

HIDDEN CURRICULUM, LANGUAGE, AND MATH: HOW TO HELP EMERGENT BILINGUALS TO SUCCEED IN STEM



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WHY DID I CHOOSE TO BECOME AN EDUCATOR?

Recovering traditionalist: from traditionalist to critical pedagogy approach.

Interdisciplinary method:
language + culture + content knowledge (STEM).

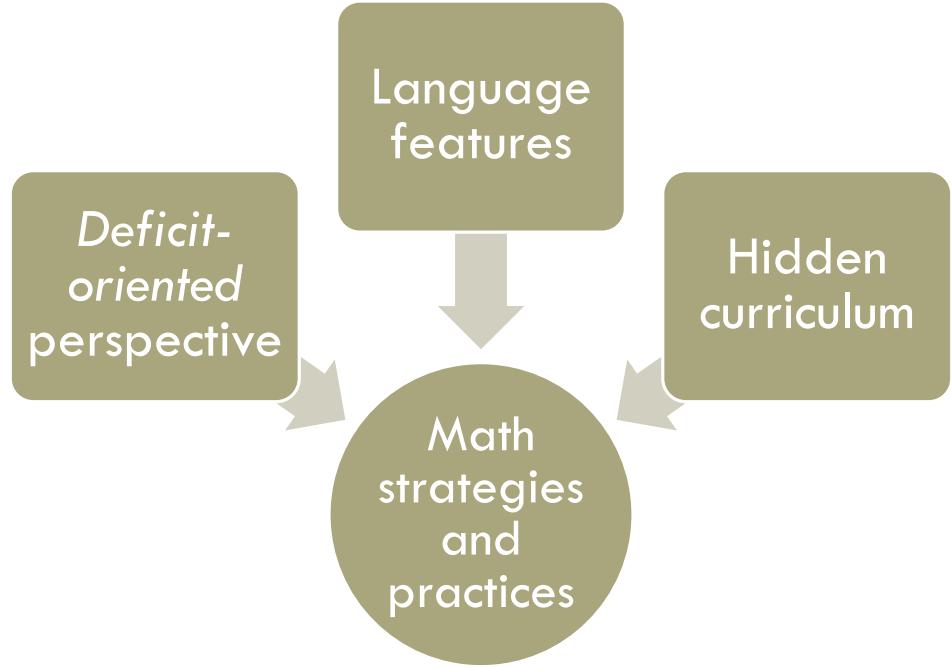
Identity development: identity is hybrid and fluid.

As teacher I can be a role model for my students.



GOALS FOR THIS SESSION

1. Understand how these three elements (**language features, deficit-oriented approach perspective, and hidden curriculum**) influence the development of math strategies and practices in **K-5 immersion** classes.
2. Walk away with **math ideas** that we can use in our class to enhance **number sense** and develop math understanding.



PREMISES

1. Students who speaks languages different than English at home have been often considered from a **deficit-oriented** perspective (LESA, LEP, ELLs). (Harry & Klingner, 2007).
2. **Language features** are highly correlated with the development of thinking strategies and ability to solve mathematics tasks (Di Stefano, Litster, & MacDonald, 2017a).
3. **Hidden curriculum (HC)**: emergent bilinguals in DLE settings are taught in both English and a target language, assuming that languages have **equal status**. However, different **power balances** exist among languages of instruction (Lee & Jeong, 2013; Palmer, 2007, 2010).



COMMON CONCERNS IN K-5

- Students developed language proficiency in the target language but they did not “caught” **number sense**.
- Teachers need to concentrate on students passing the school Math test (K-2) and state comprehensive assessment test (grades 3 to 5) in English.

