NGSS Science and Engineering Practices with Corresponding ELD Standards

2nd Grade
1. Asking questions and defining problems

*Students will inquire, identify, predict, describe, and define*

- Ask questions based on observations to find more information about the natural and/or designed world(s).
- Ask and/or identify questions that can be answered by an investigation.
- Define a simple problem that can be solved through the development of a new or improved object or tool

(NGSS Appendix F)

**General Strategies** for All Students

- Provide an engaging context that peaks student curiosity (discrepant event, interesting scenario, hands-on activity, relevant situation, authentic problem)
- Keep class chart for student questions
- Encourage student to ask questions based on the crosscutting concepts, e.g. *What patterns do I observe? What causes…? Which is faster? Hotter? Bigger? What are the parts of…? How can I make … with …? How does the shape of … relate to its function? What is the same about …? What changes do I observe?* (For more possible questions see [http://crosscutsymbols.weebly.com/](http://crosscutsymbols.weebly.com/))
- Recast students’ incomplete or flawed questions, *So what you’re asking is…? You’re question then is …?*
- Brainstorm with students a list of questions based on a shared experience and then together sort them into “testable” and “non-testable” questions
- Provide a context (real or imaginary) for students to define a problem they can be solved through engineering, e.g., playground or classroom environment, class pet habitat, cafeteria, etc.

**Corresponding ELD Standards**

Part 1. Interacting in Meaningful Ways:  
A. Collaborative: 1. Exchanging information/ideas;  
B. Interpretive: 5. Listening actively

<table>
<thead>
<tr>
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<td>PI.B.5 Demonstrate active listening to read-alouds and oral presentations by asking basic questions with oral sentence frames and substantial prompting and support.</td>
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<td><strong>Sentence frames:</strong></td>
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<tr>
<td>What is ..?</td>
<td>I wonder...</td>
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<td>What does ..?,</td>
<td>What would happen if...?</td>
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<td>Where is ...?</td>
<td>What causes...?</td>
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<td>When I ... why does...?</td>
<td>If I change ..., what will happen to ...?</td>
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<td>When does ... ?</td>
<td>I predict ... because ...</td>
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<td>How does ..?</td>
<td>The problem we will solve is ...</td>
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<td>I predict ...</td>
<td>What questions do you have about...?</td>
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<td><strong>Questions/Prompts:</strong></td>
<td>What questions do you have about what you might change?</td>
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<td>Which of these questions are you wondering about?</td>
<td>What questions could you ask to find out...?</td>
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<td>Which of these parts do you want to change?</td>
<td>What is the problem we are trying to solve?</td>
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<td>Could ... be the problem you might solve?</td>
<td>How might we solve this problem?</td>
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<td>What do you need to know about ...?</td>
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2. Developing and using models

*Students compare, develop, represent, describe, explain, and revise*

- Distinguish between a model and the actual object, process, and/or events the model represents.
- Compare models to identify common features and differences.
- Develop and/or use a model to represent amounts, relationships, relate scales (bigger, smaller), and/or patterns in the natural and designed world(s).
- Develop a simple model based on evidence to represent a proposed object or tool.

(NGSS Appendix F)

**General Strategies for All Students**

- Provide examples of models of familiar objects, processes, and events for students to discuss and compare, e.g., *how plants grow, how rolling balls change direction, how water changes*
- Model for students how to develop and use models (e.g., *diagrams, drawings, physical replica, dioramas, dramatizations, storyboards*) to represent their developing ideas.
- Regularly have students draw models in their notebooks to use as artifacts for discussion. Encourage students to revise their models based on new information.
- Provide supports for students to share their models and ask each other questions in pairs or small groups:
  - *Student A. What does your model show?*
  - *Student B. My model shows...*
  - *Student A. What does ... mean?*
  - *Student B. It shows ...*

