Making Challenging Mathematics Accessible for Emergent Bilinguals

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What are some strategies for teaching mathematics with EBs?

Cognitive Demand

Low-level Cognitive Demand

- Memorization
- Procedures without Connections
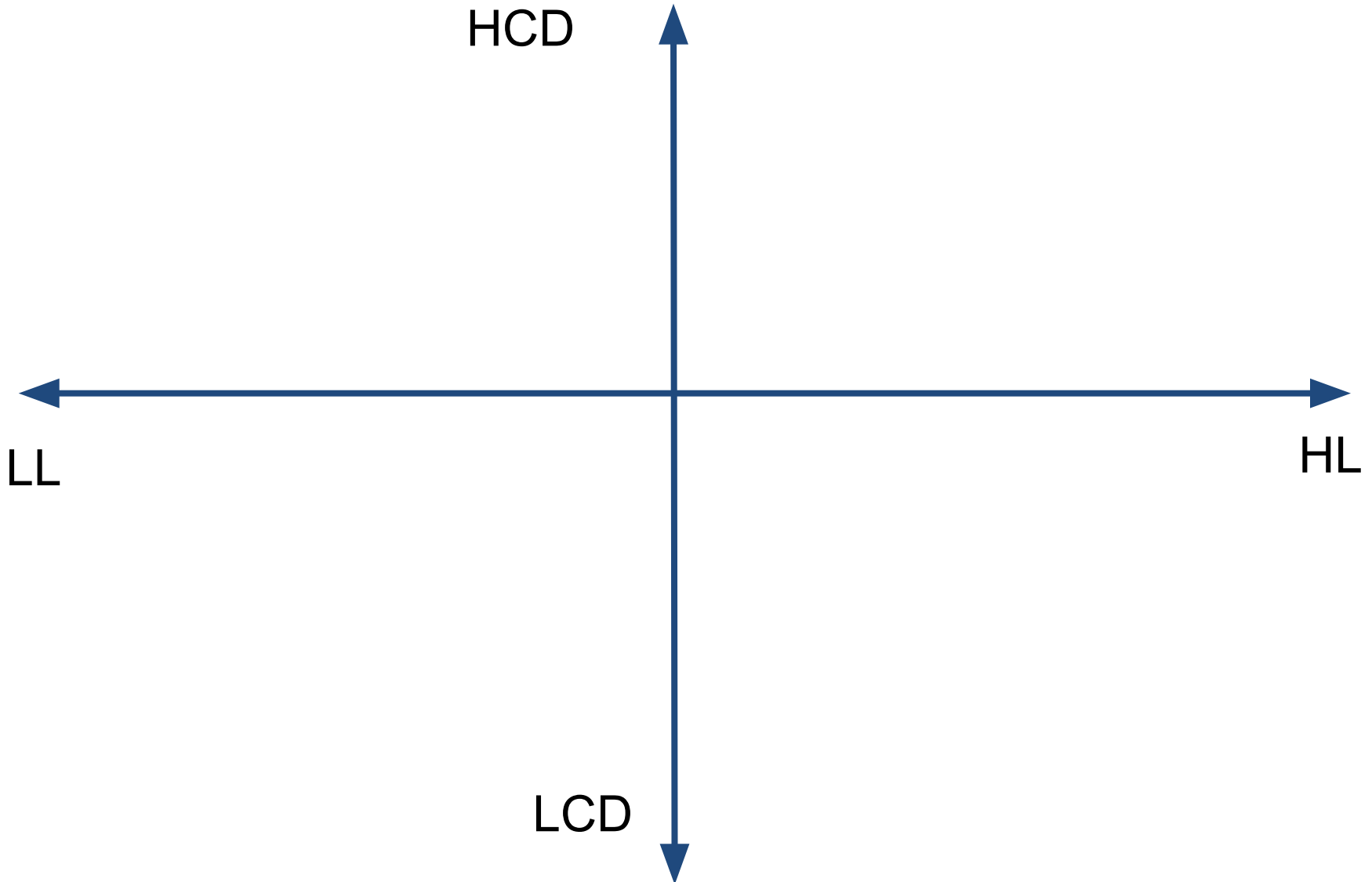
High-level Cognitive Demand

