

**Build Math Minds Virtual Summit
July 31, 2017 – August 2, 2017**

The Interdependence of Language and Math: K-2 ELs Solving Inversion and Compensation Task

Becoming Linguistically and Culturally Responsive Teachers

Instructional strategies to that allow teachers to become more linguistically and culturally responsive and improve ELs’ performances when solving inversion and compensation tasks:

1. **BUILD UP:** use vocabulary and syntax that will build up on ELs language proficiency. For example, use terms such as “rotate”; explain the differences between “balanced” and “equal”; for Latinas/os ELs, use cognates from Spanish, such as “remove” (*remover*) and “cancel” (*cancelar*).
2. **ADAPT:** limit the use of phrasal verbs; use “you language”.
3. **REPLACE:** replace story problem with examples closer to the students own socio-cultural background (e.g., piñata, cupcake trays, etc.).

What teachers should do to help ELs	
Linguistically Responsive Teachers	Culturally Responsive Teachers
<p align="center">Language</p> <ul style="list-style-type: none"> • Use “you language”. • Limit the use of phrasal verbs and choose other more descriptive vocabulary (e.g., remove, delete, cancel, add, subtract, rotate). • Ask students to explain their thinking with their own words. • Limit or explain when words can be used as synonyms (e.g., equal/matched/balanced don’t have the same meaning) 	<p align="center">Context</p> <ul style="list-style-type: none"> • Structure story problems on culturally relevant materials (e.g., piñata). • Incorporate students’ personal experiences (e.g., cupcakes). • Support uncommon children experiences with visual aids (e.g. balance scale, rocket ship). • Know your students socio-cultural background. Knowledge is not static, and for this reason must be viewed critically.

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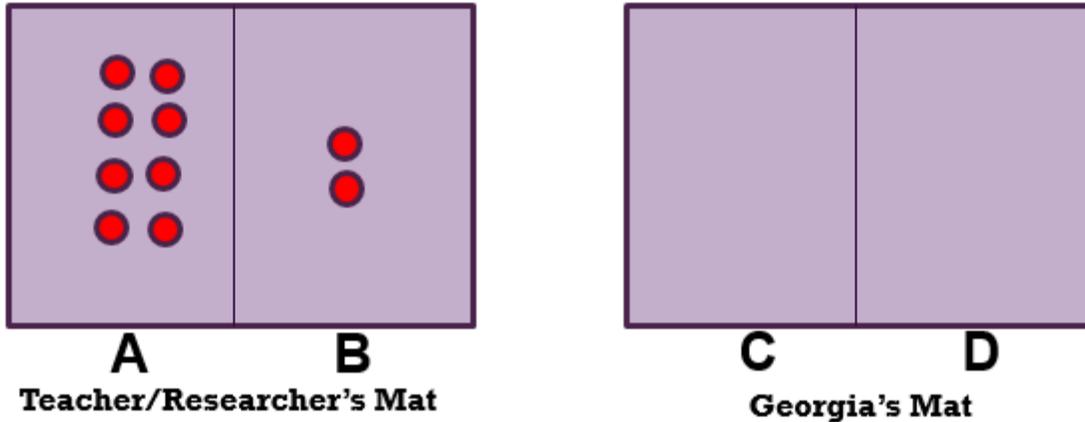
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Selected Transcriptions of the Math Intervention Sessions

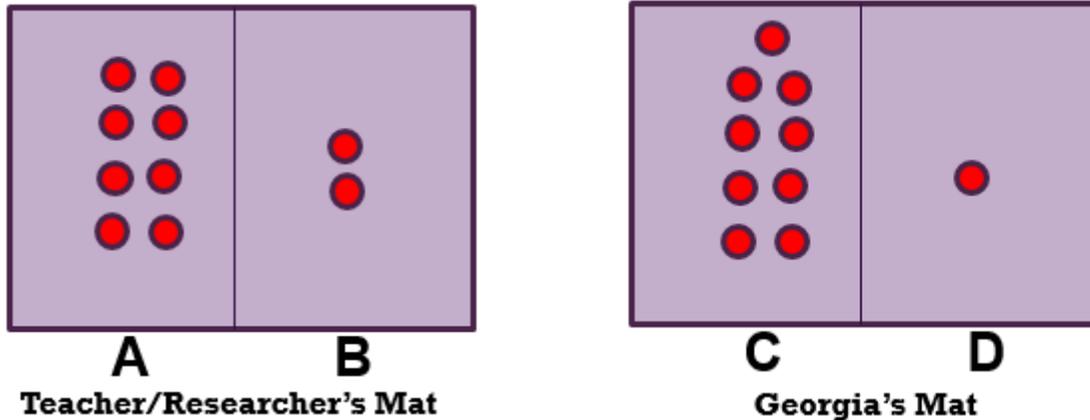
Transcription #1: Story problems: the “cupcake tray” with Georgia

