build upon the previous turns of other students, to actually carry out a dialogue with the other members of their learning community. This requires planning and routines that go beyond the ordinary turn-taking conventions.

Using Wait Time

In most classrooms, teacher and student exchanges take place at an "astonishing speed" according to Mary Budd Rowe (1986). When she studied classroom conversations, she discovered that teachers typically wait less than a second for a student response. Increased wait time of at least 2.7, and preferably at least 3, seconds can have these effects on students:

1. The length of student responses increases between 300% and 700%.
2. More inferences are supported by evidence and logical argument.
3. The incidence of speculative thinking increases.
4. The number of questions asked by students increases.
5. Student-student exchanges increase; teacher-centered "show and tell" behavior decreases.
6. Failures to respond decrease.
7. Disciplinary moves decrease.
8. The variety of students participating voluntarily increases. Also the number of unsolicited, but appropriate, contributions by students increases.
9. Student confidence, as reflected in few inflected responses, increases.
10. Achievement improves on written measures where the items are cognitively complex.

Effects on teachers are equally important:

1. Teachers' responses exhibit greater flexibility. This is indicated by the occurrence of fewer discourse errors and greater continuity in the development of ideas.
2. The number and kind of questions asked by teachers changes. There are fewer questions, but more of them entail asking for clarification or inviting elaboration or contrary positions.
3. Expectations for the performance of certain students seems to improve. This effect was especially pronounced where minority students were concerned.

The effects have been observed with all kinds of students from elementary school to college and including special needs students, talented and gifted students, and English language learners. Beginning effects can be almost instantaneous, often detectable in the first hour! Getting going on this change to classroom practice would seem to be a "no-brainer." But it turns out that what appears to be a simple technique is, in fact, difficult to learn.

Wait Time after Posing a Question

When the teacher asks a question, not all students will process that question at the same rate. English language learners, students with less background knowledge, students with processing difficulties, all may be left behind if the teacher too quickly to chooses a student to answer her question. It may feel strange to ignore the student with the quickly raised hand and wait for others to respond. But consciously waiting before calling on anyone gives more students a chance to think and formulate a response. This technique has another, equally important effect. In many classrooms, students know that all of the teacher's questions will be answered by a few "star students." The "silent majority" feel no obligation to try and answer a question because they know that before they can formulate a response, one of the stars will beat them to it. Over time, this has a demoralizing effect on students and on the teacher. In such classrooms, it is difficult to sustain a discussion in which all students participate, and more importantly, students

do not have the sense that they have an obligation to think about the problem or question along with everyone else. If a teacher uses wait time consistently and varies the choice of students she calls on, a change will take place in the classroom. Students who formerly never volunteered an answer will begin to realize that the teacher's questions are also for them.

Wait Time after Calling on a Student

A second kind of wait time can be seen after the teacher has called on a student. Many students will take quite a while to answer. They may sit silently, staring at the teacher. They may begin to formulate an answer, stumbling and stopping in a way that is difficult to follow. It sometimes feels very uncomfortable to wait silently as a student struggles to formulate an answer. Most of us naturally want to jump in and rescue the student by offering to let them pass or soliciting another student's help. Yet teachers who have gritted their teeth and remained silent, waiting for an answer of some kind, have come to see significant changes among their students. Many more students are willing to engage in the conversation. Teachers who use this kind of wait time effectively often explicitly tell the students that they are, in fact, waiting. As a student struggles to answer, they will say to other students things like, "That's OK, give her time." Or, "That's OK, we'll wait." This kind of behavior models accountability to the community.

Wait Time after a Student Gives a Response

A third kind of wait time emerges after the student has given a response. It is easy to forget that when a student produces an answer, not all of the other students will be able to process that answer equally quickly. The teacher may find ways, in addition to silence, to extend the time that the student's answer "hangs in the air." For example, the teacher can thoughtfully repeat the student's answer: "Hmmm, the fractions with odd denominators." Some teachers take the step of writing an answer on the board, or slowly clarifying it in a revoicing move: "So, you're saying that the fractions with odd denominators will be the ones that create repeating decimals. So Anna's conjecture is that repeating decimals will result for all fractions with odd denominators. Is that right Anna?" Other teachers may ask another student to repeat what Anna has said. Although none of these moves involve silence, all are a form of "wait time," because all give the students additional time to process what has been said.

Rowe, M.B (1986). *Wait time: Slowing down may be a way of speeding up!* Journal of Teacher Education, *3*, 43-50.

Norms for Discussion

You have the **right** to…	You are **obligated** to…
• Make a contribution to an attentive, responsive audience. • Ask questions that clarify and advance your understanding. • Be treated civilly. • Have your ideas discussed.	• Speak so that everyone can hear. • Speak one at a time. • Listen for understanding. • Agree or disagree (and explain why) in response to other people's ideas. • Critique ideas, not people.

Questions for Text Study

The *Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects* require discipline-specific reading and writing. Therefore, science teachers need to think a little differently about our questions. In addition to asking students to think like a scientist (as we engage in the content of science), we need to think about how we can support students to read and write like a scientist as well. We can do this by working toward the reading and writing standards (Packet 3, yellow, pages 62 and 64-66) as we engage with texts.

Interpretive (ReadLike) Questions

Interpretive questions are open-ended questions that take readers deeply into discussions that focus on the ideas of the text using textual evidence. When considering text-specific questions that you will use with students, consider the following:

- What does the author do that is aligned to and could support reading standards?
- Are the author's purpose, central ideas, and/or conclusions clear? Can they be used as models or will students need support in identifying them?
- What is complex about this text? How can you scaffold learning?
- What ideas in the text would you like students to focus on? What questions will help students think deeply about those ideas?
- What ideas and evidence from the text would you like to hear students discuss?

Analytic (WriteLike) Questions

Analytic questions are open-ended questions that take readers deeply into discussions that focus on the author's methods or craft. When considering text-specific questions that you will use with students, consider the following:

- What does the author do that is aligned to and could support writing standards?
- What does the author do that would help students with their own scientific writing?
- Are there style conventions (e.g., the way the data is presented) that you would like students to notice and emulate?