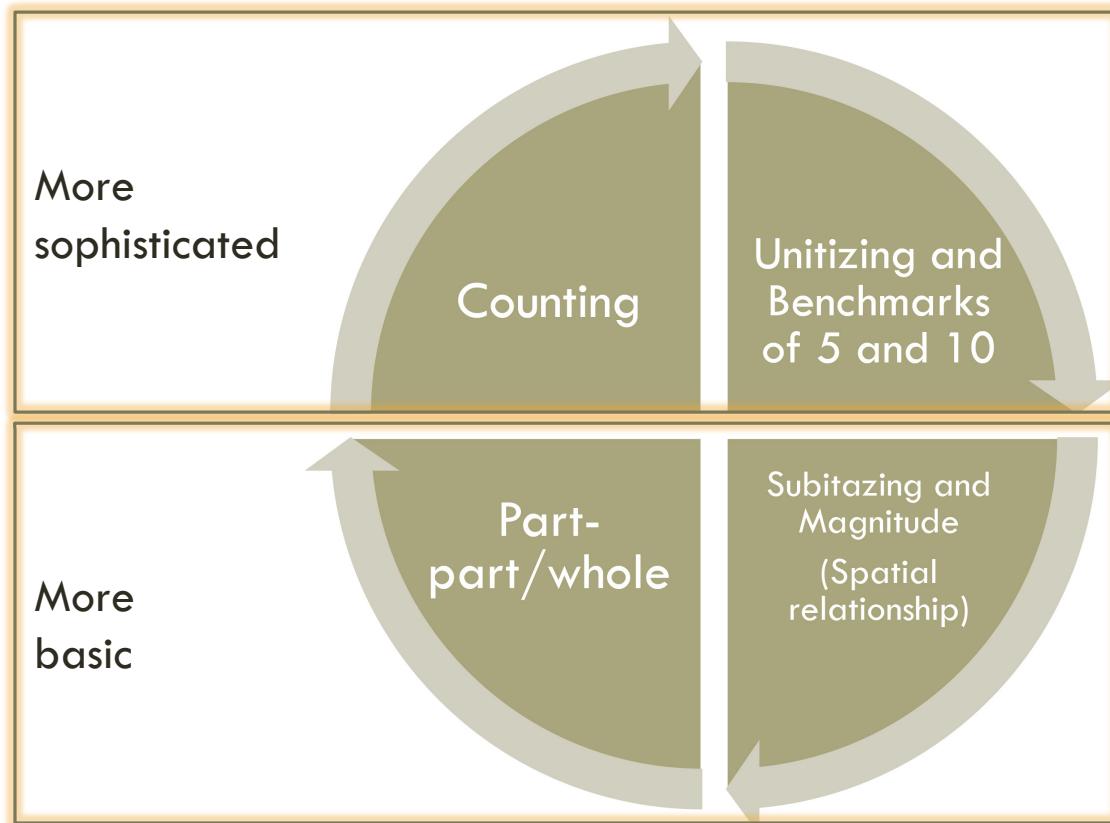
→ **What are your major concerns?**

Take 2-3 minutes to share your ideas in small groups.



WHAT IS NUMBER SENSE?

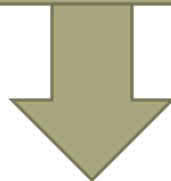
EL SENTIDO DE LOS NÚMEROS



Number sense is the coordination of **all** these skills.

WHY DO WE NEED TO DEVELOP NUMBER SENSE?

- **Subitizing and magnitude** → Recognizing how many without counting by seeing a visual pattern. Develop **spatial relationship**. Important to learn estimate.
- **Part-part whole** → Reason with numbers
- **Counting** → Decide on a strategy based on the problem and on the numbers involved
- **Unitizing** → Refer to benchmark of 5 and 10. Develop number relationship.



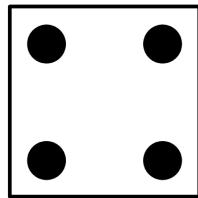
Develop fluidity and flexibility with numbers

Source: Shumway, 2017; Tondevold, 2015.

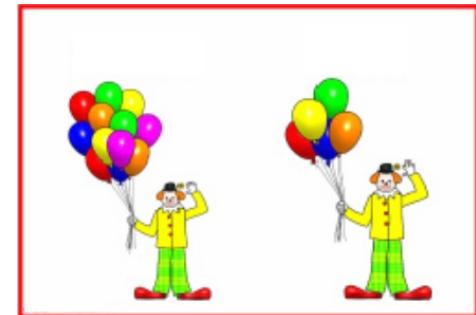


1- SUBITAZING AND MAGNITUDE (SPATIAL RELATIONSHIP)