Cupcakes trays contains 12 cupcakes



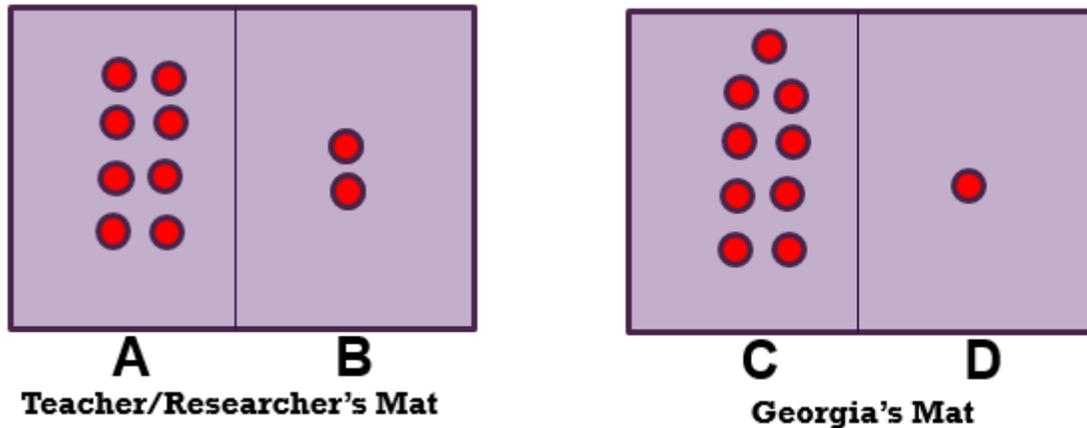
- ❖ B: I am going to pretend that you have some cookies on this side of the balance [points to Georgia's Mats] and I have some cookies on this side of the balance [points to Teacher's Mats].
- ❖ G: ... or cupcakes!
- ❖ B: Do you want to do cupcakes?
- ❖ G: Okay.
- ❖ B: Okay. So, I have ...
- ❖ G: ... three cupcakes?
- ❖ B: No ...
- ❖ G: ... five? Six? Seven? Eight? Nine, Ten? Elev... [Counts each counter as it is placed on of the two mats in front of the teacher-researcher].
- ❖ B: Nope.
- ❖ G: I only make 12 cupcakes.
- ❖ B: I have eight cupcakes ...
- ❖ G: ... **I only make 12 cupcakes.**
- ❖ B: Listen.
- ❖ G: Huh?
- ❖ B: I only have ... I have eight and two cupcakes.
- ❖ G: hmmm ... mmm (indicating yes).

Similar & Same – Few vs. +1/-1



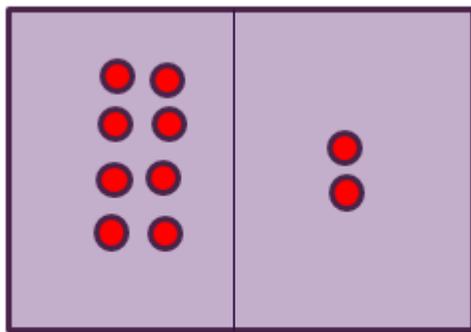
- ❖ B: So, Georgia let's look at our cupcakes. What's the **same** about my two sets of cupcakes ... or what is **very similar** to my two sets of cupcakes that are like your two sets of cupcakes? For instance, when I look at this Georgia, I see I've got **a lot** of cupcakes and **few**. Did you get that same kind of idea? A lot and then a **few**?
- ❖ G: No, 'cause **I only have one** cupcake there [points to D].
- ❖ B: Oh, well I have two cupcakes the second time. **You just got one?**
- ❖ G: [Nods to indicate yes.]
- ❖ B: So, here could I say that you have less than me?
- ❖ G: [Nods to indicate yes.]
- ❖ B: You think so?
- ❖ G: [Nods to indicate yes.]
- ❖ B: You think we have the same or you have **fewer** cupcakes than me?
- ❖ G: Same.
- ❖ B: Okay, so tell me why is it that you can have one there and I can have two here and we can have the same?
- ❖ G: hmmm ...I don't know... still.
- ❖ B: If I look at your other mat, right here [points C] on your other mat [points to both A & C] do we have the same number of cupcakes on these mats?
- ❖ G: [Pauses to look] No!

