Understanding Language
Language, Literacy, and Learning in the Content Areas

The Role of Oral and Written Discourse in Teaching and Learning Science

Literacy for Science in CCSS and NGSS
National Research Council
December 9 and 10, 2013

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Topics

1. **Disciplinary practices** in CCSS and NGSS with a focus on English language learners (ELLs)

2. **Oral and written discourse** in teaching and learning science

Premise: *what students do with language* as they engage in content area learning

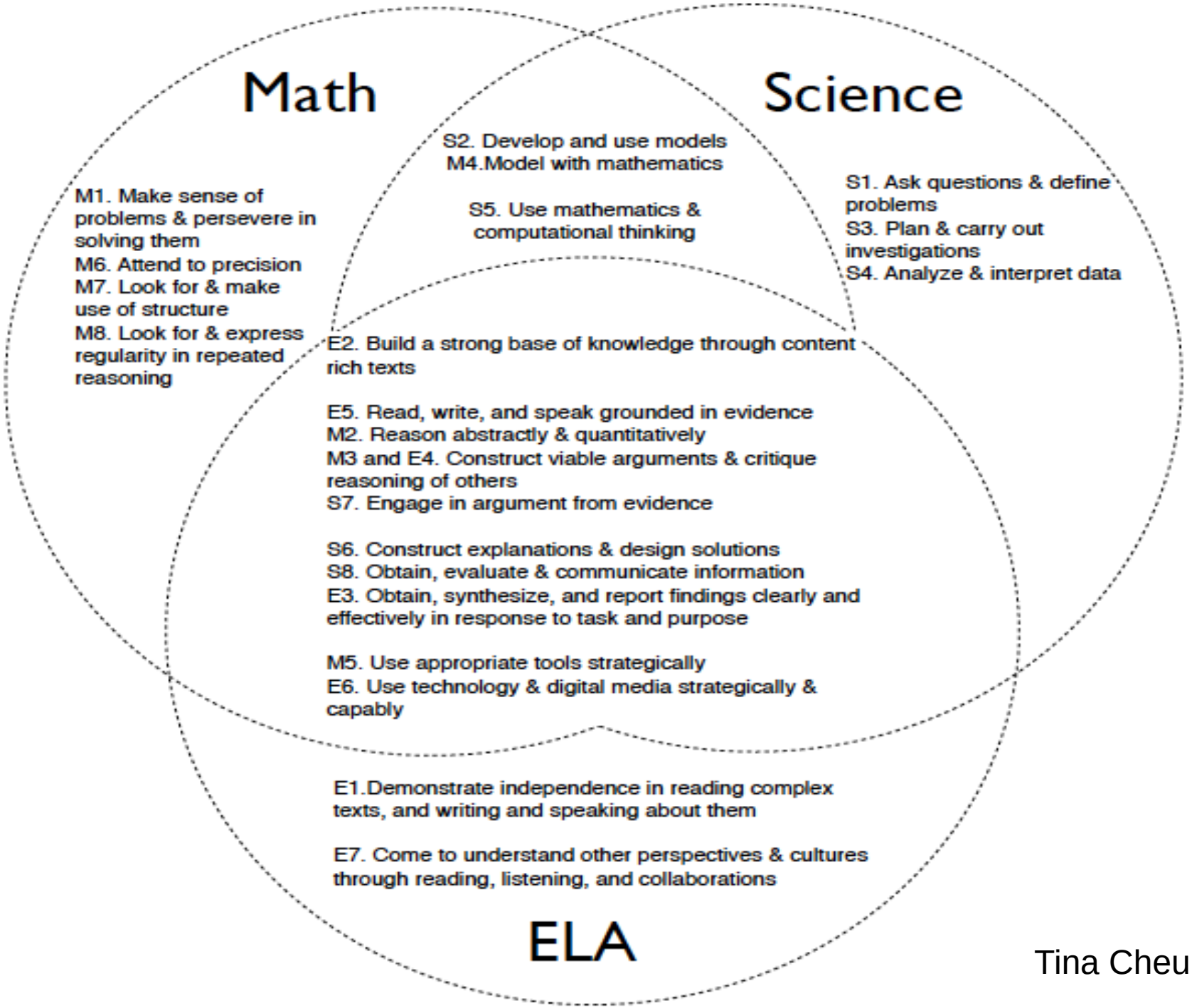
Topic 1:
Disciplinary Practices in CCSS and NGSS

