DISCIPLINARY LITERACY IN GRADES K-2

Purpose of this Document

This document is intended to illustrate how disciplinary literacy skills develop in science and possible strategies that teachers can use while helping their students deepen their understanding of science content and practices. It is important to note that the 2016 ELA Standards are meant to complement the specific content demands of the Arizona High School Science Standards, not replace them.

In this document, **text** is broadly defined as any communication, spoken, written, or visual, involving language. This include written words, numbers, and symbols; visual representations in graphs, pictures, flowcharts, videos, and computer simulations; information provided by reading scientific tools and instruments; published documents in print or electronic format; unpublished documents written by students, peers, or teachers; or other sources of information.

Science Sense-Making

A fundamental goal of science education is to help students figure out how the world works and make sense of scientific phenomena or compelling questions. A scientific phenomenon is an event or situation that is observed to exist or happen, especially one whose cause or explanation is in question. Sense-making is a conceptual process in which a learner actively engages with scientific phenomena to construct logical and coherent explanations that incorporate their current understanding of science and are consistent with the available evidence. To develop a scientific understanding of the natural and designed worlds, and to answer compelling questions in science, students must be able to:

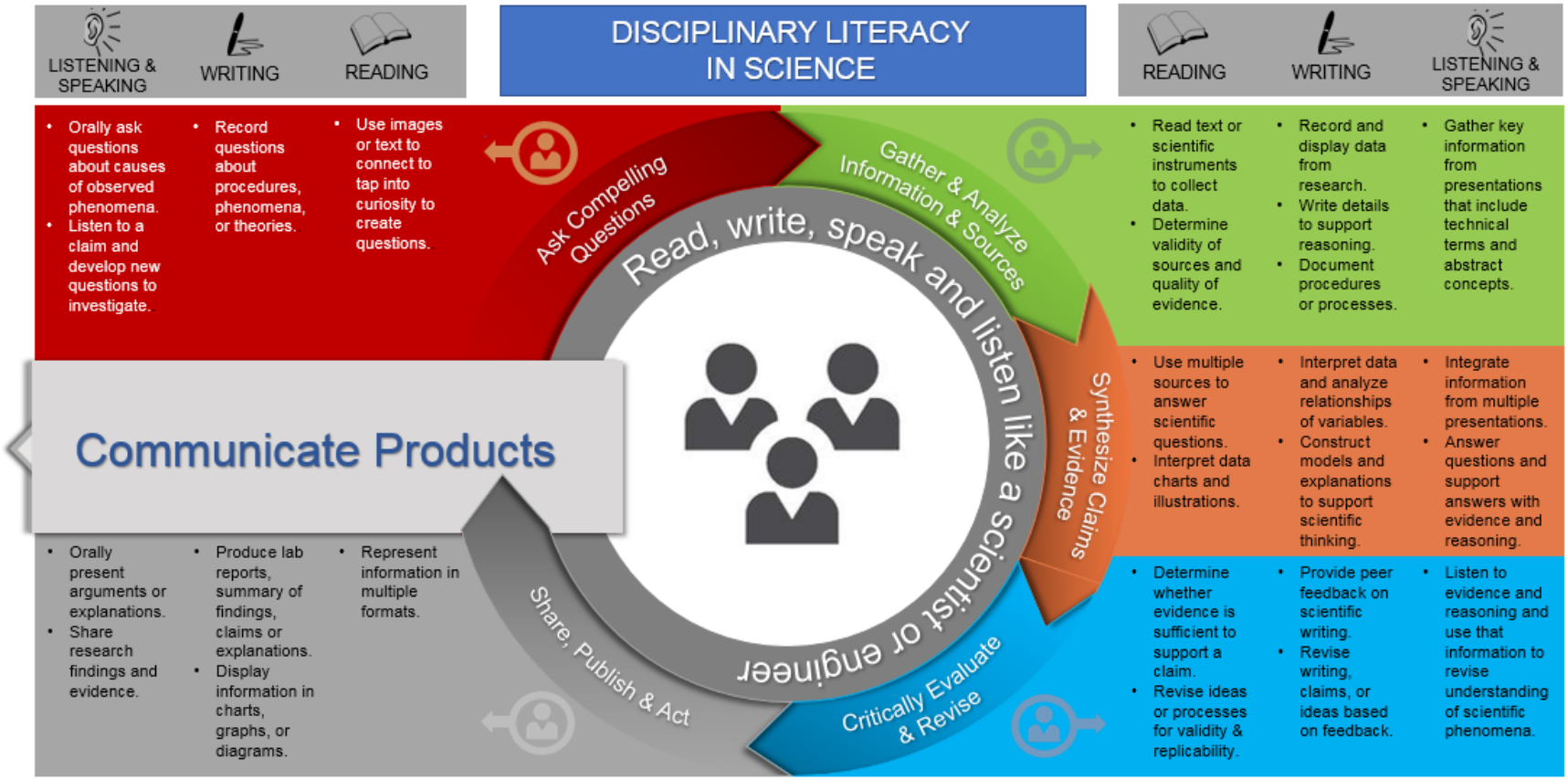
- **Gather and analyze** information and sources
- **Synthesize claims and evidence** to support reasoning
- **Critically evaluate and revise** ideas and connect them to scientific principles and theories
- **Communicate** understanding and reasoning through a variety of methods or products