Altogether vs. All together

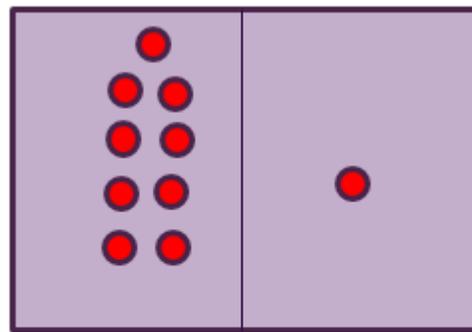


- ❖ B: Are eight and nine ... are they close to each other?
- ❖ G: hmmm... mmmm [indicating yes].
- ❖ B: Yea! What's the difference between eight and nine cupcakes?
- ❖ G: We take away one then ... [takes one counter off of C]
- ❖ B: Then you'd have eight?
- ❖ G: uh...huh [nods head up and down, indicating yes].
- ❖ B: Now, do you still have the same number as me?
- ❖ G: Let's see. One, two, three, four, five, six, seven, eight, nine [points to each counter on C&D]. Nope...nope...nope [takes one counter off D].
- ❖ B: No, **altogether** [points to A & B].
- ❖ G: Now it does.
- ❖ B: So, how many should you have **altogether**?
- ❖ G: hmmm.... Eight by making five plus three.
- ❖ B: You mean by making eight? Do I have eight here altogether [A & B]?
- ❖ G: Ye.... [looks at A & B] No! You only have ten!
- ❖ B: I have ten. Do you have ten on your side?
- ❖ G: No.
- ❖ B: I want to make sure we have the same.
- ❖ G: [Covers up counters on B] You have to minus two.
- ❖ B: No, I am not taking ... I want to hold on to all of my cupcakes. I am not getting rid of cupcakes. Are you crazy?
- ❖ G: I want to get rid of some of mine.
- ❖ B: What if you wanted to get the same number as me? What could you do to your board?
- ❖ G: I don't know!

How can I make mine the same as yours?



A **B**
Teacher/Researcher's Mat



C **D**
Georgia's Mat

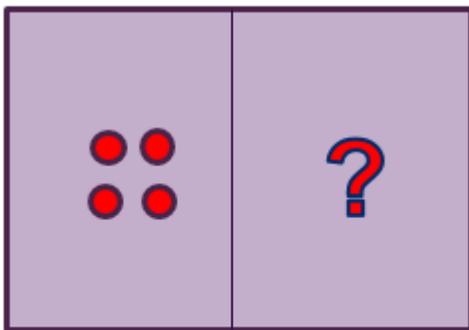
- ❖ B: Hmm...Well, what's the dif ... what do we have here? On my first ... At first, I was given eight cupcakes and you were given nine [places one counter back on C]. Right?
- ❖ G: Hmm ... mmm [Indicating yes.]
- ❖ B: Then you said, to make it the **same** you would only need one more.
- ❖ G: [Nods to indicate "yes."]
- ❖ B: Do you still agree with that?
- ❖ G: [Nods to indicate "yes."]
- ❖ B: Yeah? Alright, so put that one more over there.
- ❖ G: [Places one counter D]
- ❖ B: So, where do you see ... Do you see eight over here [points to C&D] and two over here, like my eight and two?
- ❖ G: [Nods to indicate "yes."]
- ❖ B: I wonder if we could make those the **same**.
- ❖ G: Then ... I don't know.
- ❖ B: How could we do that to your cupcakes? Make it an eight and a two.
- ❖ G: [Quietly counts the counters on C]. Well, we will make that nine.
- ❖ B: How can I make mine nine and one **like** yours?
- ❖ G: I am not really, really sure.

Transcription #2: “Balance scale” activity with Allen under culturally relevant pedagogy lens

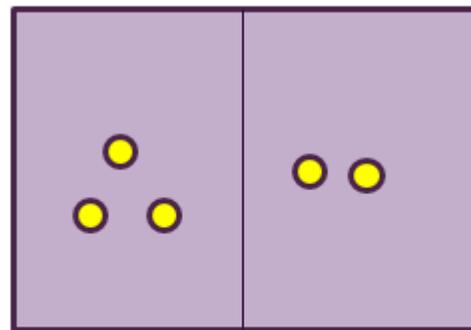
Unfamiliar with balance scale



- ❖ B: We are going to do a balance activity today.
- ❖ A: **What’s Balance?**
- ❖ B: Do you ever put like weights on a balance scale and when you put like more weights on one side it dips down and the other one goes up?
- ❖ A: [Shakes head]
- ❖ B: So, we are going to pretend these papers are like that. So, I have three on this side [RH] and one on this side [LH], so my three is going to dip way down because it is more than this one. Okay? Or I may have ...
- ❖ A: [interjects] Oh yea, I did this before.
- ❖ B: ... two and one [RH] and one nothing [LH] and it’s going to dip way down because it’s more than the one.
- ❖ A: Now I get it.



