Planning Tool: Developing the Language of Math for English Learners

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NCTM NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

PGCPS Great By Choice

Agenda

- Rationale for developing the Planning Tool
- Correlations to WIDA Standards and CCSS for Mathematical Practices
- Process of using the Planning Tool
- Closure and questions.

Rationale and Goals

What I Observed

- **Disconnect** between language supports and math goals
- **Inconsistency** in matching supports to students' language needs
- Focus **only on math terms**
- **Limited** understanding of the role of language in math

What I Wanted

- Develop a **cohesive** planning approach
- Enhance teachers' **knowledge about the role of language** in math
- Build teachers' skills to **analyze language demands**
- Help teachers' integrate **appropriate language supports**

Planning Tool Supports CCSS for Mathematical Practices

CCSS Mathematical Practice (What Students Do)
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.

Planning Tool Supports WIDA Standard

For more information visit www.wida.us

Planning Tool and the Academic Language of Mathematics

Vocabulary
- *math terms*
- *everyday words*
- *academic words used across content areas*

Word & Phrase Level

Grammar Features & Language Structures

Sentence Level

Discourse Complexity:
extended oral & written logically connected responses

Discourse Level

Modified from *The Defining Features of the Academic Language in WIDA's Standards*, WIDA Consortium, Draft, September 2011

Planning Tool Components

Part 1. Essential Questions for Planning and Preparation

- Math Lens: math goals, standards, concepts, tasks, and discussion focus
- Language Lens: language targets/goals and supports

Analyzing Language Demands

Part 2. Anticipating Linguistic Challenges of Concept-Related Vocabulary

Part 3. Anticipating Linguistic Challenges of Math Discussions and Tasks

Part 4. Determining Language Goals and Supports

Part 2: Anticipating Potential Linguistic Challenges of Concept-Related Vocabulary

Part 2. Anticipating Potential Linguistic Challenges of Concept-Related Vocabulary

	Guiding Questions To Ask Yourself	
Concept: _____	What essential **mathematical term**/s is/are related to this concept? Are ELLs already familiar with this concept in real life? What **culturally relevant real life examples** will help ELLs of all proficiency levels to access the tasks in order to explore the concept and to develop concept-related vocabulary? Are any new math terms of Greek or Latin origin and therefore, might have a cognate? How can the meanings be eventually transferred to English? How might a new mathematical term (for this concept) be related to other words already familiar to students? What other familiar mathematical terms will students be expected to use? Could any math terms be confusing for ELLs because they have corresponding homophones and/or different meanings in contexts other than mathematics? Could a new mathematical term be difficult because it is represented by a combination of words such as *GCF (the greatest common factor)?* Could pronunciation of some math terms be difficult for ELLs? What **basic concept-related words** will ELLs need to understand and use when developing conceptual understanding? What **grammar features** are embedded within mathematical terms and/or basic words related to the concept? Might any grammar features require explicit instruction? What **operations** are students expected to use in relation to this concept? Therefore, what operation-related mathematical terms and basic words/phrases will students need to understand when developing procedural fluency and application of skills around the concept? What **language supports** – ***sensory, graphic, interactive, verbal, textual-*** might be necessary to help ELLs of all language proficiency levels to understand and use vocabulary related to the concept and operations?	

Guiding Questions Relate to:

- Familiarity with the concept/term
- Complexity of math term/s:
  - Pronunciation
  - Structure
  - Meanings
- Basic words that support conceptual understanding
- Grammar features embedded within vocabulary

Examples: Linguistic considerations as identified by teachers

Area	• Familiarity with the concept: *area as part of the room; this is our reading area.* • **Use of basic words**: *inside, covers, within, space* • Confusion due to multiple meanings: the word *space*
Equal Grouping and Sharing	• **Familiarity with and further exploration of concepts of e*quality and fairness*** • Grammar: use of prepositions such as *of, among, between* • Grammar: irregular plurals, for ex., one half but two halves
Fractions	• Confusions with homophones: a whole vs. a hole; • **Grammar (cardinal and ordinal numbers):** three but a third, thirds; two-thirds; four but a fourth, one fourth, three-fourths; etc. • **Pronunciation challenges**: thirds; fourths; fifths, etc.
Time	• **Confusions with homophones:** *our* or *hour (our hands vs. an hour hand)* • Familiarity with basic words to build math connections: *a face, a hand* • Confusion due to multiple meanings: words such as *time, face, hand*

Part 3: Anticipating Potential Linguistic Challenges Related to Math Discussions & Tasks

Part 3. Anticipating Potential Linguistic Challenges Related to Mathematical Discussions and Tasks