Text-based Questions

How is the intellectual work required of learners different between the "moving from" and "moving to" questions?

Moving From...	Moving To...
What are the two common elements of successful establishment of ground rules?	What evidence do the authors provide for establishing and maintaining norms and ground rules?
What are the three types of wait time?	Which of the three types of wait time seems most powerful? Why?
How long should wait time be?	How did the authors' inclusion of research effects of wait time strengthen the argument for paying attention to wait time?

Key *Accountable Talk* Teacher Moves

Teachers find that once introduced, a relatively small number of conversational moves seem to evoke the desired features of student talk. The following are the six most important talk moves:

Move	Example
A. Revoicing	"So, let me see if I've got your thinking right. You're saying XXX?" (with time for students to accept or reject the teacher formulation)
B. Asking students to restate someone else's reasoning	"Can you repeat what he just said in your own words?"
C. Asking students to apply their own reasoning to someone else's reasoning	"Do you agree or disagree and why?"
D. Prompting students for further participation	"Would someone like to add on?"
E. Asking students to explicate their reasoning	"Why do you think that" or "How did you arrive at that answer?" or "Say more about that."
F. Challenge or counter-example	"Is this always true?" "Can you think of any examples that would not work?"

From Resnick, Michaels, and O'Connor (2010)

Task Sheet

Planning for Academically Productive Talk

Part I—Reviewing Text and Text Complexity Analysis Sheet

1. Locate Connected by the Light: Photosynthesis (Packet 2, goldenrod) and the Text Complexity Analysis sheet for that text (Packet 1, pink, page 51).
2. Take 10 minutes to discuss with a partner the purposes for reading the text (knowledge that students should gain by reading the text) as well as challenges that the text poses according to your previous analysis.

Part II—Identifying and Charting Questions

1. Identify three to four text-based questions (interpretive and/or analytic) you might pose to help students read closely to gain the identified purposes for reading this text.
2. Chart your questions on chart paper.

Sample Questions	Questions for This Text
• What is the author's purpose? • What central ideas can be drawn from this text? • What specific evidence* does the author use? Why does it count as evidence? • What is the author's argument? • What information does the author convey? • How does (or doesn't) the author convey a clear and coherent message? • How does the text organization and structure support (or get in the way of) understanding the text? • What sources does the author use? Are the sources credible and accurate? Why or why not? • How do the graphics support (or get in the way of) understanding the text? • How does the evidence support or contradict other sources?	

*Evidence includes facts, definitions, concrete details, quotations, or other information, using accurate and credible sources as appropriate to the task and stimuli.

3. What types of questions will help **socialize the intelligence** of your classroom learning community (see Key *Accountable Talk* Teacher Moves)? Identify in the chart below.

Sample Questions	Questions for This Text
• So, let me see if I've got your thinking right. You're saying XXX? • Can you repeat what he just said in your own words? • Do you agree or disagree? Why? • Would someone like to add on? • How did you arrive at that answer? • Is this always true? Can you think of any examples that would not work?	

Part III—Gallery Walk

1. Visit four to six other groups' charts.
2. Look for examples of thought-provoking, text-based questions that would help students be able to read closely and achieve the purposes for reading the text.
3. Be prepared to share your examples and reasoning with the whole group.

Part IV—Whole Group Discussion

- Which text-based questions did you find the most thought provoking?
- What made them thought-provoking questions?
- How did they help students read the text more closely?
- How did they help to achieve the purpose for reading the text?

Connected by the Light: Photosynthesis

Samuel A. Spiegel

You have read, discussed, and thought about plants and where they get most of the matter they need to live and grow. Your group should have considered soil, water, and air as potential sources of matter. Given the available evidence and scientific reasoning, you probably came to the conclusion that plants obtain most of their matter from the gases in the air. Scientists today agree that plants pull carbon dioxide from the air and water through the roots. The carbon dioxide and water are then combined through a series of chemical processes in specialized parts of the leaves using energy from light. This series of processes is known as photosynthesis.

Let's examine photosynthesis in a little more detail and consider how we came to understand the process. The name *photosynthesis* was chosen to represent what happens in the series of processes. Photo means light. Synthesis means to build or combine. Photosynthesis uses energy from light to combine molecules.

In your earlier discussions, you should have considered the research of van Helmont, Woodward, Priestly, Ingenhousz, Senebier, and Saussure. What evidence did the scientists generate? What claims can we make based on that evidence?

Let's summarize what they reported. First, van Helmont found that the weight of a tree increased over time, but the weight of the soil did not decrease. Woodward found that plants in water alone did not grow as well as those with soil in the water. He also reported that the weight gained by the plants was much greater than the amount of mass lost in the water. Priestly found that plants could restore gases to the air. Ingenhousz added to the thinking by identifying oxygen as the gas being replaced by plants and noting that light was required for this to happen. Senebier further clarified that the leaves of a plant released oxygen and that the plant required carbon dioxide along with light for the process to work. Saussure contributed that water was required for the plant to live and added something to the gain of matter.

We can further summarize the reported studies as plants release oxygen (oxygen = an output) when exposed to light (light is required). Plants take up carbon dioxide (carbon dioxide = input) in the presence of light (light required). Lastly, water is required and taken up by plants (water = input). Let's write this as a chemical equation:

Carbon dioxide + water + light → plant matter + oxygen

We can further refine expression based on other studies that have shown the plant matter produced is sugar, usually glucose.

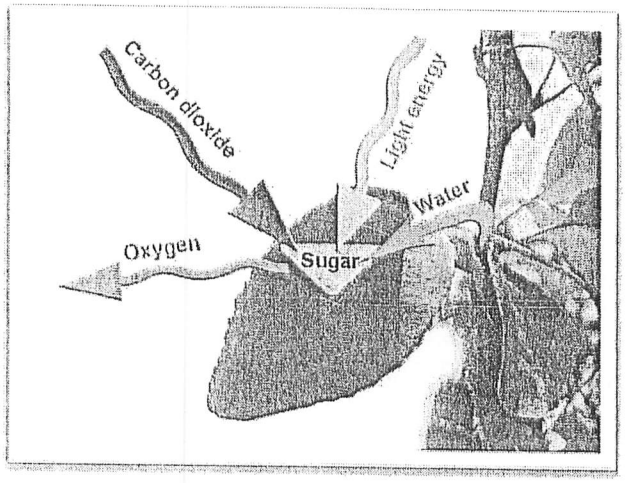


Figure 1. Simplified processes of photosynthesis showing inputs and outputs in a leaf.