**Corresponding ELD Standards**


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<td>PI.C.9 Plan and deliver very brief oral presentations (e.g., describing a picture).</td>
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<td>PI.C.9 Plan and deliver longer oral presentations (e.g., describing a science process).</td>
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<td><strong>Sentence frames:</strong></td>
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<td>The model shows ...</td>
<td>The model represents ...</td>
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<td>The model doesn’t show ...</td>
<td>These models all have ...</td>
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<td>The parts of my model are ...</td>
<td>This model is different because ...</td>
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<td><strong>Questions/Prompts:</strong></td>
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<tr>
<td>What does this model represent?</td>
<td>How is this model different than a real ...?</td>
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<td>What do you observe in this model? What don’t you observe in this model?</td>
<td>What is the same about these models? What is different?</td>
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<td>How might you act out ...?</td>
<td>How does the model help you understand ...?</td>
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<tr>
<td>What could you add to your model to show...?</td>
<td>What doesn’t it explain?</td>
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<tr>
<td>Does this part mean?</td>
<td>What ideas could you add to your model?</td>
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<tr>
<td>Make a drawing in your notebook to explain ...</td>
<td>What changes could you make?</td>
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<td>What is another way you could show?</td>
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<td>Make a diagram to explain ...</td>
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<td>Based on what you know about ... make a model of the tool you would use to ...</td>
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3. Planning and carrying out investigations

**Students design, sequence, predict, evaluate, describe, organize, compare, classify, draw, label**

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.
- Evaluate different ways of observing and/or measuring a phenomenon to determine which way can answer a question.
- Make observations (firsthand or from media) and/or measurements to collect data that can be used to make comparisons.
- Make observations (firsthand or from media) and/or measurements of a proposed object, tool, or solution to determine if it solves a problem or meets a goal.
- Make predictions based on prior experiences.

(NGSS Appendix F)

**General Strategies for all Students**

- Model the process for planning an investigation
- Explain the process of producing data and how data can be used as evidence. Use simple examples to demonstrate the difference between data and evidence.
- Teach a mini-lessons on ways to record and organize data in student science notebooks (e.g., T-charts, lists, technical drawings, labeling)
- Practice making predictions based on prior experiences, not guessing. Push students to provide a reason for their prediction.
- Introduce equipment and procedural words beforehand (separate, pour, measure, etc.) and post on a class word wall or chart with images.
- After coming to a class or group consensus on a procedure for an investigation, document the steps on the board with illustrations so that all students have access to them.
- Have students work in small groups. Encourage and make collaboration a focus.

**Corresponding ELD Standards**

Part 1. Interacting in Meaningful Ways  A. Collaborative: 1. Exchanging information/ideas; C. Productive 10. Writing

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<td>PI.C.10 Write very short informational texts (e.g., a description of an investigation) using familiar vocabulary collaboratively with an adult (e.g., joint construction of texts), with peers, and sometimes independently.</td>
<td>PI.C.10 Write short informational texts (e.g., an explanatory text explaining a prediction) collaboratively with an adult (e.g., joint construction of texts), with peers, and with increasing independence.</td>
<td>PI.C.10 Write longer informational texts (e.g., an explanatory text explaining a prediction) collaboratively with an adult (e.g., joint construction), with peers and independently.</td>
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<tr>
<td><em>First, we will ...</em></td>
<td><em>If we change ... then ...</em></td>
<td><em>What are you trying to find out?</em></td>
</tr>
<tr>
<td><em>Next, we will ...</em></td>
<td><em>We need to find out ...</em></td>
<td><em>How could you find out...?</em></td>
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<td><em>Then, we will ...</em></td>
<td><em>If ... then ...</em></td>
<td><em>What part will you change?</em></td>
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<tr>
<td><em>We could change ...</em></td>
<td><em>We will compare ... to ...</em></td>
<td><em>Is there another way?</em></td>
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<tr>
<td><em>I predict ... because ...</em></td>
<td><em>I think ... is a good idea because ...</em></td>
<td><em>What materials will you need?</em></td>
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<tr>
<td><em>I observe ...</em></td>
<td><em>I think we should change ... because ...</em></td>
<td><em>What is your goal?</em></td>
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<tr>
<td>Are you trying to find out if...?</td>
<td>What are you trying to find out?</td>
<td>How do you know ... will solve the problem?</td>
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<td>Have you considered ...?</td>
<td>How could you find out...?</td>
<td>How well does ... solve the problem?</td>
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<td>What will you do first?</td>
<td>What part will you change?</td>
<td>What would you do to make it better?</td>
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<tr>
<td>Second?</td>
<td>Is there another way?</td>
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<td>Will you need ...?</td>
<td>What materials will you need?</td>
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<td>Is this the part you will change?</td>
<td>What is your goal?</td>
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<td>Is ... your goal?</td>
<td>How do you know ... will solve the problem?</td>
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<tr>
<td>Will ... solve the problem?</td>
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4. Analyzing and interpreting data

*Students compare, represent, classify, sequence, analyze*

- Record information (observations, thoughts, and ideas).
- Use and share pictures, drawings, and/or writings of observations.
- Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.
- Compare predictions (based on prior experiences) to what occurred (observable events).
- Analyze data from tests of an object or tool to determine if it works as intended.

