NGSS AND ELL

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Three Dimensions

- Scientific and engineering practices
- Crosscutting concepts
- Disciplinary core ideas

- NGSS –standards are performance tasks that involve all 3

Scientific and Engineering Practices

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3 Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. btaining, evaluating, and communicating information

Crosscutting Concepts

1. Patterns, similarity, and diversity
2. Cause and effect: Mechanism and explanation
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter: Flows, cycles, and conservation
6. Structure and function
7. Stability and change

Disciplinary Core Ideas

Physical Sciences

PS 1: Matter and its interactions

PS 2: Motion and stability: Forces and interactions

PS 3: Energy

PS 4: Waves and their applications in technologies for information transfer

Life Sciences

LS 1: From molecules to organisms: Structures and processes

LS 2: Ecosystems: Interactions, energy, and dynamics

LS 3: Heredity: Inheritance and variation of traits

LS 4: Biological Evolution: Unity and diversity

Earth and Space Sciences

ESS 1: Earth's place in the universe

ESS 2: Earth's systems

ESS 3: Earth and human activity

Engineering, Technology, and the Applications of Science

ETS 1: Engineering design

ETS 2: Links among engineering, technology, science, and society

**Scientific and Engineering Practices

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*** Discourse intensive!*

Multidimensioned performance tasks

- Stress what students can do with knowledge, not memorized knowledge

- Different habits of mind required

willing to undertake familiar practices

in familiar knowledge domain

to tackle unfamiliar problems

How science understanding develops

- Multiple opportunities to hear and use (science ideas and practices)
- Rich contexts create desire and opportunity to engage and contribute
- Appropriate supports
- Acceptance of flawed (non-scientific) language

How language develops

- Multiple opportunities to hear and use (language)
- Rich contexts create desire and opportunity to engage and contribute
- Appropriate supports
- Acceptance of flawed language (while still supporting language development)

Science class is a language development opportunity

IF

Classroom discourse

is managed for inclusion

Appropriate and varied

language development supports

for all students

Every student is a science language learner

- Attention to language challenges benefits all students
- What additional supports ELL students need depends on their language level
- Priority given to participation and science meaning making over correct language usage

Science specific language barriers

- Technical terminology (word redefinitions or inventions)
- “academic” usage (analyze, determine…)
- Multi-phrase sentence structure, many referents (it, that…)
- Nominalization (whole concepts turned into single words such as respiration, adaptation…)
- Need for precision

Science specific language opportunities

- Diagrams, graphs and tables augment text
- Manipulation of real objects
- Diversity of topics and associated language to be explored
- Design opportunities that connect to real world problems

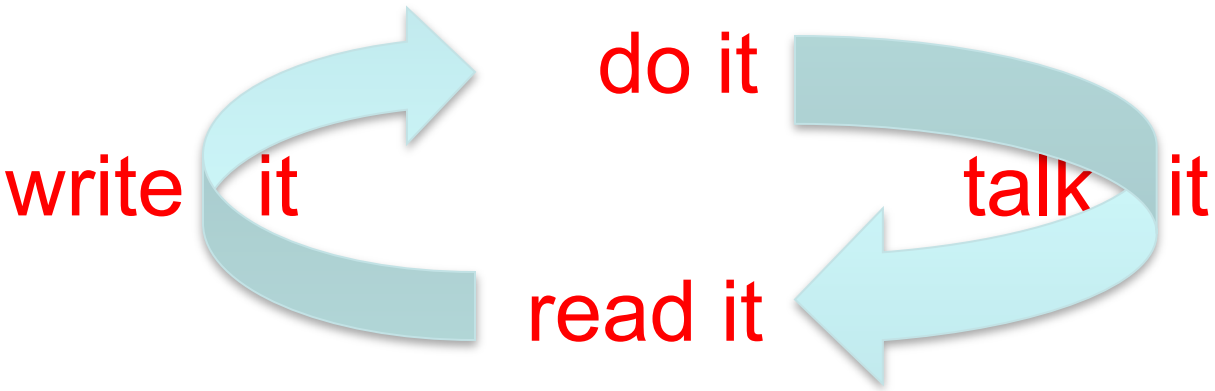
Engagement in practices

As a tool to learn science and engineering

As a way to understand the nature of science (with reflection)