Let's rewrite the chemical equation as words and then using the chemical symbols and amount for each.

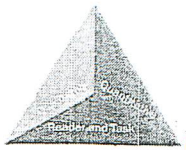
Carbon dioxide + water + light → glucose (sugar) + oxygen

$6CO_2 + 6H_2O$ + light energy → $C_6H_{12}O_6 + 6O_2$

Notice that it takes six molecules of carbon dioxide and six molecules of water for the process to produce one molecule of glucose, and six oxygen molecules are released as waste. In chemistry, like in mathematics, equations must be balanced on both sides. You need to have the same number of carbon on the left as are on the right side of the equation. We use the "yields" symbol (→) rather than an equal sign because the process usually goes in one direction. The formulae are shown here just to familiarize you with them. You will study them in greater detail in later science classes. For now let's stay focused on the general processes, thinking about what goes in and what comes out.

Light energy powers the process to break down the carbon dioxide and water and then recombines the atoms to form sugar, with oxygen as a byproduct. The end result of the processes is that light energy is transformed into some chemical energy in the sugar, plus heat energy that is lost. But if all the light energy is lost or used to make sugar, where does the plant get the energy to live? Sugar is the key. In later lessons we will think about the role sugar (glucose) plays as the key to energy and matter in organisms and ecosystems.

So what does all this mean in terms of where a plant gets the matter and energy needed to live and grow? Develop a scientific argument to answer the question: How do most plants obtain the matter and energy they need to live and grow?



Text Complexity Analysis of

_____*(title)*

by _____*(author)*

Recommended Complexity Band:

Qualitative Measures

Meaning/Purpose: *(Briefly explain the levels of meaning (Literary Text) or purpose (Informational text.)*

Text Structure: *(Briefly describe the structure, organization, and other features of the text.)*

Language Features: *(Briefly describe the conventions and clarity of the language used in the text, including the complexity of the vocabulary and sentence structures.)*

Knowledge Demands: *(Briefly describe the knowledge demands the text requires of students.)*

Text Description

Briefly describe the text:

Quantitative Measure

Complexity Band Level (provide range):

Lexile or Other Quantitative Measure of the Text:

Considerations for Reader and Task

Below are factors to consider with respect to the reader and task (See attached guiding questions to assist each teacher in filling out this section for his or her own class):

Potential Challenges this Text Poses:

Major Instructional Areas of Focus (3-4 CCS Standards) for this Text:

Differentiation/Supports for Students:

Recommended Placement

Briefly explain the recommended placement of the text in a particular grade band.

Optional: Created by _____(name, state, e-mail, date) Reviewed by _____(name, state, e-mail, date)

From New Hampshire Department of Education, Text Complexity Resources, Common Core State Standards Outsourced Education Resources located at http://www.education.nh.gov/spotlight/ccss/documents/analysis-template.pdf

Text Complexity: Qualitative Measures Rubric

INFORMATIONAL TEXT

Text Title_____ Text Author_____

QUALITATIVE	Very Complex ←			→ Slightly Complex
PURPOSE	○ **Purpose:** Subtle, implied, difficult to determine; intricate, theoretical elements	○ **Purpose:** Implied, but fairly easy to infer; more theoretical than concrete	○ **Purpose:** Implied, but easy to identify based upon context or source	○ **Purpose:** Explicitly stated; clear, concrete with a narrow focus
TEXT STRUCTURE	○ **Organization of Main Ideas:** Connections between an extensive range of ideas or events are deep, intricate and often implicit or subtle; organization of the text is intricate or specialized for a particular discipline	○ **Organization of Main Ideas:** Connections between an expanded range ideas, processes or events are deeper and often implicit or subtle; organization may contain multiple pathways and may exhibit traits common to a specific discipline	○ **Organization of Main Ideas:** Connections between some ideas or events are implicit or subtle; organization is evident and generally sequential	○ **Organization of Main Ideas:** Connections between ideas, processes or events are explicit and clear; organization of text is clear or chronological or easy to predict
	○ **Text Features:** If used, are essential in understanding content	○ **Text Features:** If used, greatly enhance the reader's understanding of content	○ **Text Features:** If used, enhance the reader's understanding of content	○ **Text Features:** If used, help the reader navigate and understand content but are not essential
	○ **Use of Graphics:** If used, extensive, intricate, essential integrated graphics, tables, charts, etc., necessary to make meaning of text; also may provide information not otherwise conveyed in the text	○ **Use of Graphics:** If used, essential integrated graphics, tables, charts, etc., may occasionally be essential to understanding the text	○ **Use of Graphics:** If used, graphics mostly supplementary to understanding of the text, such as indexes, glossaries; graphs, pictures, tables, and charts directly support the text	○ **Use of Graphics:** If used, simple graphics, unnecessary to understanding the text but directly support and assist in interpreting the written text
LANGUAGE FEATURES	○ **Conventionality:** Dense and complex; contains abstract, ironic, and/or figurative language	○ **Conventionality:** Complex; contains some abstract, ironic, and/or figurative language	○ **Conventionality:** Largely explicit and easy to understand with some occasions for more complex meaning	○ **Conventionality:** Explicit, literal, straightforward, easy to understand
	○ **Vocabulary:** Generally unfamiliar, archaic, subject-specific, or overly academic language; may be ambiguous or purposefully misleading	○ **Vocabulary:** Somewhat complex language that is sometimes unfamiliar, archaic, subject-specific, or overly academic	○ **Vocabulary:** Mostly contemporary, familiar, conversational; rarely unfamiliar or overly academic	○ **Vocabulary:** Contemporary, familiar, conversational language
	○ **Sentence Structure:** Mainly complex sentences often containing multiple concepts	○ **Sentence Structure:** Many complex sentences with several subordinate phrases or clauses and transition words	○ **Sentence Structure:** Simple and compound sentences, with some more complex constructions	○ **Sentence Structure:** Mainly simple sentences
KNOWLEDGE DEMANDS	○ **Subject Matter Knowledge:** Extensive, perhaps specialized or even theoretical discipline-specific content knowledge; range of challenging abstract and theoretical concepts	○ **Subject Matter Knowledge:** Moderate levels of discipline-specific content knowledge; some theoretical knowledge may enhance understanding; range of recognizable ideas and challenging abstract concepts	○ **Subject Matter Knowledge:** Everyday practical knowledge and some discipline-specific content knowledge; both simple and more complicated, abstract ideas	○ **Subject Matter Knowledge:** Everyday, practical knowledge; simple, concrete ideas
	○ **Intertextuality:** Many references or allusions to other texts or outside ideas, theories, etc.	○ **Intertextuality:** Some references or allusions to other texts or outside ideas, theories, etc.	○ **Intertextuality:** A few references or allusions to other texts or outside ideas, theories, etc.	○ **Intertextuality:** No references or allusions to other texts, or outside ideas, theories, etc.