(NGSS Appendix F)

**Strategies for All Students**

- Model ways of recording data in a class notebook. Use a think-aloud to demonstrate how to determine what is relevant information.
- Use joint construction of text and drawings. Do a mini-lesson on technical drawing.
- Facilitate sharing and critiquing of student notebook entries.
- Introduce and use a set of agreed upon expectations for data organization.
- Use focus questions to drive the inquiry and response.
- Record students’ predictions and return to them throughout the investigations.
- Introduce ways to organize data (graphs, charts, Venn Diagrams, graphic organizers)
- Provide sentence frames for oral and written discourse.
- Chart the data that students collect and model how to use that data to analyze whether an object or tool meets the students’ goals.

**Corresponding ELD Standards**

**Part I. Interacting in Meaningful Ways**

**B. Interpretive 6. Reading/Viewing closely:**

- **Emerging**
  - PI.B.6 Describe ideas, phenomena (e.g., plan life-cycle), and text elements (e.g., main idea, events) based on understanding of a select set of grade-level texts and viewing of multimedia, with substantial support.

- **Expanding**
  - PI.B.6 Describe ideas, phenomena (e.g., *how earthworms eat*), and text elements (e.g., main idea, events) in greater detail based on understanding of a variety of grade-level texts and viewing of multimedia with moderate support.

- **Bridging**
  - PI.B.6 Describe ideas, phenomena (e.g., *weathering*), and text elements (e.g., central message, events) using key details based on understanding of a variety of grade-level texts and viewing of multimedia with light support.
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<tr>
<td>PI.I.A.1 Apply understanding of how different text types are organized to express ideas (e.g. how data is organized within a text*) to comprehending and composing texts in shared language activities guided by the teacher with peers, and sometimes independently.</td>
<td>PI.I.A.1 Apply understanding of how different text types are organized to express ideas (e.g. how graphics relate to text*) to comprehending texts and composing texts with increasing independence.</td>
<td>PI.I.A.1 Apply understanding of how different text types are organized predictably to express ideas (e.g. compare the different ways data is represented in a text*), to comprehending and writing texts independently.</td>
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</table>

*Modified to align with NGSS

**Sentence frames:**

Emerging:
- I observe ...
- It looks ...
- It feels ...
- It smells ...
- It sounds like ...
- I think ...
- ... reminds me of ...
- My picture shows ...

Bridging:
- A pattern I observe is...
- ... and ... are similar because they both...
- ... and ... are different because ...
- I think ... because ...
- I used to think ..., but now I think ...

**Questions/Prompts:**

Emerging:
- Do you observe ...?
- Is this a pattern?
- Are these the same or different?
- Do you think it means...?
- Start by drawing ...
- Make a diagram to show ...
- Does this mean your design works?

Bridging:
- What do you observe?
- What surprised you?
- Does this change what you think about ...?
- What patterns do you observe?
- Does ... answer the question ...?
- How does ... show that your design works?
5. Using mathematics and computational thinking

*Students enumerate, measure, graph, estimate, describe, organize*

- Decide when to use qualitative vs. quantitative data.
- Use counting and numbers to identify patterns in the natural and designed world(s).
- Describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs.
- Use quantitative data to compare two alternative solutions to a problem.

(NGSS Appendix F)

**General Strategies for all Students**

- Discuss the ways students use math to describe, measure, and compare their observations, (e.g., *My plant had 2 leaves yesterday; today is has 3. Today the air is 20°C; That’s warmer than yesterday.*)
- Model through a think-aloud when to use quantities (counting and numbers) to describe observations and when to use comparative terms (e.g., bigger, higher, more, less, darker, softer).
- Mini-lessons on measurement and graphs when appropriate
- Provide simple tables for student to record data as they test their designs. Discuss what the data show.