Disciplinary Literacy in Science

Disciplinary literacy in science focuses on how reading, writing, speaking, and listening are used to develop sense-making in science. It emphasizes the content knowledge, experiences and skills, and ability to acquire new knowledge that experts within science disciplines use to apply and generate new knowledge.

As students begin to develop disciplinary literacy in science, they use strategies to build background knowledge and experiences specific to science content and practices, learn specialized vocabulary, deconstruct complex text structures, map graphic and mathematical representations against explanations in text, pose discipline-specific questions, and provide evidence to support, evaluate, and

communicate claims. As students develop disciplinary literacy in science, they strengthen their ability to think critically in a way that is meaningful to developing scientific understanding of the world and scientific habits of mind.



Reading Informational Text

Reading and interpreting scientific and technical text is critical to building knowledge in science and engineering. The 2016 ELA Standards provide the skills for students to do this. This section of the document illustrates ways science teachers can help students apply reading standards as they develop disciplinary literacy in science.

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Key Ideas and Details	Using **Key Ideas and Details** to Build Disciplinary Literacy in Science
(Link to RI.1, RI.2, RI.3 for grades K-2) These ELA standards help students gather and combine more than 1 source of information (evidence from text) that can be used to support their reasoning as they develop basic understanding of science phenomena. Being able to read and interpret scientific and technical text is a fundamental practice of science and engineering.	Key Ideas and Details standards can be applied to help students: • Use text to find answers to relevant science questions or problems. • Follow a written lab protocol or sequence of steps. • Connect formation from text to background knowledge. • Determine which information is important to answering scientific questions. • Pay attention to details in text and when reading/collecting data from scientific instruments. • Describe how specific images (e.g., a diagram showing how a machine works) support a scientific or engineering idea. • Interpret and evaluate data, evidence, and scientific reasoning. • Provide an accurate and objective summary or conclusion.

Craft and Structure	Using **Craft and Structure** to Build Disciplinary Literacy in Science
(Link to RI.4, RI.5, RI.6 for grades K-2) These ELA standards help students use scientific language during investigations, observations of science phenomena, reading texts, and classroom discussions. Scientific and technical text often contains a variety of text structures, visual representations, and vocabulary that has a very specific meaning.	Craft and Structure standards can be applied to help students: • Use strategies (context clues, restatement, examples) to determine the meaning of words and phrases in the text. • Use context to determine meanings of words and compare how vocabulary may be used differently in a science context compared to non-science contexts. • Identify different structures within a text (headings, tables of contents, glossaries, electronic menus, icons) to locate key facts or information in a text. • Identify information in pictures, diagrams and other visual representations; explain why the author used them instead of paragraph text. • Identify when an author is making a scientific claim, and the evidence and reasoning used to support their claim. • Use the information in text to answer questions, and support reasoning and conclusions.