- Raise the bar for content (academically rigorous)
- Raise the bar for language (language intensive)
- Call for a high level of classroom discourse (oral and written) across all content areas for all students

Development 1:
Science and Language in Relation to NGSS

- Language learning opportunities and challenges will emerge as students, especially ELLs, engage with the NGSS.
- When students, especially ELLs, are adequately supported *to "do" specific things with language,* both science learning and language learning are promoted.
- This article describes key features of the *language of the science classroom* as students engage in language-intensive science and engineering practices.

Lee, O., Quinn, H., & Valdés, G. (2013). Science and language for English language learners in relation to Next Generation Science Standards and with implications for Common Core State Standards for English language arts and mathematics. *Educational Researcher, 42*(4), 223-233.



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Science & Engineering Practices and Language Functions

NGSS Practice 7: Engage in argument from evidence	
Analytical Science Tasks	• Distinguish between a claim and supporting evidence or explanation • Analyze whether evidence supports or contradicts a claim • Analyze how well a model and evidence are aligned • Construct an argument
Receptive Language Functions	• Comprehend arguments made by others orally • Comprehend arguments made by others in writing
Productive Language Functions	Communicates (orally and in writing) ideas, concepts, and information related to the formation, defense, and critique of arguments • Structure and order written or verbal arguments for a position • Select and present key evidence to support or refute claims • Question or critique arguments of others

Language in the Science Classroom

Features of Classroom Language	Teachers' Language Use and Tasks	Students' Language Use and Tasks		
	Oral &Written	Oral	Written	
	Receptive & Productive	Receptive & Productive	Receptive	Productive
Modality	Explanations and presentations (one-to-many, many-to-many)	Whole-classroom participation (one-to-many)	Comprehension of written classroom and school-based formal and informal written communication	Production of written classroom and school-based formal and informal written communication • Written reports • Science journal entries
	Communication with small groups of students (one-to-group)	Small group participation (one-to-group)		
	Communication with individual students (one-to-one)	Interaction with individual peers (one-to-one)		
	Communication with parents (one-to-one)	Interaction with adults within school contexts (one-to-one)		
Registers	Colloquial + classroom registers + disciplinary language and terminology	Colloquial + classroom registers + disciplinary language and terminology	Science-learner written registers + disciplinary language and terminology + disciplinary discourse conventions	
Examples of Registers	Classroom registers: • Giving directions • Checking for understanding • Facilitating discussions Science discourse registers used for: • Describing models • Constructing arguments • Providing written or verbal explanation of a phenomenon or system	Classroom registers: • Comprehending oral directions • Asking for clarification • Participating in discussions Learner-appropriate science discourse registers and conventions used for: • Describing models • Constructing arguments • Providing oral explanations of a phenomenon or system	Classroom, school, and science-learner written registers • Textbooks • Lab or equipment manuals • Writing by other students • Internet materials • Science-oriented trade books • Science press articles • Syllabi • School Announcements • Formal documents (e.g., class assignment, quarterly grades, assessment results)	

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Development 2:
English Language Proficiency Development (ELPD) Framework

- To communicate to ELL stakeholders in states the language practices that ELLs must acquire for academic learning in CCSS and NGSS and for second language acquisition more generally
- To provide guidance to states on how to use the expectations of the CCSS and NGSS as tools to create and evaluate ELP/ELD standards

Pimentel, S., Castro, M., Cook, G., Kibler, A., Lee, O., Pook, D., Stack, L., Valdés, G., & Walqui, A. (2012). *Framework for English language proficiency development standards corresponding to the Common Core State Standards and the Next Generation Science Standards.* Washington, DC: Council of Chief State School Officers.