From New Hampshire Department of Education, Text Complexity Resources, Common Core State Standards Outsourced Education Resources located at http://www.education.nh.gov/spotlight/ccss/documents/informational-text-rubric.pdf

Questions to Consider in Planning for Instructional Scaffolding of Informational Text:

Purpose:

- Would spending time helping students to establish a purpose for reading this text be appropriate?
- Will students know in advance what they are expected to do with the information they gain from reading this text?

Text Structure:

- Would graphic organizers or other aids be appropriate in making the structure of the text visible to students?
- Would a partial outline or some other text-based aid be appropriate in deciphering the structure of the text?
- Would previewing and discussing the graphics included with the text prior to reading be appropriate?

Language Features:

- Would a review of figurative, abstract, or ironic language and a modeling of how that type of language might be interpreted be appropriate?
- Would glossing certain vocabulary (particularly multiple meaning words that extend across other subject matter content areas, i.e. Tier 2 words) prior to reading be appropriate?

Knowledge Demands:

- What background knowledge needs to be introduced (or re-introduced) to facilitate reading success that will not supplant the actual information gained from the reading experience?
- What explicit references and/or allusions to other texts might require additional resources/opportunities for students to explore?

General:

- In what ways might collaborative groupings of students during the reading process be appropriate?

Task Sheet
Understanding Text Types

Part I—Writing to Inform and Make Arguments

1. As you watch the Writing to Inform and Make Arguments video clip, think about these two questions:
    a. What are the Common Core State Standards (CCSS) expectations for student writing?
    b. How can we support student writing in our science classrooms?
2. Following the video clip, write a response to the two questions.

Part II—Understanding the Writing Standards

1. Please take about 10 minutes to individually
    a. review the writing standards (Packet 3, yellow, pages 64-66) for your grade band and
    b. read Writing: Definition of the Standards' Three Text Types (Packet 3, blue, pages 23-25).
2. In pairs, discuss (about 10 minutes) the following questions:
    a. What are the differences between argument and explanatory writing according to the CCSS?
    b. What does CCSS see as differences in argument among the content areas ELA, history/social studies, science, and technical subjects?
3. Be prepared to share your thinking with our whole group.

Part III—Whole Group Discussion

- What is distinctive about these two different types of writing?
- Why are they both important to being literate?
- Why are they both important to science education?

Part IV—Writing to Inform and Make Arguments (Revisited)

1. Revisit your response to the CCSS video clip (Part I).
2. As you watch this video clip a second time, think about these two questions:
    a. What are the CCSS expectations for student writing?
    b. How can we support student writing in our science classrooms?
3. Following the video clip, revise and/or add to your original response.

Writing

Definitions of the Standards' Three Text Types

Argument

Arguments are used for many purposes—to change the reader's point of view, to bring about some action on the reader's part, or to ask the reader to accept the writer's explanation or evaluation of a concept, issue, or problem. An argument is a reasoned, logical way of demonstrating that the writer's position, belief, or conclusion is valid. In English language arts, students make claims about the worth or meaning of a literary work or works. They defend their interpretations or judgments with evidence from the text(s) they are writing about. In history/social studies, students analyze evidence from multiple primary and secondary sources to advance a claim that is best supported by the evidence, and they argue for a historically or empirically situated interpretation. In science, students make claims in the form of statements or conclusions that answer questions or address problems. Using data in a scientifically acceptable form, students marshal evidence and draw on their understanding of scientific concepts to argue in support of their claims. Although young children are not able to produce fully developed logical arguments, they develop a variety of methods to extend and elaborate their work by providing examples, offering reasons for their assertions, and explaining cause and effect. These kinds of expository structures are steps on the road to argument. In grades K–5, the term "opinion" is used to refer to this developing form of argument.

Informational/Explanatory Writing

Informational/explanatory writing conveys information accurately. This kind of writing serves one or more closely related purposes: to increase readers' knowledge of a subject, to help readers better understand a procedure or process, or to provide readers with an enhanced comprehension of a concept. Informational/explanatory writing addresses matters such as types (*What are the different types of poetry?*) and components (*What are the parts of a motor?*); size, function, or behavior (*How big is the United States? What is an X-ray used for? How do penguins find food?*); how things work (*How does the legislative branch of government function?*); and why things happen (*Why do some authors blend genres?*). To produce this kind of writing, students draw from what they already know and from primary and secondary sources. With practice, students become better able to develop a controlling idea and a coherent focus on a topic and more skilled at selecting and incorporating relevant examples, facts, and details into their writing. They are also able to use a variety of techniques to convey information, such as naming, defining, describing, or differentiating different types or parts; comparing or contrasting ideas or concepts; and citing an anecdote or a scenario to illustrate a point. Informational/explanatory writing includes a wide array of genres, including academic genres such as literary analyses, scientific and historical reports, summaries, and précis writing as well as forms of workplace and functional writing such as instructions, manuals, memos, reports, applications, and résumés. As students advance through the grades, they expand their repertoire of informational/explanatory genres and use them effectively in a variety of disciplines and domains.