	Guiding Questions To Ask Yourself	
Meaningful Task/s and Purposeful Discussion/s	What is the **purpose for the discussion/discourse** as a result of the mathematical task/s? What cognitive and therefore, language functions are embedded in the discourse? Please select from the sample list below. ___ Identify ___ Reason ___ Define ___ Describe ___ Justify ___ Argue ___ Compare/Contrast ___ Evaluate ___ _____ What would **exemplar responses** sound/look like? What linguistic challenges might ELLs experience when listening to and constructing such responses? What **academic* vocabulary, language structures, and grammar feature** will ELLs need to understand and use? What **grammar features and language structures**, if any are embedded language functions related to mathematical tasks? What **conjunctions (connecting and transition words)** might require introduction and/or explicit instruction to help ELLs to bridge ideas w sentence AND/OR to link multiple sentences in order to construct lo organized extended responses. (Please see the example below to support the above-mentioned quest What **engagement prompts and starters** might be integrated to supp participation of ELLs of all proficiency levels during the task and disco What **language supports** - ***sensory, graphic, interactive, verbal, textual*** to be prepared and implemented to make the task accessible and discourse comprehensible for ELLs of all language proficiency levels? *academic words are generally the words used across content areas	
	Example: *Mathematical Task: Determining and comparing-contrasting the areas of two rectangular figures* The discourse is built around discussing different strategies for finding areas and then comparing/contrasting the areas. Firstly, in addition to concept-related vocabulary such as *area, square units, rectangles* students might need to know and use academic words related to the language function of comparing-contrasting such as *the same, similar, both, similarly, similarities, different, differences, differ/s.* Secondly, as far as grammar features, compare-contrast language function requires the use of comparatives (*larger, bigger, more, less, smaller, fewer*) and superlatives (*largest, biggest, most, least, fewest*). When constructing extended responses, ELLs might need help using conjunctions such as *both, similarly, although, even though, however, nevertheless.* Therefore, an integration and explicit instruction of sentence frames such as *Similarly to _____, _____. Even though _____, _____.* might be necessary.	

Guiding Questions Relate to:

- Purpose for math discourse
- Structural complexity of extended responses
- Cognitive and language function/s embedded within discourse and tasks
- Language of cognitive functions:
  - Vocabulary (basic and academic)
  - Grammar features
  - Language structures

Example: Comparing & Contrasting Areas of Two Rectangular Figures

Part 3. Anticipating Potential Linguistic Challenges Related to Mathematical Discussions and Tasks

Meaningful Task/s and Purposeful Discussion/s	Guiding Questions To Ask Yourself
	What is the **purpose for the discussion/discourse** as a result of the mathematical task/s? What cognitive and therefore, language functions are embedded in the discourse? Please select from the sample list below. ___Identify ___Reason ___Define ___Describe ___Justify ___Compare/Contrast ___Evaluate **What would exemplar responses** sound/look might ELLs experience when listening to **What academic* vocabulary, langua** will ELLs need to understand and us **What grammar features and lan** if any are embedded in language functions related to mat **What conjunctions (connecting n words)** might require prior introduction and/or explicit ins p ELLs to bridge ideas within a sentence AND/OR to link mul s in order to construct logically organized extended responses (Please see the example belo he above-mentioned questions.) **What engagement prompts** might be integrated to support participation sk and discourse? **What language su** *ive, verbal, textual* - are to be prepared and imp k accessible and discourse comprehensible for ELLs of proficiency levels? *academic words are generally the words across content areas
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Linguistic Challenges Relate to:

- Grammar: use of conjunctions such as *although, even though, however, nevertheless.*
- Vocabulary: *both, the same, similar, identical, congruent, similarly, similarities, different, differences, differ/s.*
- Grammar: use of comparatives (*larger, bigger, more, less, smaller, fewer*) and superlatives (*largest, biggest, most, least, smallest, fewest*).

Part 4: Determining Language Learning Goals and Language Development Supports

- Focus on math goals
- Consider ELLs' language skills
- Select essential language targets as goals
- Integrate appropriate language supports

Part 4. Determining Language Goal/s and Supports

What specific linguistic challenge/s must be targeted as the language learning goal/s for this unit/lesson? What specific language development supports will be integrated to build and advance ELLs' comprehension and communication during different stages of the unit/lesson?

_____

_____

_____

Language Development Supports for ELLs to Increase Comprehension and Communication

Environment	

• Welcoming & stress-free
• Respectful of diversity
• High expectations
• Structures & routines
• Thinking-focused (vs. answer-seeking) discourse
• Checks for understanding through multiple modalities
• Explicit instruction of specific language targets
• Participation and engagement techniques
• Meaningful integration of games and learning centers
	• Opportunities to apply knowledge and create problems or representation to further thinking
	• Task/Activity:
	  ○ Accessible by all students
	  ○ Multiple entry points
	  ○ Relevant to students' life experiences and culture
	  ○ Built on prior mathematical learning
	  ○ High cognitive demand
	  ○ Multiple strategies for solutions

Sensory Supports*	Graphic Supports*	Interactive Supports*	Verbal and Textual Supports
• Real-life objects (realia) or concrete objects • Physical models • Manipulatives • Pictures & photographs • Visual representations or models such as diagrams or drawings • Videos & films • Newspapers or magazines • Gestures • Total Physical Response (TPR) • Physical movements • Music & songs	• Graphs • Charts • Timelines • Number lines • Graphic organizers • Graphing paper	• In a whole group • In a small group • In pairs as a group (first, two pairs work independently, then they form a group of four) • With a partner such as *Turn-and-Talk* • In triads, for ex. *Problem-Solution Triads* • Cooperative learning structures such as *Think-Pair-Share Timed Pair Share, Rally Coach, Numbered Heads Together* • Interactive websites or software • With a mentor or coach	• Labeling • Use of students' native language • Modeling • Repetitions • Paraphrasing • Summarizing • Guiding questions • Clarifying questions • Probing questions • Leveled questions such as What? When? How? Why? • Questioning prompts & cues • Word Banks • Sentence starters • Sentence frames • Discussion frames • Accountable Talk moves, including *Wait Time*