Craft and Structure	Using **Craft and Structure** to Build Disciplinary Literacy in Science
Reading text structures that embed bullets, data, images, captions, and non-linguistic representations is a fundamental practice of science and engineering.	

Integration of Knowledge and Ideas	Using **Integration of Knowledge and Ideas** to Build Disciplinary Literacy in Science
(Link to RI.7, RI.8, RI.9 for grades K-2) These ELA standards help students integrate scientific knowledge and ideas when obtaining, evaluating, and communicating information. Students integrate information to evaluate the validity and reliability of ideas, methods, claims, and designs. They use this knowledge to generate their own questions about scientific phenomena or to identify solutions to design problems.	Integration of Knowledge and Ideas standards can be applied to help students: • Use information from multiple sources, including lab investigations, to answer a scientific question. • Use multiple sources or formats of information related to the same science concept and explain whether these representations provide similar levels of detail. • Locate the claim, evidence, and reasoning in scientific explanations and arguments. • Identify explanations and arguments that are supported by evidence and determine why some evidence is relevant to a scientific question and some is not. • Distinguish between explanations that account for all gathered evidence and those that do not. • Explain how specific images (e.g., a diagram showing how a machine works or a labeled drawing of animal parts) contribute to and clarify a text.

Range of Reading and Level of Complexity	Using **Range of Reading and Level of Complexity** to Build Disciplinary Literacy in Science
(Link to RI.10 for grades K-2) This ELA standard requires that students engage with different lengths, structures, types, and complexities of science text, appropriate for their grade level. Reading science texts requires a set of discipline-specific skills and strategies. Science texts use scientific vocabulary and present information in multiple formats.	Implementation strategies for this standard are embedded in the previous reading examples. Students in science classrooms often read at different levels of proficiency, and even the same student may read at different levels based on text structures or format. Teachers should understand the complexity of the text provided to students and implement appropriate strategies to support student conceptual understanding of science phenomena.

Writing

Writing is a key means of engaging in argument from evidence and requires students to construct a convincing argument that supports or refutes claims for explanations about the natural world. Students use appropriate and sufficient evidence and scientific reasoning to defend and critique the validity and reliability of claims and explanations about the natural world, or methods for collecting data and evidence.

The 2016 ELA Standards provide the skills for students to assert and defend claims, show what they know about a subject, and convey what they have experienced, thought, and designed. This section of the document illustrates ways science teachers can help students apply writing standards as they develop disciplinary literacy in science. Scientific writing may include:

- informal writing (notes based on observations, summarizations of technical texts, making thinking visible by tracking how understanding of phenomena changes over time)
- formal writing (lab reports, documenting procedures, investigation designs, explanations of models, and research)
- persuasive writing (calls for action, letters to editors/policy makers, position statements)

Text Types and Purposes	Using **Text Types and Purposes** to Build Disciplinary Literacy in Science
(Link to W.1, W.2, W.3 for grades K-2) These ELA standards help students write in formats that are typically found in science contexts or may be specific for their content area. Typically, only formal science writing is written in passive/third person voice. In science, focus is shifted from stating personal opinions to using evidence to support an explanation or scientific argument. Students use evidence and reasoning to defend scientific claims and explanations, or methods for collecting data and evidence. It is critical that students know how to incorporate appropriate visual representations to support the scientific explanations and arguments they write.	Text Types and Purposes standards can be applied to help students: • Record thoughts, ideas, sketches, or collected data in science notebooks to be used as evidence or to support reasoning. • Identify arguments that are supported by evidence and determine why some evidence is relevant to a scientific question and some is not. • Distinguish between explanations that account for all gathered evidence and those that do not. • Construct an explanation with evidence to support a claim and distinguish between opinions and evidence in one's own explanations. • Write formal or informal texts. The product may include notebook entries, observations, functional text, or visual displays of data. • Produce science writing in a voice appropriate for the type of writing and the audience. • Write step-by-step procedures for experiments that are detailed enough that others would be able to repeat the procedure and achieve the same results. • Communicate information, solutions, or design ideas with others using models, drawings, writing, or numbers that provide detail about scientific ideas, practices, or design ideas