Although information is provided in both arguments and explanations, the two types of writing have different aims. Arguments seek to make people believe that something is true or to persuade people to change their beliefs or behavior. Explanations, on the other hand, start with the assumption of truthfulness and answer questions about why or how. Their aim is to make the reader understand rather than to persuade him or her to accept a certain point of view. In short, arguments are used for persuasion and explanations for clarification.

Like arguments, explanations provide information about causes, contexts, and consequences of processes, phenomena, states of affairs, objects, terminology, and so on. However, in an argument, the writer not only gives information but also presents a case with the "pros" (supporting ideas) and "cons" (opposing ideas) on a debatable issue. Because an argument deals with whether the main claim is true, it demands empirical descriptive evidence, statistics, or definitions for support. When writing an argument, the writer supports his or her claim(s) with sound reasoning and relevant and sufficient evidence.

Narrative Writing

Narrative writing conveys experience, either real or imaginary, and uses time as its deep structure. It can be used for many purposes, such as to inform, instruct, persuade, or entertain. In English language arts, students produce narratives that take the form of creative fictional stories, memoirs, anecdotes, and autobiographies. Over time, they learn to provide visual details of scenes, objects, or people; to depict specific actions (for example, movements, gestures,

Creative Writing beyond Narrative

The narrative category does not include all of the possible forms of creative writing, such as many types of poetry. The Standards leave the inclusion and evaluation of other such forms to teacher discretion.

postures, and expressions); to use dialogue and interior monologue that provide insight into the narrator's and characters' personalities and motives; and to manipulate pace to highlight the significance of events and create tension and suspense. In history/social studies, students write narrative accounts about individuals. They also construct event models of what happened, selecting from their sources only the most relevant information. In science, students write narrative descriptions of the step-by-step procedures they follow in their investigations so that others can replicate their procedures and (perhaps) reach the same results. With practice, students expand their repertoire and control of different narrative strategies.

Texts that Blend Types

Skilled writers many times use a blend of these three text types to accomplish their purposes. For example, *The Longitude Prize*, included above and in Appendix B, embeds narrative elements within a largely expository structure. Effective student writing can also cross the boundaries of type, as does the grade 12 student sample "Fact vs. Fiction and All the Grey Space In Between" found in Appendix C.

The Special Place of Argument in the Standards

While all three text types are important, the Standards put particular emphasis on students' ability to write sound arguments on substantive topics and issues, as this ability is critical to college and career readiness. English and education professor Gerald Graff (2003) writes that "argument literacy" is fundamental to being educated. The university is largely an "argument culture," Graff contends; therefore, K–12 schools should "teach the conflicts" so that students are adept at understanding and engaging in argument (both oral and written) when they enter college. He claims that because argument is not standard in most school curricula, only 20 percent of those who enter college are prepared in this respect. Theorist and critic Neil Postman (1997) calls argument the soul of an education because argument forces a writer to evaluate the strengths and weaknesses of multiple perspectives. When teachers ask students to consider two or more perspectives on a topic or issue, something far beyond surface knowledge is required: students must think critically and deeply, assess the validity of their own thinking, and anticipate counterclaims in opposition to their own assertions.

"Argument" and "Persuasion"

When writing to persuade, writers employ a variety of persuasive strategies. One common strategy is an appeal to the credibility, character, or authority of the writer (or speaker). When writers establish that they are knowledgeable and trustworthy, audiences are more likely to believe what they say. Another is an appeal to the audience's self-interest, sense of identity, or emotions, any of which can sway an audience. A logical argument, on the other hand, convinces the audience because of the perceived merit and reasonableness of the claims and proofs offered rather than either the emotions the writing evokes in the audience or the character or credentials of the writer. The Standards place special emphasis on writing logical arguments as a particularly important form of college- and career-ready writing.

The unique importance of argument in college and careers is asserted eloquently by Joseph M. Williams and Lawrence McEnerney (n.d.) of the University of Chicago Writing Program. As part of their attempt to explain to new college students the major differences between good high school and college writing, Williams and McEnerney define *argument* not as "wrangling" but as "a serious and focused conversation among people who are intensely interested in getting to the bottom of things *cooperatively*":

> Those values are also an integral part of your education in college. For four years, you are asked to read, do research, gather data, analyze it, think about it, and then communicate it to readers in a form . . . which enables them to assess it and use it. You are asked to do this not because we expect you all to become professional scholars, but because in just about any profession you pursue, you will do research, think about what you find, make decisions about complex matters, and then explain those decisions—usually in writing—to others who have a stake in your decisions being sound ones. In an Age of Information, what most professionals do is research, think, and make arguments. (And part of the value of doing your own thinking and writing is that it makes you much better at evaluating the thinking and writing of others.) (ch. 1)

In the process of describing the special value of argument in college- and career-ready writing, Williams and McEnerney also establish argument's close links to research in particular and to knowledge building in general, both of which are also heavily emphasized in the Standards.

Much evidence supports the value of argument generally and its particular importance to college and career readiness. A 2009 ACT national curriculum survey of postsecondary instructors of composition, freshman English, and survey of American literature courses (ACT, Inc., 2009) found that "write to argue or persuade readers" was virtually tied with "write to convey information" as the most important type of writing needed by incoming college students. Other curriculum surveys, including those conducted by the College Board (Milewski, Johnson, Glazer, & Kubota, 2005) and

the states of Virginia and Florida[6], also found strong support for writing arguments as a key part of instruction. The 2007 writing framework for the National Assessment of Educational Progress (NAEP) (National Assessment Governing Board, 2006) assigns persuasive writing the single largest targeted allotment of assessment time at grade 12 (40 percent, versus 25 percent for narrative writing and 35 percent for informative writing). (The 2011 prepublication framework [National Assessment Governing Board, 2007] maintains the 40 percent figure for persuasive writing at grade 12, allotting 40 percent to writing to explain and 20 percent to writing to convey experience.) Writing arguments or writing to persuade is also an important element in standards frameworks for numerous high-performing nations.[7]

Specific skills central to writing arguments are also highly valued by postsecondary educators. A 2002 survey of instructors of freshman composition and other introductory courses across the curriculum at California's community colleges, California State University campuses, and University of California campuses (Intersegmental Committee of the Academic Senates of the California Community Colleges, the California State University, and the University of California, 2002) found that among the most important skills expected of incoming students were articulating a clear thesis; identifying, evaluating, and using evidence to support or challenge the thesis; and considering and incorporating counterarguments into their writing. On the 2009 ACT national curriculum survey (ACT, Inc., 2009), postsecondary faculty gave high ratings to such argument-related skills as "develop ideas by using some specific reasons, details, and examples," "take and maintain a position on an issue," and "support claims with multiple and appropriate sources of evidence."