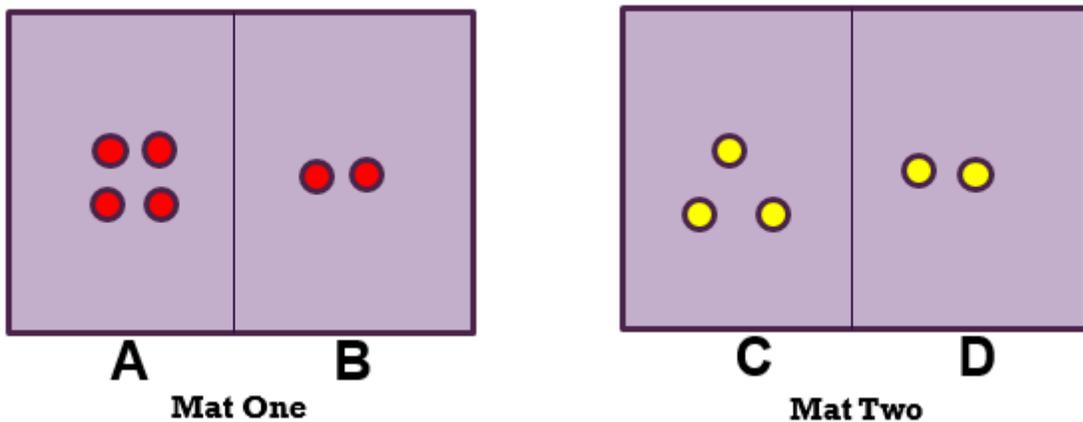
A B
Mat One



C D
Mat Two

- ❖ B: If I have on this side [A] four and something [B], and on this side and I have three [C] and two [D]. What do I need here [R1] to make that balanced?
- ❖ A: Um, six?
- ❖ B: You think a six should go here [B]? So, six and four is in one hand, and three and two is in the other hand. Are they balanced?
- ❖ A: [shakes head]
- ❖ B: No. What could we put here [B] to make four and something balance with three and two?
- ❖ A: [holds hands up like a balance scale] uh ...

Matched vs. Equal

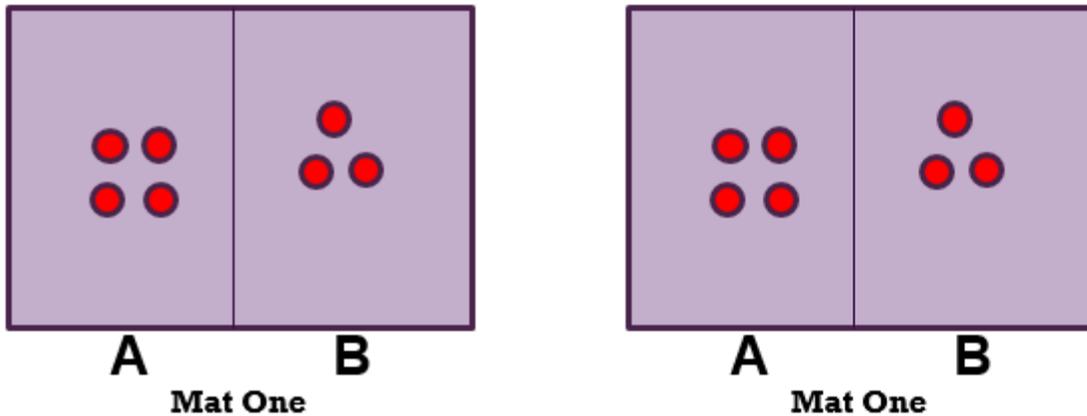


- ❖ B: So, let's try this Allen, if I put two here [B], what do I have over here? On this side of the scale [A & B]?
- ❖ A: Six.
- ❖ B: Six? What do I have on this side [D]?
- ❖ A: Two.
- ❖ B: No, on this side of the scale [C & D]?
- ❖ A: Oh, five.
- ❖ B: Five. Ok, where do you see two on this side of the scale?
- ❖ A: [points D]
- ❖ B: Ok, so we **matched** these two [B & D], they would be **equal**, wouldn't they? Right, are these two [A & C] **equal** though?
- ❖ A: [shakes head]

Phrasal verbs

Phrasal verbs: one verb + one preposition.

Phrasal verbs are one of the most complex elements of the English language for ELs



- ❖ B: So, what can we do to make these two equal [A & C]?
- ❖ A: **Take one off. Take one away** ... [from A].
- ❖ B: Ok, well let me tell you this, watch. If I **take one away** [remove from A], I can't take it off altogether I have to put it over here [B]. Now, are these two matched [B & D]?
- ❖ A: [shakes head]
- ❖ B: These two match now [A & C] what can we do to make these match [B & D]? This is the one we can **take things off** of [B].