As a language development opportunity

Cycle of learning



Seeds of Science, Roots of reading (LHS)

Student science journals are key tools

Student science journal

Informal writing and diagrams for student use

- Recording data and observations
- Remembering ideas and questions
- Developing a model
- Reflecting

CC ELA

Key CCSS ELA "Practices"[19]	Disciplinary Core Ideas from the CCSS
1. Support analyses of a range of grade level complex texts with evidence 2. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience 3. Construct valid arguments from evidence and critique the reasoning of others 4. Build and present knowledge through research by integrating, comparing, and synthesizing ideas from texts 5. Build upon the ideas of others and articulate their own when working collaboratively 6. Use English structures to communicate context specific messages	<u>Reading</u> • Read complex literature closely and support analyses with evidence • Read complex informational texts closely and support analyses with evidence • Use context to determine the meaning of words and phrases • Engage in the comparison and synthesis of ideas within and/or across texts <u>Writing</u> • Write analytically (e.g., write to inform/explain and to make an argument) in response to sources • Write narratives to develop craft of writing • Develop and strengthen writing through revision and editing • Gather, synthesize, and report on research • Write routinely over various timeframes <u>Speaking and Listening</u> • Participate in purposeful collaborative conversations with partners as well as in small and large groups • Comprehend information presented orally or visually • Share information in a variety of formats (including those that employ the use of technology) • Adapt speech to a variety of contexts and tasks <u>Language</u> • Use the English language to achieve rhetorical and aesthetic effects and recognize and use language strategically • Determine word meanings and word nuances

CC Mathematics

Standards for Mathematical Practices[24]	Disciplinary Core Ideas ("Domains")
1. Make sense of problems and persevere in solving them 2. Reason abstractly and quantitatively 3. Construct viable arguments and critique the reasoning of others 4. Model with mathematics 5. Use appropriate tools strategically 6. Attend to precision 7. Look for and make use of structure 8. Look for and express regularity in repeated reasoning	**K-5** Counting and Cardinality (K only) Operations and Algebraic Thinking Numbers and Operations in Base Ten Numbers and Operations - Fractions (3-5 only) Measurement and Data Geometry **6-8** Ratios and Proportional Relationships Number System Expressions and Equations Functions (8 only) Geometry Statistics and Probability **9-12** Number and Quantity Algebra Functions Modeling Geometry Statistics and Probability

Overlap

- Student discourse
  - opportunity for language development
  - challenge for language learner inclusion
- Reasoned thinking
- Argument from evidence