The value of effective argument extends well beyond the classroom or workplace, however. As Richard Fulkerson (1996) puts it in *Teaching the Argument in Writing*, the proper context for thinking about argument is one "in which the goal is not victory but a good decision, one in which all arguers are at risk of needing to alter their views, one in which a participant takes seriously and fairly the views different from his or her own" (pp. 16–17). Such capacities are broadly important for the literate, educated person living in the diverse, information-rich environment of the twenty-first century.

[6]Unpublished data collected by Achieve, Inc.
[7]See, for example, frameworks from Finland, Hong Kong, and Singapore as well as Victoria and New South Wales in Australia.

Short Research Task 1: Scientific Argument

Read the following two texts about photosynthesis:

1. Connected by the Light: Photosynthesis
2. Exchange Cycles: Photosynthesis

Write a scientific argument in which you answer the scientific question:

- Where do plants get most of their matter?

Make a claim that answers the question. Be sure to support your claim with multiple sources of scientific data and evidence from both resources. Include reasoning that builds a strong (compelling) argument that will persuade your readers. Identify a counterclaim and include reasoning that would explain what is scientifically inaccurate about the counterclaim. Write your argument in the space provided in the following pages.

Use the Literacy in History/Social Studies, Science, and Technical Subjects Argument Rubric – Grades 6-8 (Packet 1, green, page) to guide your writing.

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Literacy in History/Social Studies, Science, and Technical Subjects
Argument Rubric – Grades 6-8
Tennessee Department of Education

Revised: April 2013

Score	Development	Focus & Organization	Language
4	In response to the task and the stimuli, the writing: • utilizes well-chosen, relevant, and sufficient data and evidence[1] from the stimuli to insightfully support claim(s) and counterclaim(s). • thoroughly and accurately explains and elaborates on the evidence provided, connecting the evidence to claim(s) and counterclaim(s) through logical reasoning, demonstrating a clear understanding of the topic and the stimuli.	In response to the task and the stimuli, the writing: • contains a logical and relevant introduction. • states and maintains a clear and sophisticated argument. • utilizes effective organizational strategies to logically order reasons and evidence to create a unified whole. • effectively clarifies relationships among claim(s), reasons, evidence, and counterclaim(s) to create cohesion. • contains a logical and relevant concluding statement or section.	The writing: • illustrates consistent and sophisticated command of precise language and domain-specific vocabulary appropriate to the task. • effectively establishes and maintains a formal style.
3	In response to the task and the stimuli, the writing: • utilizes relevant and sufficient data and evidence[1] from the stimuli to adequately support claim(s) and counterclaim(s). • adequately and accurately explains and elaborates on the evidence provided, connecting the evidence to claim(s) and counterclaim(s) through logical reasoning, demonstrating a sufficient understanding of the topic and the stimuli.	In response to the task and the stimuli, the writing: • contains a relevant introduction. • states and maintains a clear argument. • utilizes adequate organizational strategies to logically order reasons and evidence to create a mostly unified whole. • clarifies most relationships among claim(s), reasons, evidence, and counterclaim(s), but there may be some gaps in cohesion. • contains a relevant concluding statement or section.	The writing: • illustrates consistent command of precise language and domain-specific vocabulary appropriate to the task. • establishes and maintains a formal style.
2	In response to the task and the stimuli, the writing: • utilizes mostly relevant but insufficient data and evidence[1] from the stimuli to partially support claim(s) and counterclaim(s). Some evidence may be inaccurate or repetitive. • explains some of the evidence provided, connecting some of the evidence to claim(s) and counterclaim(s) with reasoning, demonstrating only a partial understanding of the topic and the stimuli. There may be some level of inaccuracy in the explanation.	In response to the task and the stimuli, the writing: • contains a limited introduction. • states a weak argument. • demonstrates an attempt to use organizational strategies to order some reasons and evidence, but ideas may be hard to follow at times. • clarifies some relationships among claim(s), reasons, evidence, and counterclaim(s), but there are lapses in focus. • contains a limited concluding statement or section.	The writing: • illustrates inconsistent command of precise language and domain-specific vocabulary. • establishes but inconsistently maintains a formal style.
1	In response to the task and the stimuli, the writing: • utilizes mostly irrelevant or no data and evidence[1] from the stimuli, or mostly/only personal knowledge to inadequately support claim(s) and counterclaim(s). Evidence is inaccurate or repetitive. • inadequately or inaccurately explains the evidence provided; evidence, claim(s), and counterclaim(s) appear disconnected, demonstrating little understanding of the topic and the stimuli.	In response to the task and the stimuli, the writing: • contains no or an irrelevant introduction. • states an unclear argument. • demonstrates an unclear organizational structure; ideas are hard to follow most of the time. • fails to clarify relationships among claim(s), reasons, evidence, and counterclaim(s); claims are unclear and/or there is a lack of focus. • contains no or an irrelevant concluding statement or section.	The writing: • illustrates little to no use of precise language and domain-specific vocabulary. • does not establish or maintain a formal style.

[1] Evidence includes facts, definitions, concrete details, quotations, or other information, using accurate and credible sources as appropriate to the task and the stimuli.

