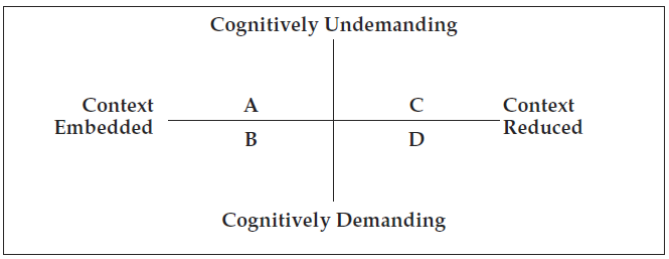
Using Children's Literature in Mathematics Lessons

Welchman-Tischler (1992) suggests a variety of ways to integrate children's literature into mathematics lessons, which include a) provide a context; (b) introduce manipulatives; (c) model a creative experience; (d) pose an interesting problem; (e) prepare for a concept or skill; (f) develop a concept or skill; and (g) provide a context for review. Story can be used as springboard to introduce new concepts, vocabulary words and sentence frames. Reading a story during the teaching of a unit can help students making connections with other mathematical concepts and/or with real-world problems. Story can also provide a relevant context to assess, enrich or extend the concept learned at the end of the unit. Books can be read aloud, as an activity in the lesson, as classroom readers, or part of the extensive reading scheme in the particular grade levels.

Possible use	Book title	Topic(s)	Possible ideas
Provide a context	Breakfast Around the World (Kim, 2016)	Fraction	Learn about simple fraction concepts by seeing what people eat for breakfast around the world. Students can practice the use of fraction language to talk about the food they eat in their culture.
Introduce manipulatives	Spaghetti and Meatballs for All! (Burns, 1997)	Area and perimeter	Arrange tables and chairs so that everyone will have a seat in the family reunion. Students can use manipulatives or other physical tools in exploring the concepts of measurement.
Model a creative experience	One Hundred Hungry Ants (Pinczes, 1993)	Multiplication and division	After 100 ants reorganize themselves in various ways on their journey to a picnic, students can model a creative experience using their own combinations with a different number of ants.
Pose an interesting problem	Fractions in Disguise: A Math Adventure (Einhorn, 2014)	Fraction	Crack the case with George Cornelius Factor in which students can explore fractions with equal parts intrigue and humor.
Prepare for a concept or skill	The Doorbell Rang (Hutchins, 1986)	Multiplication and division	Sharing cookies with friends and neighbors prepares students for the concept of division.
Develop a concept or skill	Sparrows Singing: Discovering Addition and Subtraction (Atwood, 2012)	Addition and Subtraction	Counting sparrows with multiple representations. Students can develop relationships between the conceptual and procedural aspects of addition and subtraction.
Provide a context for review	Matthew's Sunshine Bakery: Multiplication Arrays (Stone, 2015)	Multiplication and division	Identify the arrays and multiplication equations on baking adventure. Students can practice their times tables and other acquired computational skills. The story also provides a context for review/ assessment at the end of the unit.

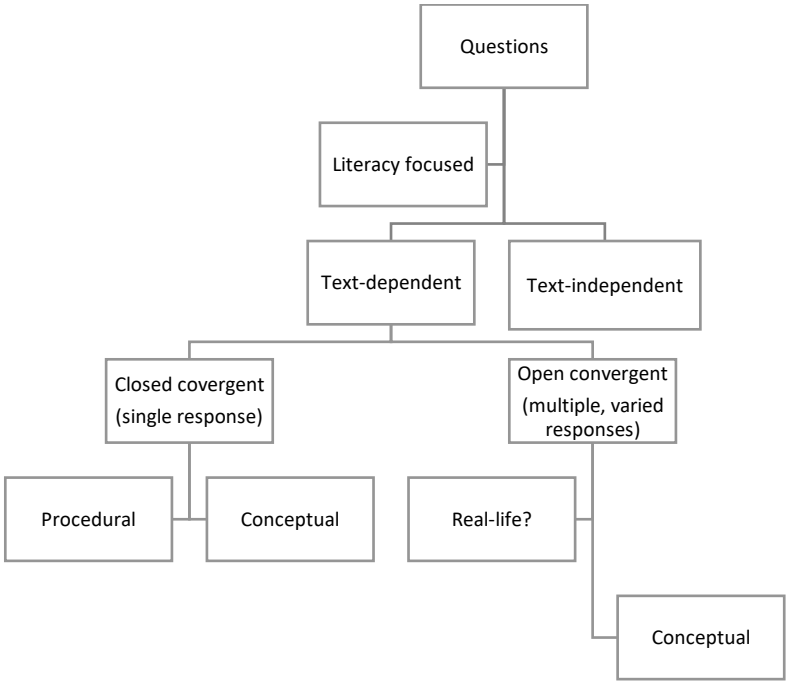
Cognitive and Contextual Demands (Cummins, 2000)



Cummins's framework elaborates on the Basic Interpersonal Communicative Skills (BICS)/ Academic Cognitive Academic Language Proficiency (CALP) distinction by highlighting important underlying dimensions of conversational and academic communication. Conversational abilities (Quadrant A) often develop relatively quickly among second language learners because these forms of communication are supported by interpersonal and contextual cues and make relatively few cognitive demands on the individual. Mastery of the academic functions of language (academic registers/ Quadrant D), on the other hand, is a more formidable task because such uses require high levels of cognitive involvement and are only minimally supported by contextual or interpersonal cues. Optimal instruction for linguistic, cognitive and academic growth will tend to move from Quadrant A, to B, and from Quadrant B to D (p.68).