Central themes across curriculum

English Language Proficiency Development Framework

- From CCSSO

Guidance to states for aligning EL standards with NGSS and Common Core

Tables for every practice

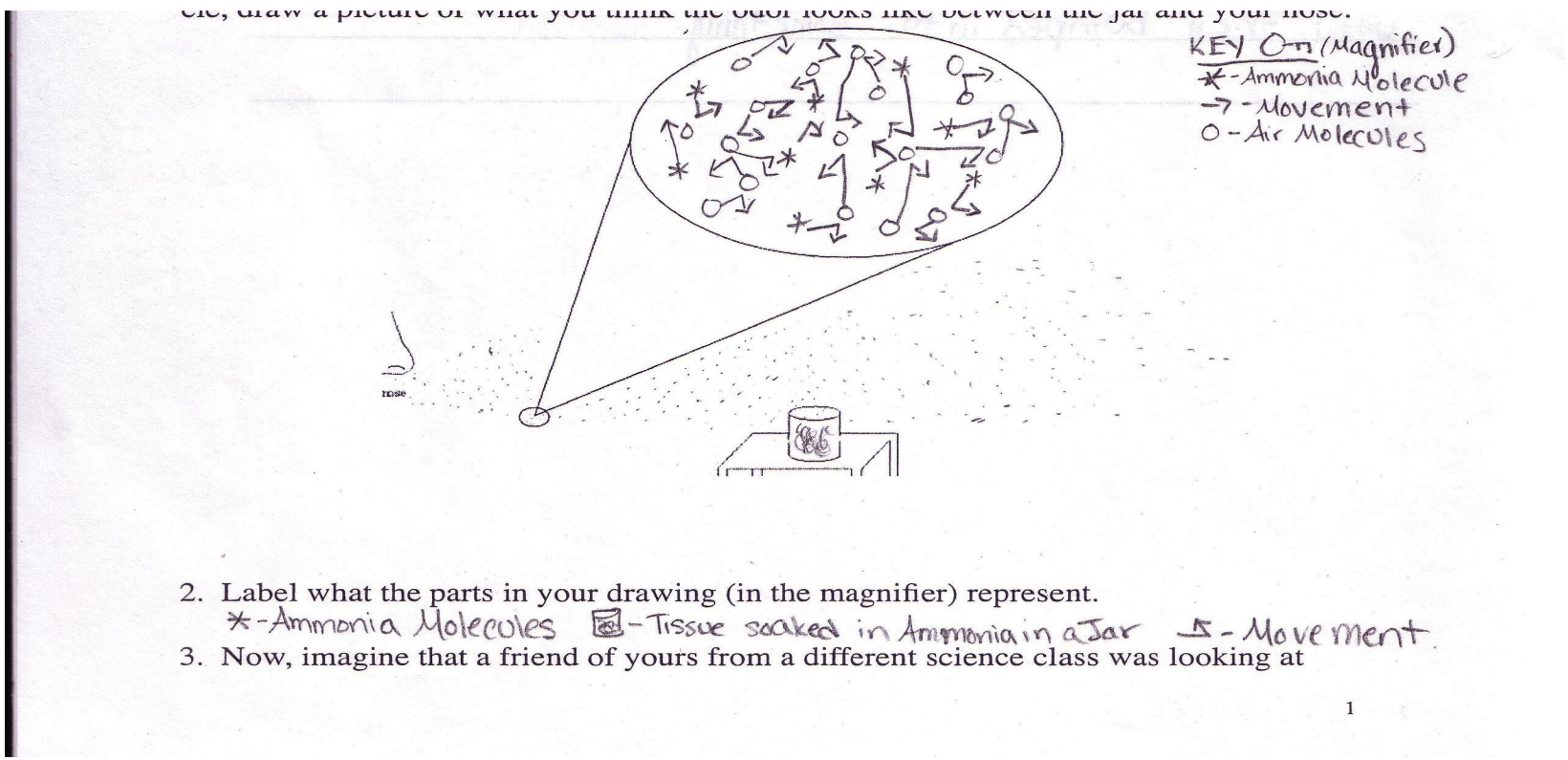
http://www.ccsso.org/Documents/2012/ELPD%20Framework%20Booklet-Final%20for%20web.pdf

Key NGSS Practice 2: Develop models	
Analytical Tasks	• Develop and represent an explicit model of a phenomenon or system • Use a model to support an explanation of a phenomenon or system • Make revisions to a model based on either suggestions of others or conflicts between a model and observation
Receptive Language Functions	• Comprehend others' oral and written descriptions, discussions, and justifications of models of phenomena or systems • Interpret the meaning of models presented in texts and diagrams
Productive Language Functions	Communicate (orally and in writing) ideas, concepts, and information related to a phenomenon or system using a model developed for this purpose: • Label diagrams of a model and make lists of parts • Describe a model using oral and/or written language as well as illustrations • Describe how a model relates to a phenomenon or system • Discuss limitations of a model • Ask questions about others' models

IQST Assessment: *Modeling Smell*

Your teacher opened a jar that contained a substance that had an odor. Imagine you had a very powerful microscope that allowed to see the odor up really, really close. What would you see?

- Lesson 15: student models
  - 75% of students create a particle model, 25% a mixed model
  - 68% of students include odor particles that are moving in straight lines until they collide into each other; 32% include both odor and air



Some resources

www.nap.edu

National Academy Press

- Framework for K-12 Science Education
- Ready, Set , Science

www.ell.stanford.edu

Understanding Language