Short Research Task 2: Scientific Essay that Explains

Read the following two texts about photosynthesis:

1. Connected by the Light: Photosynthesis
2. Exchange Cycles: Photosynthesis

Write a scientific essay that explains the process of how plants obtain the matter and energy that they need to live and grow.

Be sure to refer to evidence (facts, definitions, concrete details, quotations, or other information and examples, as appropriate) from both texts to support your explanation. Write your essay in the space provided in the following pages.

Use the Literacy in History/Social Studies, Science, and Technical Subjects Informational/Explanatory Rubric – Grades 6-8 (Packet 1, blue, page 113, to guide your writing.

Literacy in History/Social Studies, Science, and Technical Subjects
Informational/Explanatory Rubric – Grades 6-8
Tennessee Department of Education

Revised: April 2013

Score	Development	Focus & Organization	Language
4	In response to the task and the stimuli, the writing: • utilizes well-chosen, relevant, and sufficient evidence[1] from the stimuli to insightfully develop the topic. • thoroughly and accurately explains and elaborates on the evidence provided, demonstrating a clear understanding of the topic and the stimuli.	In response to the task and the stimuli, the writing: • contains a logical and relevant introduction. • utilizes effective organizational strategies to create a unified whole and to aid in comprehension. • effectively clarifies relationships among ideas and concepts to create cohesion. • contains a logical and relevant concluding statement or section.	The writing: • illustrates consistent and sophisticated command of precise language and domain-specific vocabulary appropriate to the task. • utilizes sophisticated and varied transitional words and phrases. • effectively establishes and maintains a formal style and an objective tone.
3	In response to the task and the stimuli, the writing: • utilizes relevant and sufficient evidence[1] from the stimuli to adequately develop the topic. • adequately and accurately explains and elaborates on the evidence provided, demonstrating a sufficient understanding of the topic and the stimuli.	In response to the task and the stimuli, the writing: • contains a relevant introduction. • utilizes adequate organizational strategies to create a mostly unified whole and to aid in comprehension. • clarifies most relationships among ideas and concepts, but there may be some gaps in cohesion. • contains a relevant concluding statement or section.	The writing: • illustrates consistent command of precise language and domain-specific vocabulary appropriate to the task. • utilizes appropriate and varied transitional words and phrases. • establishes and maintains a formal style and an objective tone.
2	In response to the task and the stimuli, the writing: • utilizes mostly relevant but insufficient evidence[1] from the stimuli to partially develop the topic. Some evidence may be inaccurate or repetitive. • explains some of the evidence provided, demonstrating only a partial understanding of the topic and the stimuli. There may be some level of inaccuracy in the explanation.	In response to the task and the stimuli, the writing: • contains a limited introduction. • demonstrates an attempt to use organizational strategies to create some unification, but ideas may be hard to follow at times. • clarifies some relationships among ideas and concepts, but there are lapses in focus. • contains a limited concluding statement or section.	The writing: • illustrates inconsistent command of precise language and domain-specific vocabulary. • utilizes basic or repetitive transitional words and phrases. • establishes but inconsistently maintains a formal style and an objective tone.
1	In response to the task and the stimuli, the writing: • utilizes mostly irrelevant or no evidence[1] from the stimuli, or mostly/only personal knowledge, to inadequately develop the topic. Evidence is inaccurate or repetitive. • inadequately or inaccurately explains the evidence provided, demonstrating little understanding of the topic and the stimuli.	In response to the task and the stimuli, the writing: • contains no or an irrelevant introduction. • demonstrates an unclear organizational structure; ideas are hard to follow most of the time. • fails to clarify relationships among ideas and concepts; concepts are unclear and/or there is a lack of focus. • contains no or an irrelevant concluding statement or section.	The writing: • illustrates little to no use of precise language and domain-specific vocabulary. • utilizes no or few transitional words and phrases. • does not establish or maintain a formal style and an objective tone.

[1] Ev . includes facts, definitions, concrete details, quotations, or other information and examples as appropriate to the task and the stimuli.

Connected by the Light: Photosynthesis

Samuel A. Spiegel

You have read, discussed, and thought about plants and where they get most of the matter they need to live and grow. Your group should have considered soil, water, and air as potential sources of matter. Given the available evidence and scientific reasoning, you probably came to the conclusion that plants obtain most of their matter from the gases in the air. Scientists today agree that plants pull carbon dioxide from the air and water through the roots. The carbon dioxide and water are then combined through a series of chemical processes in specialized parts of the leaves using energy from light. This series of processes is known as photosynthesis.

Let's examine photosynthesis in a little more detail and consider how we came to understand the process. The name *photosynthesis* was chosen to represent what happens in the series of processes. Photo means light. Synthesis means to build or combine. Photosynthesis uses energy from light to combine molecules.

In your earlier discussions, you should have considered the research of van Helmont, Woodward, Priestly, Ingenhousz, Senebier, and Saussure. What evidence did the scientists generate? What claims can we make based on that evidence?

Let's summarize what they reported. First, van Helmont found that the weight of a tree increased over time, but the weight of the soil did not decrease. Woodward found that plants in water alone did not grow as well as those with soil in the water. He also reported that the weight gained by the plants was much greater than the amount of mass lost in the water. Priestly found that plants could restore gases to the air. Ingenhousz added to the thinking by identifying oxygen as the gas being replaced by plants and noting that light was required for this to happen. Senebier further clarified that the leaves of a plant released oxygen and that the plant required carbon dioxide along with light for the process to work. Saussure contributed that water was required for the plant to live and added something to the gain of matter.

We can further summarize the reported studies as plants release oxygen (oxygen = an output) when exposed to light (light is required). Plants take up carbon dioxide (carbon dioxide = input) in the presence of light (light required). Lastly, water is required and taken up by plants (water = input). Let's write this as a chemical equation:

Carbon dioxide + water + light → plant matter + oxygen

We can further refine expression based on other studies that have shown the plant matter produced is sugar, usually glucose.