Ask Question to Foster Students' Learning of Mathematics and English

Remember the questions that teachers ask affect students' access to a lesson, their level of engagement, and the degree of mathematical learning takes place. Questions are the catalyst to promote mathematical thinking and reasoning. They help students to engage in higher-level thinking as they predict, analyse and generalise. Use students' answers as part of further probing question (revoicing strategy), rather than rushing to say "Yes" or "NO". Help students to expand their responses by asking questions such as "How did you think about it in your mind?", "Tell us why you think…", and "Where did you start?" A wide variety (including the level of complexity) of questions should be designed and posed to ALL students, so that language learners can answer according to their level of language proficiency and according to their understanding of the mathematical concepts.



References:
Cummins, J. (2000). Language, Power and Pedagogy: Bilingual Children in the Crossfire. UK: Cromwell Press Ltd.
Welchman-Tischler, R. (1992). How to use children's literature to teach mathematics. Reston, VA: The National Council of Teachers of Mathematics.

Book Title:	
Grade Level(s): **Topic & Objective:**	**Possible Learning Outcomes** • • •
Relevance to your Students [*Is there a mathematical and/or personal problem that the main character has to solve? If so, what is the problem? Can your students relate themselves to these problems? If so, in what way?*]	
Cultural & Linguistic Considerations • • •	**New Vocabulary/ Vocabulary to Reinforce** • • •

Possible Use

Provide a context	Introduce manipulatives	Model a creative experience	Pose an interesting problem
Prepare for a concept or skill	Develop a concept or skill	Provide a context for review	Others

Event (Page number)	**Mathematical Content**, e.g. • *What are the mathematical facts/ algorithm/ concepts/ language introduced?*	**Teaching Ideas**, e.g. • *What types of questions can be asked to provoke thinking? [Problem posing conjecturing "what if"]* • *What are the essential questions that I want student to be able to answer?* • *What kind of manipulatives/ models/ tools/ representations can be used?*

Homework/ Assessment

- *What will you ask students to do that will allow you to determine what they learned and what they understand?*

Sample Questions to Support All Learners and Develop Mathematical Thinking

To help students rely on their own understanding, ask the following:

- Do you think that is true? Why?
- Does that make sense to you?
- How did you get your answer?
- Can you make a model or draw a picture to show that?
- What do you need to decide?
- Do you agree with the explanation?

To promote problem solving, ask the following:

- What do you need to find out?
- What information do you have?
- Will a diagram or number line help?
- What strategies could you use?
- Will you do it mentally? Use pencil and paper? Use a calculator?
- What tools or materials could you use to solve the problem?
- What do you think the answer will be?

To help students learn to reason mathematically, ask the following:

- Is that true for all cases? Explain.
- Can you think of an example that does not work (a counterexample)?
- How would you prove that?

To encourage conjecturing, ask the following:

- What do you predict?
- What would happen if . . . ? What if not?
- What might the pattern be?

To help students collectively make sense of mathematics, ask the following:

- What did you think about what _____ said?
- Do you agree? Why or why not?
- Does anyone have the same answer but a different way to explain it?
- Do you understand what _____ is saying?
- Can you convince the rest of us that your answer makes sense?
- What does your group notice about . . . ?
- What question could you ask the class about this problem?

To check student progress, ask the following:

- What have you found out so far?
- What else is there to do?
- What do you notice about _____?
- Why did you decide to organize your work like that?
- Have you thought of another way to solve this problem?

To help when students get stuck, ask the following:

- How would you say the problem in your own words?
- Would it help to draw a picture, make a model, or act it out?
- What have you done so far?
- What do you need to figure out next?
- Could you try it with simpler numbers or fewer numbers?
- Would it help to create a table, a graph, a number line, or other diagram?
- Have you compared your work with anyone else?
- What did other members of your group try?
- Tell me what you did the other day on the problem about _____.
- Is it similar?

To make connections among ideas and applications, ask the following:

- What other problems or mathematical ideas does this remind you of?
- How does this relate to _____?
- What ideas that we have already learned were useful in solving this problem?
- Can you give me an example of _____?
- Can you think of a general rule that works for all of these cases?
- Can you write a formula?

To encourage reflection, ask the following:

- Does your answer seem reasonable? Why or why not?
- Describe your method to us. Can you explain why it works?
- What if you had started with _____ rather than _____?
- What have you learned or found out today?
- Will this method work for all numbers?
- What are three things to remember from today's lesson?

SOURCE: Adapted from Developing Mathematical Thinking with Effective Questions by PBS Teacher Line (2002).