*from English Language Proficiency Standards: Pre-Kindergarten -Grade 12, 2007 Resource Guide; WIDA Consortium

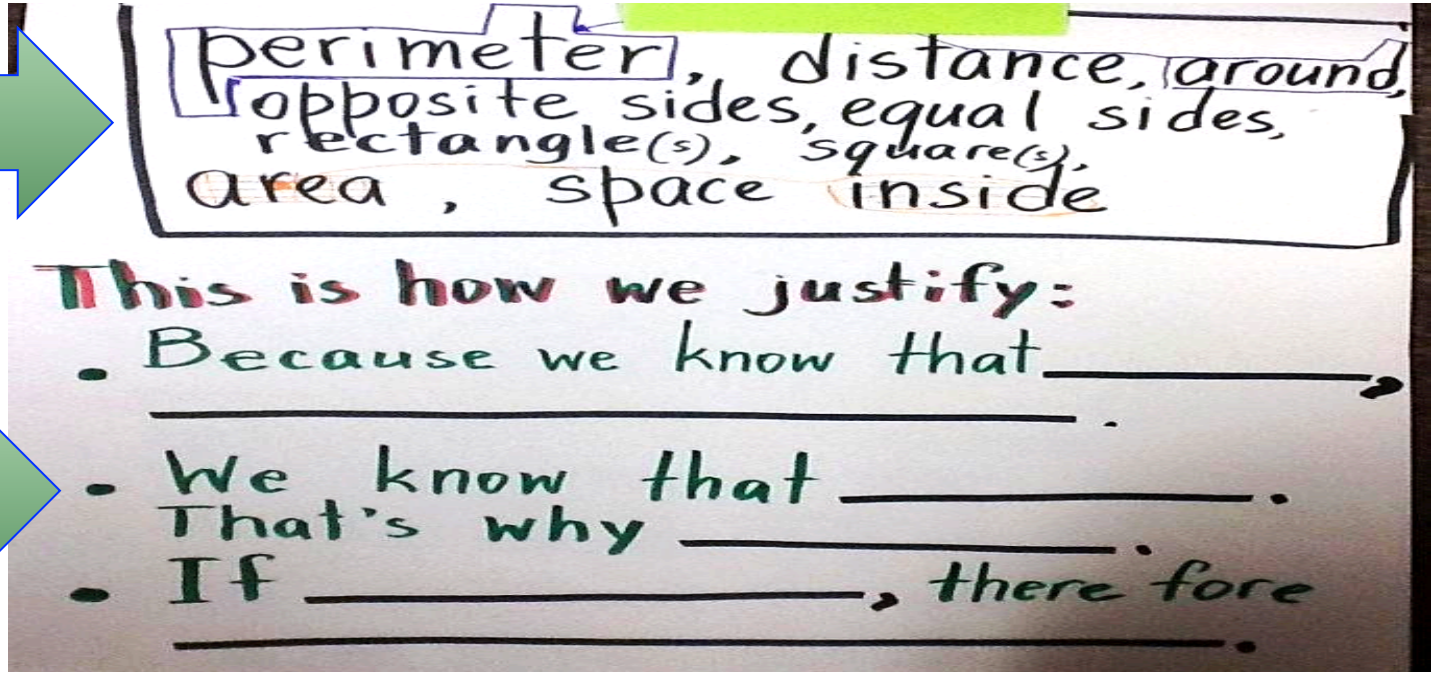
Modified by Galina (Halla) Jmourko, ESOL Coach, PGCPS; 2015, Rvsd. 2016

Example: Language Goal & Language Supports (Gr. 3)

Language Goal: Students will construct justifications to their solutions by using sentence frames and selecting appropriate vocabulary.

Word Bank

Sentence Frames



Example of a geometric figure

Closure: What are teachers saying?

"The questions help me think about the language of mathematics … that it **goes beyond math terminology and notations."**

"I've always addressed math vocabulary but mainly terms. It's in our curriculum and textbooks. But now I pay attention to **grammar** and so much attention to **basic words which are tricky."**

"Most likely, teachers address vocabulary but they hardly ever think about **grammar features."**

"That (tool) is very useful. Now, I think about **multiple meaning words in math** all the time. They are everywhere!"

"I really started **listening to my students** and **paying attention to what they say and how they say it**… Because I am better prepared and I know what language might be difficult for my students, I **plan the supports that students need.** Now, they focus more on what they want to say and don't stress about how to say it."

Session: PD for Developing ELLs' Understanding of Both Mathematics and Language

Saturday, April 16
9:45AM -11:00AM
Rm. 2003 (Moscone West)

For further questions, please contact me:
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