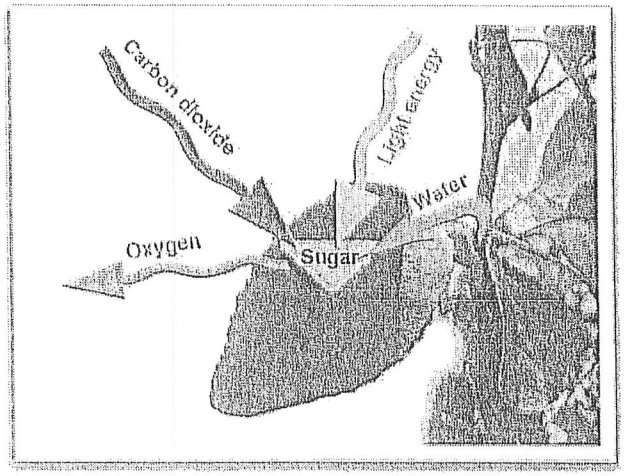

Figure 1. Simplified processes of photosynthesis showing inputs and outputs in a leaf.

Let's rewrite the chemical equation as words and then using the chemical symbols and amount for each.

Carbon dioxide + water + light → glucose (sugar) + oxygen

$6CO_2 + 6H_2O$ + light energy → $C_6H_{12}O_6 + 6O_2$

Notice that it takes six molecules of carbon dioxide and six molecules of water for the process to produce one molecule of glucose, and six oxygen molecules are released as waste. In chemistry, like in mathematics, equations must be balanced on both sides. You need to have the same number of carbon on the left as are on the right side of the equation. We use the "yields" symbol (→) rather than an equal sign because the process usually goes in one direction. The formulae are shown here just to familiarize you with them. You will study them in greater detail in later science classes. For now let's stay focused on the general processes, thinking about what goes in and what comes out.

Light energy powers the process to break down the carbon dioxide and water and then recombines the atoms to form sugar, with oxygen as a byproduct. The end result of the processes is that light energy is transformed into some chemical energy in the sugar, plus heat energy that is lost. But if all the light energy is lost or used to make sugar, where does the plant get the energy to live? Sugar is the key. In later lessons we will think about the role sugar (glucose) plays as the key to energy and matter in organisms and ecosystems.

So what does all this mean in terms of where a plant gets the matter and energy needed to live and grow? Develop a scientific argument to answer the question: How do most plants obtain the matter and energy they need to live and grow?

Exchange Cycles: Photosynthesis

Partnership for Environmental Education and Rural Health

We know that matter has to be recycled because it is in a limited supply on earth. How do we know where the original matter came from and how is it possible to follow the recycling processes of all of this matter? We don't know everything concerning these questions, but we do have evidence to support certain theories.

Photosynthesis

Photosynthesis is a very important process in the recycling of carbon, water and oxygen. Scientists have studied this process for hundreds of years. The basic equation for photosynthesis, shown below, has been understood since the 1800s:

$6CO_2 + 12H_2O + \text{Energy from Sunlight} \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$

What this says is that 6 molecules of carbon dioxide combine with 12 molecules of water in the presence of sunlight energy to form one molecule of sugar plus 6 molecules of oxygen and 6 molecules of water. Scientists know this because they can actually measure these substances. Scientists can actually follow the movement of oxygen through the photosynthetic process by using radioactive oxygen (labeled below as **red**).Two experiments were conducted. One experiment used water that contained the radioactive oxygen (shown in **red** below), and the other experiment used carbon dioxide that contained the **radioactive oxygen** (also shown in **red**). The results of the experiment are shown below:

1: $6CO_2 + 12H_2\mathbf{O} + \text{Energy from Sunlight} \rightarrow C_6H_{12}O_6 + 6\mathbf{O}_2 + 6H_2O$
2: $6C\mathbf{O}_2 + 12H_2O + \text{Energy from Sunlight} \rightarrow C_6H_{12}\mathbf{O}_6 + 6O_2 + 6H_2\mathbf{O}$

"What has this got to do with cycles?" you might ask. Notice in step 1 that the oxygen in water gets released as oxygen gas. In step 2 the carbon in the carbon dioxide in air gets captured in sugar (glucose). Both steps capture the carbon in carbon dioxide into the sugar. In other words, both oxygen and carbon are conserved in sugar. The carbon in the sugar of the last candy bar you ate could have been in the air exhaled by a dinosaur. Can you make a drawing of the cycles for oxygen and carbon as it moves among the environment, plants, and animals?

Another major contribution to understanding photosynthesis came from Melvin Calvin (see Story time) who discovered the process that uses the energy obtained from the sunlight to turn the carbon in carbon dioxide into glucose. This is known as the Calvin Cycle. Calvin supplied green algae with radioactively-labeled carbon molecules, and traced the movement of the carbon over different time periods using an identification method known as chromatography. The carbon gradually moved through different carbon compounds until it finally ended up in glucose. Using the data obtained in this experiment, Calvin mapped the steps in photosynthesis.

Note: For photocopying purposes, text that should be red will appear in boldface type.

IV. Writing to Sources and Research

1. ***Materials portray writing to sources as a key task.*** Crafting an argument frequently relies on using information; similarly, an analysis of a subject will include argumentative elements. While these forms are not strictly independent, what is critical to both forms of writing is the use and integration of evidence. In historical, technical, and scientific writing, accuracy matters, and students should demonstrate their knowledge through precision and detail.

2. ***Materials make it clear that student writing should be responsive to the needs of the audience and the particulars of the text in question.*** As the standards are silent on length and structure, student writing should not be evaluated by whether it follows a traditional format or formula (e.g. the five paragraph essay). Instead, the Common Core State Standards have been carefully designed to focus on the elements or characteristics of good writing including drawing sufficient evidence from texts, writing coherently with well-developed ideas, and writing clearly with sufficient command of standard English.

3. ***Students are given extensive practice with short, focused research projects.*** Writing Standard 7 emphasizes that students should conduct several short research projects in addition to more sustained research efforts. Materials should require several of these short research projects annually to enable students to repeat the research process many times and develop the expertise needed to conduct research independently. A progression of shorter research projects also encourages students to develop expertise in one area by confronting and analyzing different aspects of the same topic as well as other texts and source materials on that topic.