Framework for English Language Proficiency Development Standards corresponding to the Common Core State Standards and the Next Generation Science Standards

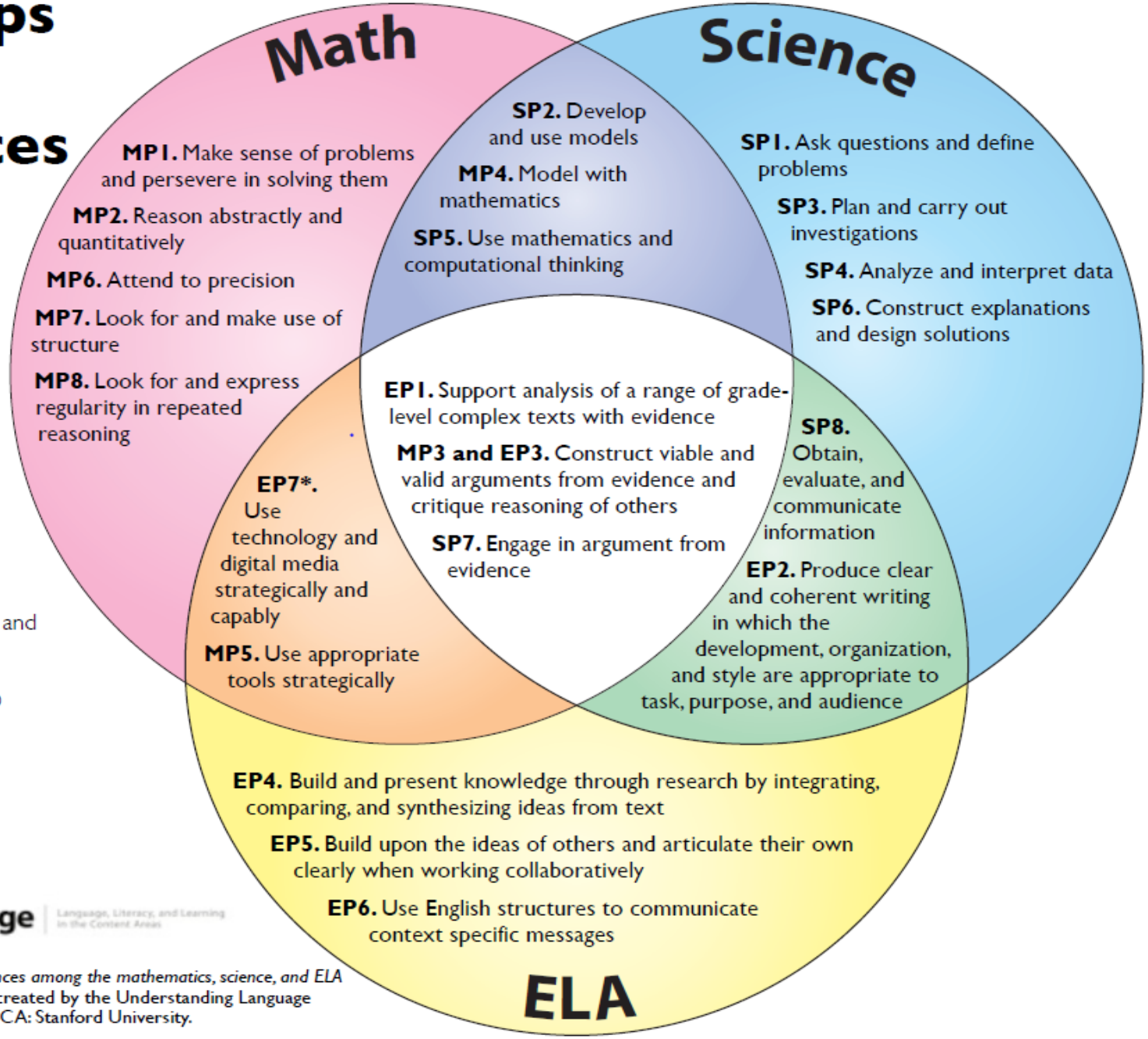
Developed by the Council of Chief State School Officers and the English Language Proficiency Development Framework Committee in collaboration with the Council of Great City Schools, the Understanding Language Initiative at Stanford University, and World-Class Instructional Design and Assessment, with funding support from the Carnegie Corporation of New York