**Corresponding ELD Standards**


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<td>PI.A.4 Adjust language choices (e.g., vocabulary, use of dialogue, etc.) according to purpose (e.g., persuading, entertaining), task, and audience (peers vs. adults), with moderate support from peers or adults.</td>
<td>PI.A.4 Adjust language choices according to purpose (e.g., persuading, entertaining), task and audience (e.g., peer-to-peer vs. peer-to-teacher), with light support from peers or adults.</td>
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<td>PI.C.10 Write very short informational texts (e.g., a description of a rock) using familiar vocabulary collaboratively with an adult (e.g., joint construction of texts), with peers, and sometimes independently.</td>
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### Emerging

**Sentence frames:**

- We counted…
- We measured ...
- There are more/less ...
- The ... is bigger/smaller ...
- We found out that ...
- The graph/table shows ...

**Questions/Prompts:**

- How many?
- How much?
- How long?
- How could you find out how many?
- How could you find out how long?
- How could you find the mass?
- Do you observe a pattern in these numbers?
- Do you think the pattern means ...
- Or ...
- Make a graph to show ...
- Does the graph mean?
- Is this a way to show ...
- Do the numbers mean that ...
- Does the difference in ...

### Expanding and Bridging

**Sentence frames:**

- We counted ... in order to ...
- We measured ... in order to ...
- We compared ... and ... to find out ...
- We were surprised that ...
- We can use the graph/table to show ...

**Questions/Prompts:**

- How should you record your observations?
- How would you measure...?
- What could you compare...?
- How will you describe how ... are different?
- What patterns do you observe in these numbers?
- What do you think the pattern means?
- How could you show this using a graph?
- Compare these numbers. Why are they the same or different?
- If you changed ... do you think the numbers would be different?
6. Constructing explanations and designing solutions

*Students infer, explain, provide evidence, design, identify, apply, solve, compare*

- Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.
- Use tools and/or materials to design and/or build a device that solves a specific problem or a solution to a specific problem.
- Generate and/or compare multiple solutions to a problem.

(NGSS Appendix F)

**General Strategies for all Students**
- Mini-lesson on language structures and norms for engaging in academic discussions
- Writing frames for explanatory writing
- Start with diagrams and graphic organizers to formulate ideas
- Think-Pair-Share to encourage building on the ideas of others
- Introduce engineering design process
- Whole class or small groups make concept maps
- Use crosscutting concepts to think about science ideas with another lens.

**Corresponding ELD Standards**

**Part 1. Interacting in Meaningful Ways**  

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### Sentence frames:

#### Emerging
- I observed ...
- I think ... because...
- We could solve the problem by ...
- The best way to solve the problem is ...

#### Expanding
- The evidence is ...
- I think the pattern shows ...
- I think ... causes ...
- When ... then ...
- The more..., the ...
- We think ... is the best solution because ...
- Both of these solutions...; however, ... is better because ...
- Why do you think that ...?

#### Bridging
- Explain in your own words.
- What ideas show that ...
- What does ... mean?
- Give an example.
- What is the effect of ...?
- What would happen if...?
- How did you use ... to ...?
- How is ... an example of ...?
- Why is ... important?
- How does what learned about ... help you explain ...?
- How does ... compare to ...?
7. Engaging in argument from evidence

Students discuss, compare, persuade, synthesize, negotiate, suggest, critique, evaluate, reflect
- Identify arguments that are supported by evidence.
- Distinguish between explanations that account for all gathered evidence and those that do not.
- Analyze why some evidence is relevant to a scientific questions and some is not.
- Distinguish between opinions and evidence in one’s own explanations.
- Listen actively to arguments to indicate agreement or disagreement based on evidence, and/or to retell the main points of the argument.
- Construct an argument with evidence to support a claim.
- Make a claim about the effectiveness of an object, tool, or solution that is supported by relevant evidence. (NGSS Appendix F)

General Strategies for all Students
- Provide norms and structures for students to discuss in pairs, small group, and whole class.
- Introduce and clarify terms such as evidence, claim, argument, data, opinion.
- Provide examples of arguments supported by evidence.
- Students sort examples of explanations supported by evidence and those that are not.
- Model and discuss expectations for argumentation.
- Encourage divergent ideas for discussion topics.
- Use common misconceptions as starting points for argumentation topics.
- Give students “concept cartoons” to discuss in pairs and small groups.
- Facilitate class debates.

Corresponding ELD Standards

Emerging
PI.A.3 Offer opinions and negotiate with others in conversations using learned phrases (e.g., I think...), as well as open responses, in order to gain and/or hold the floor.
PI.B.7 Describe the language writers or speakers use to present an idea (e.g., words or phrases used to make an argument) with prompting and substantial support.