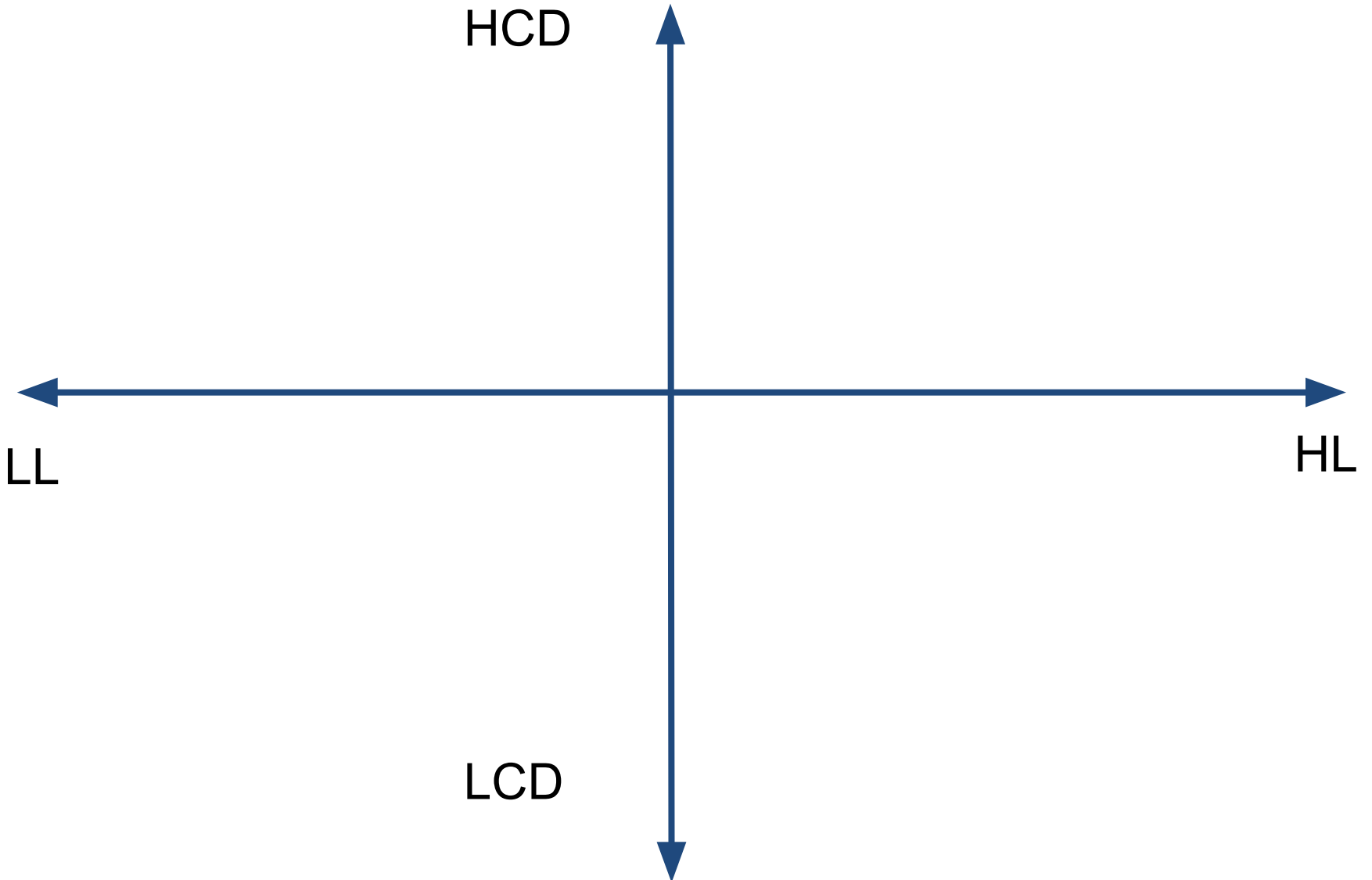- Procedures with Connections
- Doing Mathematics

(Stein et al., 2009)

Sort the Tasks by Language and Cognitive Demands
For each task, place the tasks on the following plane.

HCD

LL

HL

LCD

Gallery Walk

HCD

LL

HL

LCD

Debrief

Receptive Language

- Listening
- Reading

Productive Language

- Speaking
- Writing

Experiencing EB Strategies in Math

Task 1: No Support

수완이와 아버지는 오늘 낚시를 가서 고등어와 꽁치를 잡았습니다. 잡은 물고기를 바구니에 넣어 가지고 오는데 최대 6 킬로그램까지만 담을 수 있다고 합니다. 고등어 한 마리의 무게가 500 그램이고 꽁치 한 마리의 무게가 350 그램이면 바구니에 생선을 각각 몇 개씩 넣어야할까요?

Task 1: Simplify the Language

수완이와 아버지는 오늘 고등어와 꽁치를 잡았습니다. 바구니에 생선을 넣는데 6kg보다 많이 넣을 수는 없다고 합니다. 고등어 한 마리가 500g이고 꽁치 한 마리가 350g이면 바구니에 생선을 각각 몇 개씩 넣어야할까요?

