DISCIPLINARY LITERACY IN GRADES 3-5

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 Science Standards for grades 3-5, 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information provided by reading scientific tools and instruments; published documents in print or electronic format; unpublished documents written by students, peers, or teachers; or other sources of information.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:

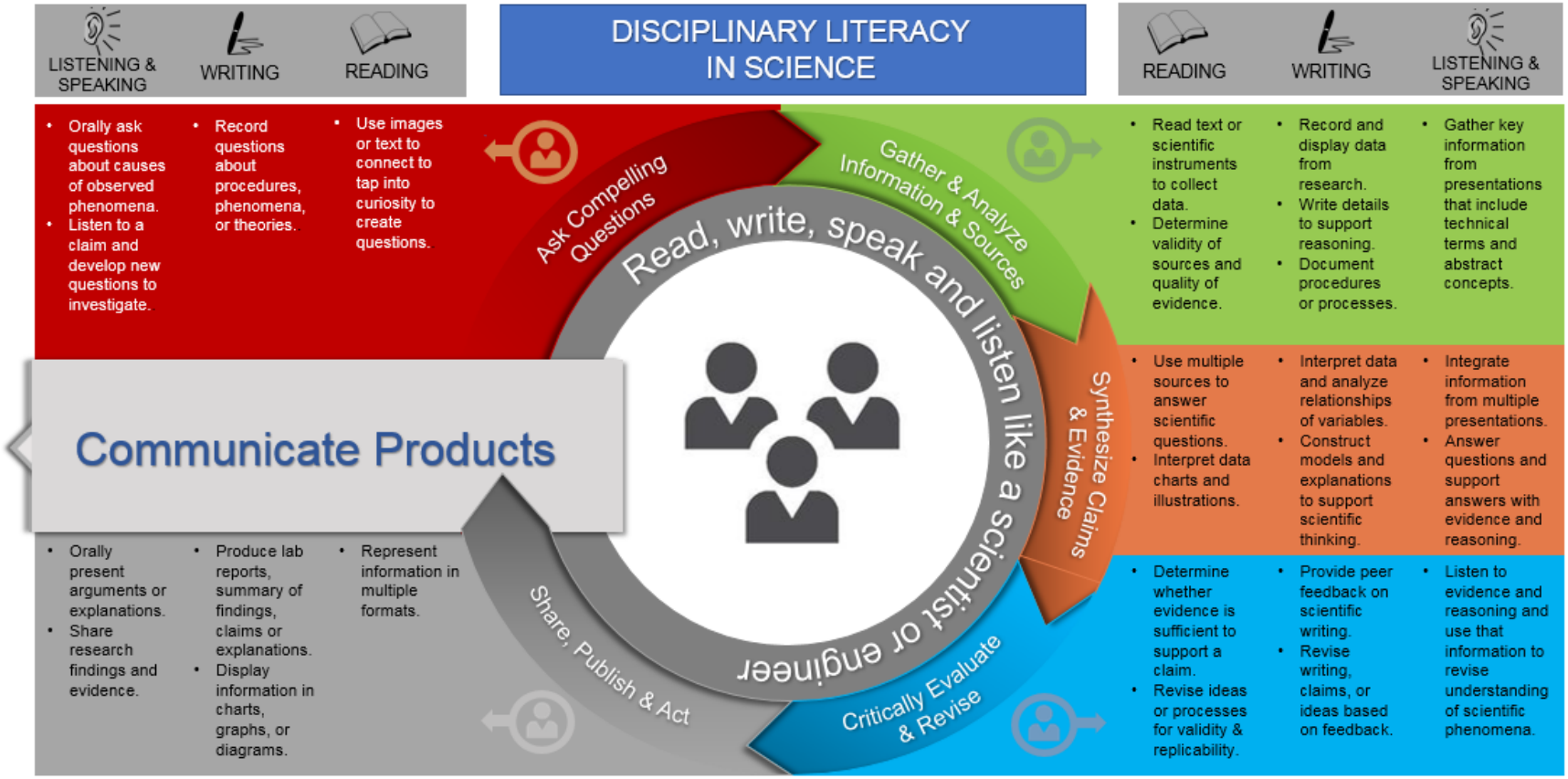
- **Gather and analyze** information and sources
- **Synthesize claims and evidence** to support reasoning
- **Critically evaluate and revise** ideas and connect them to scientific principles and theories
- **Communicate** understanding and reasoning through a variety of methods or products

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.

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 3-5) These ELA standards help students gather and analyze sources and information (evidence from text) that can be used to support their reasoning as they develop conceptual 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: • Find answers to relevant science questions or problems. • Understand and follow a written lab protocol, scientific process, or procedure. • Connect new understandings with background knowledge. • Determine which information is important to answering scientific questions. • Pay attention to details, accuracy, and precision when reading/collecting data from scientific instruments. • Interpret diagrams, pictures, charts, graphs, and data to gather information. • Interpret and evaluate quality and quantity of data, evidence, and scientific reasoning. • Determine the credibility of information, including sample size and visual representations of data and findings.