Expanding
PI.A.3. Offer opinions and negotiate with others in conversations using an expanded set of learned phrases (e.g., I agree with X, but...), as well as open responses, in order to gain and/or hold the floor, provide counterarguments, etc.
PI.B.7 Describe the language writers or speakers use to present or support an idea (e.g., the vocabulary or phrasing used to make an argument based on evidence), with prompting and moderate support.

Bridging
PI.A.3. Offer opinions and negotiate with others in conversations using a variety of learned phrases (e.g., That’s an interesting idea, but...), as well as open responses, in order to gain and/or hold the floor, provide counter-arguments, elaborate on an idea, etc.
PI.B.7 Describe how well writers and speakers use specific language resources to support an opinion or present an idea (e.g., whether the vocabulary used to present evidence is precise enough) with light support.
Emerging
PI.C.11 Support opinions by providing good reasons and some textual evidence or relevant background knowledge (e.g., referring to textual evidence or knowledge of content).

Expanding
PI.C.11 Support opinions by providing good reasons and increasingly detailed textual evidence (e.g., providing examples from the text) or relevant background knowledge about the content.

Bridging
P1C.11 Support opinions or persuade others by providing good reasons and detailed textual evidence (e.g., specific events or graphics from text) or relevant background knowledge about the content.

<table>
<thead>
<tr>
<th>Sentence frames:</th>
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<th>Question/Prompts:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I claim...</td>
<td>I claim...</td>
<td>Why do you think this argument is supported by evidence?</td>
</tr>
<tr>
<td>My evidence is ...</td>
<td>I would like to add ...</td>
<td>What is different about these explanations?</td>
</tr>
<tr>
<td>I agree/disagree with ...</td>
<td>I would argue that ...</td>
<td>Have we considered all of the evidence?</td>
</tr>
<tr>
<td>because...</td>
<td>Have you thought about...?</td>
<td>What is missing from this explanation?</td>
</tr>
<tr>
<td>What about...?</td>
<td>I have a different idea about ...</td>
<td>Does this information help us answer the question...?</td>
</tr>
<tr>
<td>I used to think... but now I think...</td>
<td>You said that..., but, I think that...</td>
<td>Why do you think ... is evidence that supports this claim?</td>
</tr>
<tr>
<td>My models shows...</td>
<td>What is your evidence?</td>
<td>Why do you think that is so?</td>
</tr>
<tr>
<td>My data shows...</td>
<td>I agree/disagree that ... supports the claim ...</td>
<td>What is your evidence?</td>
</tr>
</tbody>
</table>

Questions/Prompts:

Which argument is supported by evidence?
Which explanation makes more sense to you?
Which piece of evidence supports this claim?
Is this an opinion or evidence?
Do you agree or disagree?
Do you think ... supports the idea that...?
### 8. Obtaining, evaluating, and communicating information

*Students read, summarize, describe, compare, combine, explain, communicate*

- Read grade-appropriate texts and/or use media to obtain scientific and/or technical information to determine patterns in and/or evidence about the natural and designed world(s).
- Describe how specific images (e.g., a diagram showing how a machine works) supports a scientific or engineering idea.
- Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons) and other media that will be useful in answering a scientific question and/supporting a scientific claim.
- Communicate information or design ideas and/or solutions with others in oral and/or written forms using models, drawings, writing, or numbers that provide detail about scientific ideas, practices, and/or design ideas.

<table>
<thead>
<tr>
<th>General Strategies for all Students</th>
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<tbody>
<tr>
<td>☐ Use reading comprehension strategies, read aloud, unpack complex text, and guided reading.</td>
</tr>
<tr>
<td>☐ Introduce visual literacy strategies for interpreting illustrations and creating diagrams.</td>
</tr>
<tr>
<td>☐ Discuss text features in informational text and multimedia.</td>
</tr>
<tr>
<td>☐ Introduce graphic organizers, use sticky notes to annotate text.</td>
</tr>
<tr>
<td>☐ Reinforce vocabulary using pictorials (review key concepts by illustrating and labeling on chart paper in front of students).</td>
</tr>
<tr>
<td>☐ Provide ample opportunities for students to talk, write, and read about their science experiences.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Corresponding ELD Standards</th>
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<tr>
<td>Part 1. Interacting in Meaningful Ways: All</td>
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<tr>
<td>Part 2. Learning How English Works: All</td>
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