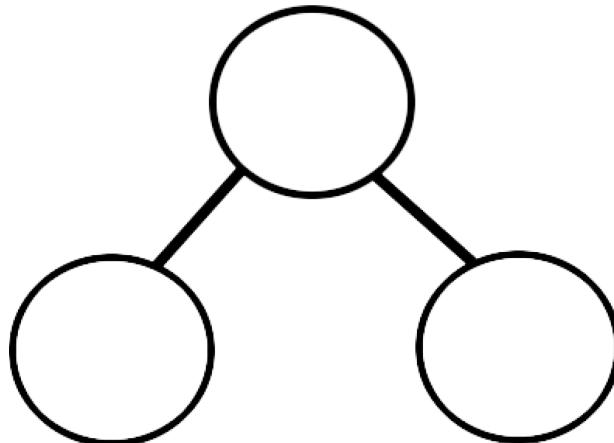
Subitizing



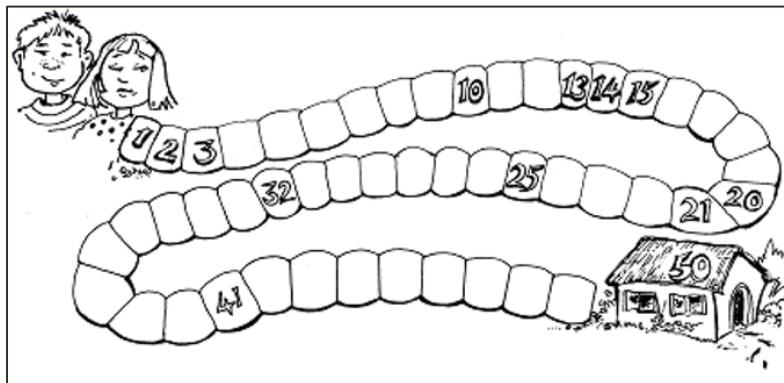
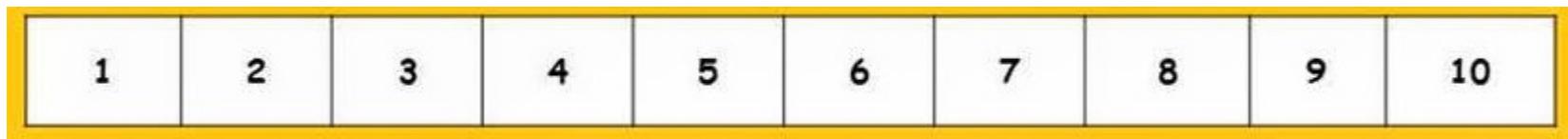
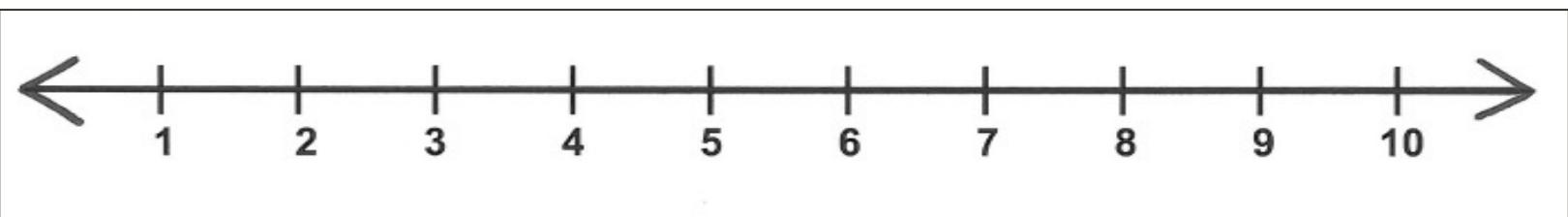
Magnitude



