Targeted Areas

- Science focus
- Integration with
  - English language and literacy
  - Mathematics

Science

- Science content knowledge
- Science inquiry to promote science understanding
  - hands-on and minds-on (reasoning and application)
  - gradual shift from teacher-directed to student-initiated inquiry
Inquiry Framework

1. Questioning
   - State the problem
     - What do I want to find out? (written in the form of a question)
   - Make a hypothesis
     - What do I think will happen? (explain your reasoning)

2. Planning
   - Make a plan by asking these questions (think, talk, write)
     - What materials will I need?
     - What procedures or steps will I take to collect information?
     - How will I observe and record results?

3. Implementing
   - Gather the materials
     - What materials do I need to implement my plan?
   - Follow the procedures
     - What steps do I need to take to implement my plan?
   - Observe and record the results
     - What do I observe?
     - How do I display my results? (graph, chart, table)

4. Concluding
   - Draw a conclusion
     - What did I find out? Check the most correct statement based on your data.
     - Was my hypothesis correct or incorrect? (explain your reasoning)

5. Reporting
   - Share your results (informal)
     - What do you want to tell others about the activity?
   - Produce a report (formal)
     - What is the answer to the problem?

Inquiry Matrix

<table>
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<tr>
<th>Inquiry levels</th>
<th>Questioning</th>
<th>Planning</th>
<th>Implementing</th>
<th>Concluding</th>
<th>Reporting</th>
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English Language & Literacy

- Literacy strategies for all students
- ESOL strategies
- Linguistic scaffolding
- Home language
- Home and community culture

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**Literacy Strategies for All Students**

Incorporate reading and writing strategies

- Activate prior knowledge
- Promote comprehension of expository science texts
- Promote scientific genres of writing
- Connect science process skills (e.g., describe, explain, predict, conclude, report) to language functions (e.g., explain, compare, contrast)
- Use graphic organizers (e.g., concept map, word wall, Venn diagram, KWL)

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**ESOL Strategies**

Use language support strategies

- Use a small number of key terms in multiple contexts
- Promote hands-on inquiry
- Use realia (real objects or events)
- Encourage multiple modes of representations (gestural, oral, pictorial, graphic, textual)
- Use graphic devices (graphs, charts, tables, drawings, pictures)
- Promote precision in observing and describing objects and events through attention to positional words (above/below, inside/outside), comparative terms (e.g., hot, hotter, hottest), and affixes (e.g., increase or decrease)

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**Linguistic Scaffolding**

Reduce language load while maintaining the rigor of science content and process

- Adjust language load for students at varying levels of English proficiency
- Use language that matches students’ communicative competence in length, complexity, and abstraction
- Communicate at or slightly above students’ level of communicative competence (i.e., comprehensible input)
- Build students’ understanding and discourse skills (e.g., from “it is foggy” to “water vapor condenses into little water drops”)

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**Home Language**

- Use home language support
  - Present science terms in multiple languages in the beginning of each lesson
  - Use cognates (and highlight false cognates) in home language
  - Allow code-switching
  - Allow ELLs to discuss the lesson in class using their home language
  - Encourage bilingual students to assist less English proficient students in their home language
  - Allow ELLs to write about activities in home language

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**Home Culture**

- Incorporate the ways students’ cultural experiences influence science instruction
  - Build on students’ lived experiences at home and in the community (i.e., funds of knowledge)
  - Explore culturally-based ways students communicate and interact in their home and community (i.e., cultural congruence)
  - Use students’ cultural artifacts, culturally relevant examples, and community resources
  - Use texts with content that is familiar to ELLs

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**Mathematics**

- Measurement and instruments
- Recording and display of data using graphs, charts, tables, and drawings
- Analysis and interpretation of data
Research Synthesis


Big Ideas

Based on your experience and expertise, think about effective science instruction for ELLs.

- What do ELLs bring to the science classroom?
- What are effective classroom practices in teaching science for ELLs?

What ELLs Bring to Science

- ELLs bring to the science classroom cultural and linguistic experiences that can be used as intellectual resources.
- At the same time, ELLs bring cultural norms and practices that are sometimes discontinuous or in conflict with norms and practices of science.
**Effective Classroom Practices**

- Articulate ELLs’ linguistic and cultural experiences with science disciplines:
  - when continuous, capitalize on students’ thinking and knowledge as points of contact
  - when discontinuous, make norms and practices of science explicit and visible

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**Effective Classroom Practices (continued)**

- Provide all students with academically rigorous curriculum.
- Engage students in hands-on, inquiry-based instruction to promote scientific understanding, inquiry, and discourse.
- Be aware of ELLs’ differing needs when deciding how much explicit instruction to provide and how to guide students for their own learning.

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**Equitable Learning Opportunities**

1. Value and respect ELLs’ experiences from home and community
2. Articulate ELLs’ linguistic and cultural knowledge with science disciplines
3. Provide academically rigorous curriculum and instruction
4. Offer educational resources