CCSSO
Council of Chief State School Officers

Relationships and Convergences

Found in:
1. CCSS for Mathematics (practices)
2a. CCSS for ELA & Literacy (student capacity)
2b. ELPD Framework (ELA "practices")
3. NGSS (science and engineering practices)

Notes:
1. MP1–MP8 represent CCSS Mathematical Practices (p. 6–8).
2. SP1–SP8 represent NGSS Science and Engineering Practices.
3. EP1–EP6 represent CCSS for ELA "Practices" as defined by the ELPD Framework (p. 11).
4. EP7* represents CCSS for ELA student "capacity" (p. 7).



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Suggested citation:
Cheuk, T. (2013). *Relationships and convergences among the mathematics, science, and ELA practices*. Refined version of diagram created by the Understanding Language Initiative for ELP Standards. Stanford, CA: Stanford University.

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English Language Proficiency Development (ELPD) Framework

- **NGSS**
  - Science & engineering practices and language functions
  - Discipline-specific language in the K-12 science classroom
- **CCSS ELA**
  - ELA practices and language functions
  - Discipline-specific language in the K-12 ELA classroom
- **CCSS Math**
  - Math practices and language functions
  - Discipline-specific language in the K-12 math classroom

Development 3:
English Language Proficiency (ELP) Standards

- To highlight and elaborate on the critical language, knowledge about language, and skills using language that are:
  - in CCSS for ELA/literacy and math and NGSS
  - necessary for ELLs to succeed in school

Council of Chief State School Officers. (in press). *English language proficiency (ELP) standards.* Washington, DC.

Shafer Willner, L. (2013). *Initial tour of the 2013 English language proficiency standards.* Developed by WestEd for the Council of Chief State School Officers. Washington, DC: Author.

K-12 Practices Matrix

Use the **K-12 Practices Matrix** to identify a practice and its corresponding ELP Standard. Click on the ELP Standard number to go to the standard.

Practices	ELP Standards									
ELA "Practices"[3] (EP)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
EP1. Support analyses of a range of grade-level complex texts with evidence.	EP1	EP1	EP1		EP1			EP1		
EP2. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.			EP2	EP2		EP2	EP2		EP2	EP2
EP3. Construct valid arguments from evidence and critique the reasoning of others.	EP3			EP3		EP3				
EP4. Build and present knowledge through research by integrating, comparing, and synthesizing ideas from texts.	EP4				EP4	EP4				
EP5. Build upon the ideas of others and articulate his or her own when working collaboratively.	EP5	EP5		EP5	EP5	EP5				
EP6. Use English structures to communicate context-specific messages.				EP6	EP6		EP6	EP6		EP6

Mathematical Practices (MP)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
MP1. Make sense of problems and persevere in solving them.	MP1	MP1	MP1		MP1	MP1		MP1	MP1	
MP2. Reason abstractly and quantitatively.										
MP3. Construct viable arguments and critique the reasoning of others.				MP3		MP3			MP3	
MP4. Model with mathematics.										
MP5. Use appropriate tools strategically.										
MP6. Attend to precision.		MP6	MP6	MP6			MP6			MP6
MP7. Look for and make use of structure.										
MP8. Look for and express regularity in repeated reasoning.										