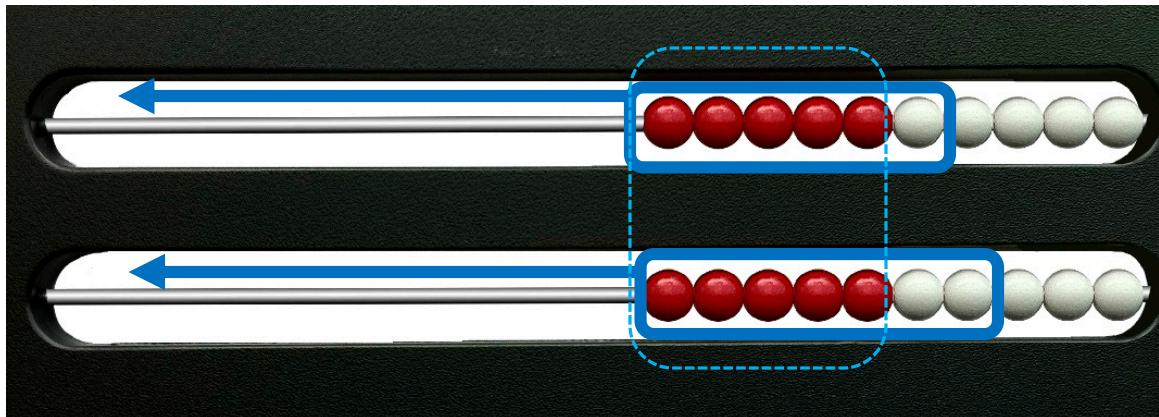
2- PART-PART-WHOLE



3- COUNTING (ONE/TWO MORE OR LESS)



4- UNITIZING (USE BENCHMARKS OF 5 AND 10)



$$\begin{array}{c} 6 + 7 = 13 \\ \swarrow \quad \searrow \\ (5 + 1) \quad (5 + 2) \\ 10 + 3 = 13 \end{array}$$

Source: <https://mathrack.com/digitalMathRack.html>

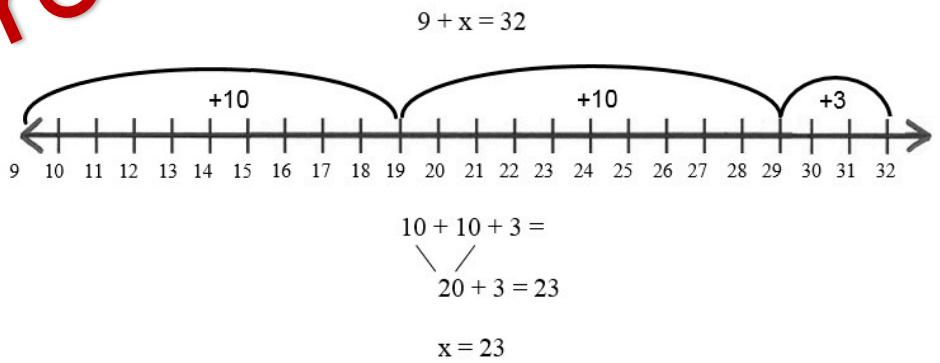
DISCUSSION

- What do you already do in your classroom routine that support students' development of number sense?
- What would you do differently?
- What activities you think you can implement to promote different representations of numbers?

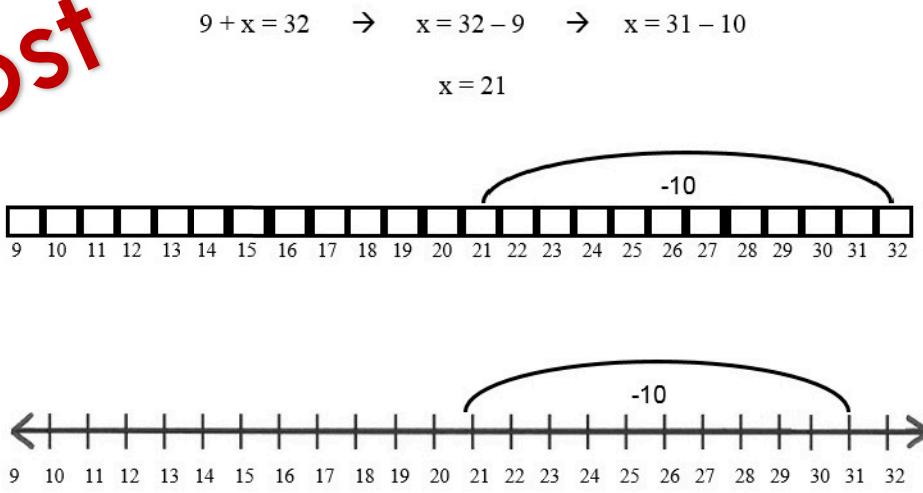
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THE USE OF NUMBER LINE TO SHOW ALGEBRAIC REASONING

Pre



Post



Linear equation on one variable (third-grade).

Message: the integration of standard and core curriculum in the target language is important as it is in the English class.