Craft and Structure	Using **Craft and Structure** to Build Disciplinary Literacy in Science
(Link to RI.4, RI.5, RI.6 for grades 3-5) These ELA standards help students navigate the norms and conventions of science text. 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, contrast, glossary, etc.) 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 structures within a text (headings, sub-headings, bold words, pictures, graphs, data tables, and paragraphs) and explain how they build on information in the paragraph text. • Explain how key terms relate to each other or to broader science concepts and general understanding. • Use information to answer questions and support reasoning and conclusions. • Make meaning out of mathematical symbols and equations; diagrams, or other visual representations and explain why the author used them instead of paragraph text.

Craft and Structure	Using **Craft and Structure** to Build Disciplinary Literacy in Science
Reading text structures that embed bullets, graphs, data, images, captions, and non-linguistic representations of information 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 3-5) 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 data and information from multiple sources, including lab investigations, to support a scientific explanation or solve a scientific problem. • Use multiple sources or formats of information related to the same science concept and explain whether these sources provide similar levels of detail or whether the information supports or contradicts each other. • Locate the claim, evidence, and reasoning in scientific explanations and arguments. • Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation • Convert visual representations (graph, chart, picture, etc.) of information into words; convert words into visual representations. • Evaluate whether an author's claim is supported by the evidence provided and whether that evidence is relevant to the reasoning of the claim or argument.

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 3-5)	Implementation strategies for this standard are embedded in the previous reading examples.

Range of Reading and Level of Complexity	Using **Range of Reading and Level of Complexity** to Build Disciplinary Literacy in Science
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.	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 3-5)	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.

Text Types and Purposes	Using **Text Types and Purposes** to Build Disciplinary Literacy in Science
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 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.	• Write a claim, evidence-based argument, or explanation that includes logical reasoning, accurate science content, and relevant and sufficient evidence to support the claim. Claims are created with effective word choice, appropriate use of science vocabulary, and writing style. • Write formal or informal texts. The product may include notebook entries, research papers, laboratory notes or reports, functional text, or visual displays of data. • Produce science writing in a voice appropriate for the type of writing and the audience. Objective or academic voice in science is used when a writer wants to deliver information in a neutral, factual, and unbiased way. • 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. • Produce texts that include charts, graphs, timelines, photographs, videos, maps, flowcharts, diagrams, models, or tables to supplement or support the text.

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 3-5) These ELA standards help students develop scientific writing appropriate for task, purpose and audience.	Production and Distribution of Writing standards can be applied to help students: • 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 (Internet, keyboarding skills, formatting, storing) to create a published piece where information and ideas are connected and presented clearly and efficiently. • Use technology (blogs, wikis, smartboards, apps) to support collaborative brainstorming and writing. • Integrate graphs, data tables, drawings or illustrations, 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 3-5 and W.9 for grades 4-5) 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 third person voice.	Research to Build and Present Knowledge standards can be applied to help students: • Conduct research projects or experimental investigations of differing lengths to provide enough information to construct claims, evidence, and explanations that answer scientific questions or solve a problem. • Integrate information from a variety of credible print and digital sources, taking care to use a consistent voice and avoid plagiarism. • 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. • Convert informal writing in drafts while still making sense of information and developing claims, to a formal academic voice when publishing formal writing of claims.

Range of Writing	Using **Range of Writing** to Build Disciplinary Literacy in Science
(Link to W.10 for grades 3-5) This ELA standard requires that students produce informal, formal, and persuasive	Implementation strategies for this standard are embedded in the previous writing examples. • Writing assignments should be of varying lengths (field or research notes, one paragraph responses, multiple paragraph essays, lab reports or presentations, extended research).

scientific writing across multiple delivery formats and topics, for different purposes and audiences.	• Scientific writing often includes pictures, diagrams, charts, thinking maps, data, or statistics; these can be integrated with text or presented with minimal text.

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 3-5) These ELA standards help students engage in scientific discourse 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. • Integrate multiple sources of information presented in diverse media or formats (visually, quantitatively, orally), and explain how the information supports a claim, data analysis, reasoning, or conclusion. • Collaboratively plan or conduct investigations; determine whether the data is collected with appropriate tools, in a safe and ethical manner, and is consistent with other groups' findings. • Respectfully provide and receive critiques from peers about a proposed procedure, explanation, or model by citing relevant evidence and posing specific questions. • Refine explanations, arguments, or other science ideas based on feedback.

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 3-5)	Presentation of Knowledge and Ideas standards can be applied to help students:

Presentation of Knowledge and Ideas	Using **Presentation of Knowledge and Ideas** to Build Disciplinary Literacy in Science
These ELA standards help students engage in scientific discourse 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.	• Engage in science discourse with a partner or small group by discussing questions, information, results, and supporting evidence. Speak clearly and in a sequence so listeners can follow the line of thinking and reasoning. • 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 are appropriate to purpose, audience, and task. • Use digital media (graphics, images, music, sound, visual displays, or interactive elements) in presentations to clarify science content and to add interest. • Communicate scientific information orally, using various forms of media, tables, diagrams, and charts.