Task 1: Pictures

수완이와 아버지는 오늘 고등어와 꽁치를 잡았습니다. 바구니에 생선을 넣는데 6kg보다 많이 넣을 수는 없다고 합니다. 고등어 한 마리가 500g이고 꽁치 한 마리가 350g이면 바구니에 생선을 각각 몇 개씩 넣어야할까요?

Task 1: Pictures & Captions

수완이와 아버지는 오늘 고등어와 꽁치를 잡았습니다. 바구니에 생선을 넣는데 6kg보다 많이 넣을 수는 없다고 합니다. 고등어 한 마리가 500g이고 꽁치 한 마리가 350g이면 바구니에 생선을 각각 몇 개씩 넣어야할까요?

고등어

꽁치

Task 1: English Version

Suwan and his father went fishing today. They caught mackerels and sauries. They want to put the fish into baskets. Each basket can hold 6kg. A mackeral weighs 500g and a saury weighs 350g. How many of each type of fish could fill a basket?

Task 2: No Support

팩스턴 킬리 초등학교의 세 학급이 동물원으로 견학을 갑니다. 루이스 선생님 반은 23명이고, 양 선생님 반은 25명, 그리고 에반스 선생님 반은 24명입니다 (모든 숫자는 선생님을 포함합니다). 버스와 밴, 승용차 중에서 선택할 수 있습니다. 버스는 20개의 좌석이 있고, 밴은 16, 그리고 승용차에는 5명이 탈 수 있습니다.

당신이 모든 학급을 동물원으로 이동시킬 교통수단을 결정해야하는 책임자입니다. 어떤 차량을 몇 개씩 사용할 것인지 그 이유와 함께 설명하세요. 답을 쓰고 생각한 것을 설명하십시오.

Task 2: Google Translation

Three classes of Paxton Keeley Elementary School excursions to the zoo. Mr. Lewis is half of 23 people, half the amount teacher 25 people, and Evans Sir half is 24 (all numbers include a teacher). You can choose between a bus and a van and a car. The bus has 20 seats, 16 vans and cars Five people can ride.

The officer determined that you need transportation to move all the classes to the zoo. Any vehicle to use a few pairs Describe and explain why. Explain to think and write the answer.

Task 3: No Support

Bom dia classe! Hoje eu tenho um desafio para voces. Meu amigo Diego mora em uma fazenda, e em sua fazenda existem algumas cabras e umas galinhas. Diego olhando em torno da fazenda contou um total de 52 pernas entre as cabras e as galinhas. Ele esta tentando descobrir exatamente quantas cabras vivem em sua fazenda. A mae de Diego disse que possuem um total de 16 animais. Voces podem ajudar Diego descobrir quantos dos animais sao cabras?

Task 3: Say It Aloud & Gesture

Bom dia classe! Hoje eu tenho um desafio para voces. Meu amigo Diego mora em uma fazenda, e em sua fazenda existem algumas cabras e umas galinhas. Diego olhando em torno da fazenda contou um total de 52 pernas entre as cabras e as galinhas. Ele esta tentando descobrir exatamente quantas cabras vivem em sua fazenda. A mae de Diego disse que possuem um total de 16 animais. Voces podem ajudar Diego descobrir quantos dos animais sao cabras?

Discussion

Which strategy helped you understand the problem?

Which one do you think was most effective?

What are some other ways you could support EBs in this task?

Examine this Task

The two-eyed space creatures, three-eyed space creatures, and four-eyed space creatures are having a contest to create a group with 24 total eyes.

If you have to include at least one space creature from each kind, how many space creatures of each kind are needed to make a group with 24 total eyes? If it is possible, list all possible combinations and explain your strategy. If it is impossible, explain why.

On chart paper, record your ideas on how to modify this task for EBs

The two-eyed space creatures, three-eyed space creatures, and four-eyed space creatures are having a contest to create a group with 24 total eyes.

If you have to include at least one space creature from each kind, how many space creatures of each kind are needed to make a group with 24 total eyes? If it is possible, list all possible combinations and explain your strategy. If it is impossible, explain why.

Guiding Principles for Teaching Mathematics to EBs

1. **Challenging** mathematical tasks
2. **Linguistically sensitive** social environment
3. **Support for learning English** while learning mathematics
4. Mathematical **tools and modeling** as resources
5. Cultural and linguistic differences as intellectual **resources**

(Ramirez, N.G. & Celedon-Pattichis, S., 2012)

Dos and Don'ts

- Do provide challenging mathematics tasks
- Don't dumb down the curriculum

- Do focus on academic language
- Don't focus on vocabulary without a context

- Do provide resources
- Don't allow the resources to take away the challenge

- Do allow EBs to use their first language as a resource
- Don't view the second language as a deficit

- Do allow students to collaborate with others of the same language
- Don't always place EBs together or have one person always translate

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