Science Practices (SP)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
SP1. Ask questions and define problems.	SP1					SP1	SP1	SP1		
SP2. Develop and use models.										
SP3. Plan and carry out investigations.					SP3					
SP4. Analyze and interpret data.		SP4		SP4						
SP5. Use mathematics and computational thinking.										
SP6. Construct explanations and design solutions.		SP6	SP6		SP6	SP6	SP6			
SP7. Engage in argument from evidence.				SP7		SP7			SP7	
SP8. Obtain, evaluate, and communicate information.		SP8	SP8	SP8	SP8	SP8	SP8	SP8	SP8	SP8

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Development 4:
ELPD Framework: Teacher's Guide to the Science and Math Resources

- To develop and validate a teacher's guide that explains how the resources within the ELPD Framework can be used to generate classroom materials and design learning activities that support ELs' engagement with NGSS and CCSS math

Cook, G. (2013-2015). *Teacher's guide to the mathematics and science resources of the ELPD Framework.* National Science Foundation, Discovery Research K-12.

Topic 2:
Oral Discourse in Teaching and Learning Science

CCSS ELA and NGSS

- Science and engineering practices rely heavily on oral discourse in small or large group settings
- Oral discourse is important in content area learning for all learners, especially those who struggle with written discourse
- Oral discourse is not emphasized compared to written discourse in CCSS ELA and Science Framework & NGSS

Science Classroom Discourse

- Students come to school with different levels of exposure to ways of using language that are often valued in science discourse
- Students tend to write the way they speak
- Teachers are not modeling language practices common in science discourse

Oral Discourse is Important for Both Science and Language Learning

- **Why?**
  - Science learning is based on experience
  - Experience is essential for the development of oral language
  - Oral language supports written language
  - Oral discourse is critical to the construction of meaning

- **How?**
  - If we can scaffold the use of language for science and engineering practices in oral discourse…
  - Then, this can support students' science learning as well as written discourse in science (and other subject areas)

Language Functions

- *Do specific things with language*

- Oral language
  - Receptive language functions
  - Productive language functions

- Written language
  - Receptive language functions
  - Productive language functions

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Disciplinary Practices and Language Functions

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Discipline-Specific Language in K-12 Science Classrooms

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Ways of Using Language

- Students need to be familiar with particular ways of using language to meet the language demands of science classroom discourse:
  - **Precise:** The level of … detail of observation and explanation required by science and engineering is not common in everyday experience; *it demands a comparable level of precision in language use*" (Quinn, Lee, & Valdés, 2012).
  - **Explicit:** In science, we often seek to report, explain, and inform our audience about objects and actions not immediately present (Schleppegrell, 2004). Explicitness makes such language more informative.
  - **Complex:** In science, we often communicate about relationships and logical connections (Lemke, 1990). Language forms used to refer to relationships and logical connections may strengthen effectiveness of science language.

Lee, O., & Llosa, L. (2011-2015). *Promoting science among English language learners (P-SELL) scale-up.* National Science Foundation, Discovery Research K-12.

Ways of Using Language Useful for Meeting Communicative Goals of Science Classroom Discourse

Precision

- Does the discourse use discipline-specific terms appropriately?
- Is the discourse exact enough to communicate nuanced meaning?

Explicitness

- Would the audience understand the discourse without context?
- Could someone who is not in the classroom understand the discourse?
- Does the student appropriately use logical connectors (e.g., because, since, therefore, so) to be explicit about relationships between ideas?

Complexity

- Does the student explain why?
- Does the student provide evidence to support a claim(s)?
- Does the student communicate about relationships between concepts?

Closing

- Given the richness of science and engineering practices, the NGSS will lead to science classrooms that are also rich language learning environments.
- Oral discourse is important for both science and language learning.
- Effective approaches to support oral discourse in relation to the NGSS are needed.
- Attention must be paid to linguistic features of diverse student groups in relation to those of the NGSS.
- An important role of the science teacher is to encourage and support language use and development in the service of making sense of science for *all students.*

Thank you!