Production and Distribution of Writing	Using **Production and Distribution of Writing** to Build Disciplinary Literacy in Science
(Link to W.4, W.5, W.6 for grades K-2)	Production and Distribution of Writing standards can be applied to help students:

These ELA standards help students develop scientific writing appropriate for task, purpose and audience.	• Develop and strengthen writing; focus on purpose and audience. • Incorporate peer or adult feedback of drafts into writing; the writing process and review of drafts can be used for any writing assignments within the science classroom. • Use technology (keyboarding skills) to interact and collaborate with others as a way of sharing ideas. • Integrate drawings or other visual representations of information to support text.

Research to Build and Present Knowledge	Using **Research to Build and Present Knowledge** to Build Disciplinary Literacy in Science
(Link to W.7, W.8, for grades K-2) These ELA standards help students synthesize multiple texts, observations, or experiments to answer questions, gather information, reason about the evidence, and communicate findings or conclusions. Final communication products typically follow a formal writing style (documenting or publishing procedures, investigation designs, explanations of models, and research) and are written in academic or passive/third person voice.	Research to Build and Present Knowledge standards can be applied to help students: • Participate in shared research and writing projects (e.g., read books on a single topic to produce a report; record science observations). • Use and combine information from multiple sources to construct claims, evidence, and explanations. • Gather relevant information from a variety of credible print and digital sources to answer a question. • Recall information from experiences or gather information from provided sources to answer a question. • Use evidence from informational texts (e.g., encyclopedias, credible web sites, experts, news articles, textbooks, trade books) to support claims, analyses, reflections, and/or research.

Speaking and Listening

Students must have ample opportunities to engage in science discourse across a variety of rich, conversations—as part of a whole class, in small groups, and with a partner. Being productive members of these conversations requires that students contribute accurate, relevant information; respond to and extend what others have said; make comparisons and contrasts; and analyze and synthesize a multitude of ideas in various domains. The 2016 ELA Standards provide the skills for students to do this. This section of the document illustrates ways science teachers can help students apply speaking and listening standards as they develop disciplinary literacy in science.

Comprehension and Collaboration	Using **Comprehension and Collaboration** to Build Disciplinary Literacy in Science
(Link to SL.1, SL.2, SL.3 for grades K-2) These ELA standards help students engage in scientific conversations to gather and evaluate information. Engaging in scientific discourse communities to collaborate and build comprehension is a fundamental practice of science and engineering.	Comprehension and Collaboration standards can be applied to help students: • Initiate and participate effectively in a range of collaborative discussions (one-on-one, small groups, teacher-led, digitally) to express their own ideas clearly and building on others' ideas. • Listen actively to others' explanations or arguments to indicate agreement or disagreement based on evidence, and/or to retell the main points. • Distinguish between opinions and evidence in the speaker's explanations or arguments. • Recount or describe key ideas or details from a text read aloud or information presented orally or through other media. • Ask and answer questions about what a speaker says to clarify comprehension, gather additional information, or deepen understanding of a science topic or issue.

Presentation of Knowledge and Ideas	Using **Presentation of Knowledge and Ideas** to Build Disciplinary Literacy in Science
(Link to SL.4, SL.5, SL.6 for grades K-2) These ELA standards help students engage in scientific conversations to informally share ideas and develop understanding of scientific phenomena and provide a formal way to present information appropriate to the audience and task. Engaging in scientific discourse communities to communicate understanding and findings is a fundamental practice of science and engineering.	Presentation of Knowledge and Ideas standards can be applied to help students: • Discuss science questions, information, results, and supporting evidence with a partner or small group; speak clearly and in a sequence so listeners can follow the line of thinking and reasoning. • Make a claim about the effectiveness of an object, tool, or solution that is supported by relevant evidence and listen actively to others' comments that indicate agreement or disagreement based on evidence. • Engage in formal presentations to small or large groups of students to share findings and supporting evidence. Presentation should be clear, concise, and logically organized; content and presentation style should be appropriate to purpose, audience, and task. • Communicate scientific information orally, using various forms of print or digital media, pictures, and charts.