Differentiate instruction and representations using both number bench and number line

WORD PROBLEMS IN ENGLISH AND IN TARGET LANGUAGE: UNCOVERING HC

Spanish

- a) Margarita tiene que ayudar a su mamá a preparar las pupusas para la cena. La mamá de Margarita prepara 15 pupusas y Margarita prepara 9 pupusas. ¿Cuántas pupusas tienen en total?
- b) Jorge tiene unas cajas con mangos. Cada caja tiene 7 mangos. Si Jorge tiene 5 cajas de mangos ¿cuántos mangos tiene en total?

English

- a) Damani brought in 2 boxes of pencils to his third-grade class. One box has 13 pencils and the other box had 20. There are 24 students in his class. If everyone gets one pencil, how many will be left?
- b) Patrick had 142 books in his library. He bought 17 more at the library's annual sale, and then his neighbor gave him another two dozen. (One dozen = 12). How many books does he have in his library now? Write an expression and then solve.



WORD PROBLEMS IN ENGLISH AND IN TARGET LANGUAGE: UNCOVERING HC

When preparing word problems in the target language consider including:

- Higher order thinking strategies;
- Numbers and vocabulary that are appropriate with students' developmental stage;
- Students' funds of knowledge;
- Align with the requirement of the state curriculum.

Always hold high expectations of your students in target language class and in the English class.

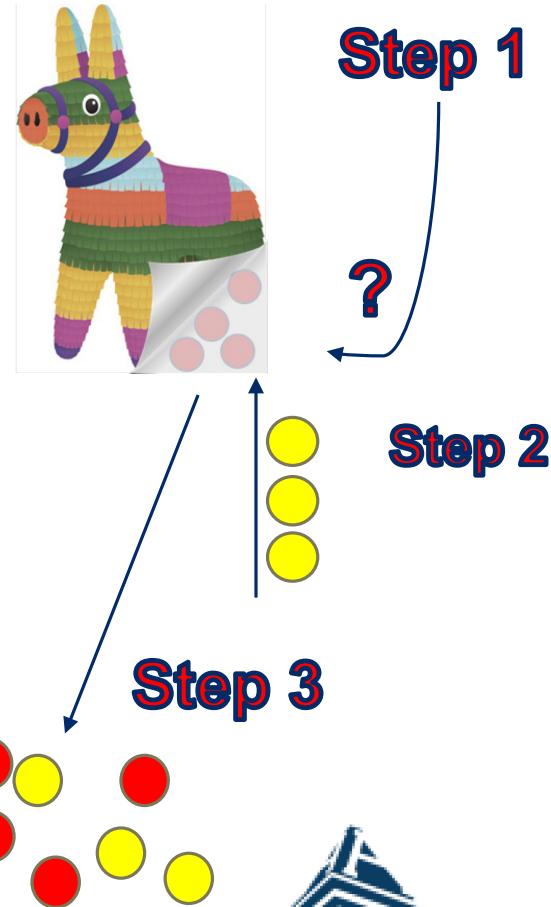


INTEGRATING FUNDS OF KNOWLEDGE

- 1** I am going to put *some* candy in the piñata.
- 2** Now, I am going to put 3 more pieces of candy in the piñata.
- 3** Then, we hit the piñata. Whack! And 7 pieces of candy fell out.

How many pieces of candy did I put in at the beginning?

$$7 - 3 = X$$



Source: Di Stefano, Litster, & MacDonald (2017b).

DISCUSSION

- What do you already do in your classroom routine that show high expectations on emergent bilinguals in the target language class? And what about in the English class?
- What would you do differently?
- How can you develop such strategies with your target-language teacher or with your English teacher?
 - Higher order thinking strategies;
 - Numbers and vocabulary that are appropriate with students' developmental stage;
 - Students' funds of knowledge;
 - Align with the requirement of the state curriculum.

TAKE-AWAY FOR THIS SESSION

1. Dismantle the **deficit-oriented** perspective
→ Enhance students' development of number sense.
 - Subitizing and magnitude
 - Part-part whole
 - Counting
 - Unitizing
2. Consider language features in mathematics
→ Become **culturally and linguistically responsive.**
 - Use numbers and vocabulary that are appropriate with students' developmental stage;
 - Integrate students' funds of knowledge;
3. Uncover hidden curriculum
→ Consider that languages have **equal status.**
 - Align with the requirement of the state curriculum in meaningful ways



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Thank you!

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