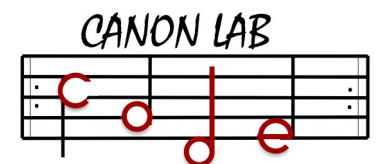


What is the Relationship between Computer Science Instruction and Reading & Math Performance?

Jean Salac, Cathy Thomas, Chloe Butler, & Diana Franklin

University of Chicago & Texas State University

 @SaladwithaC



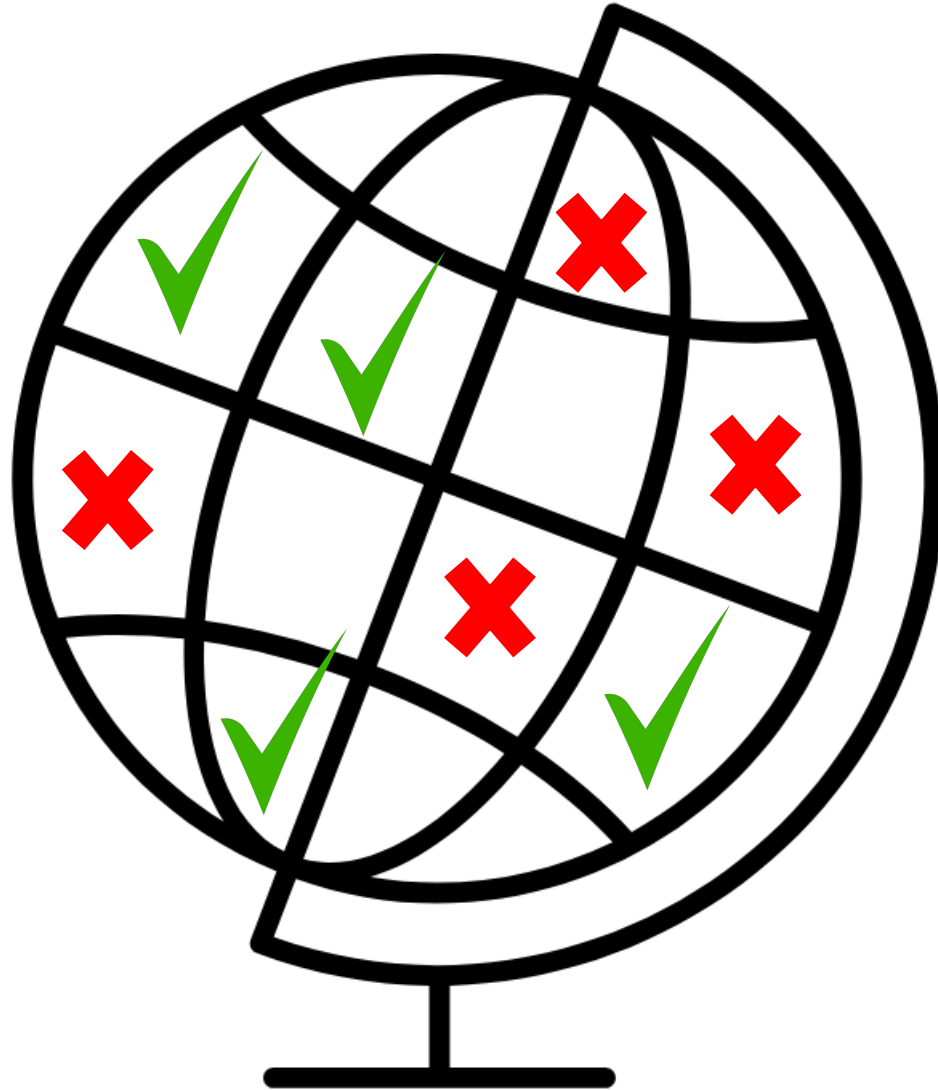
*Computing for ANYONE:
Designing for equity and inclusion*



Is there Computer Science instruction in your local primary/elementary schools?

- If yes, why do you think your local school started teaching CS?
- If no, what do you think are the barriers to including CS?

Worldwide expansion of CS instruction
is not reaching all schools.

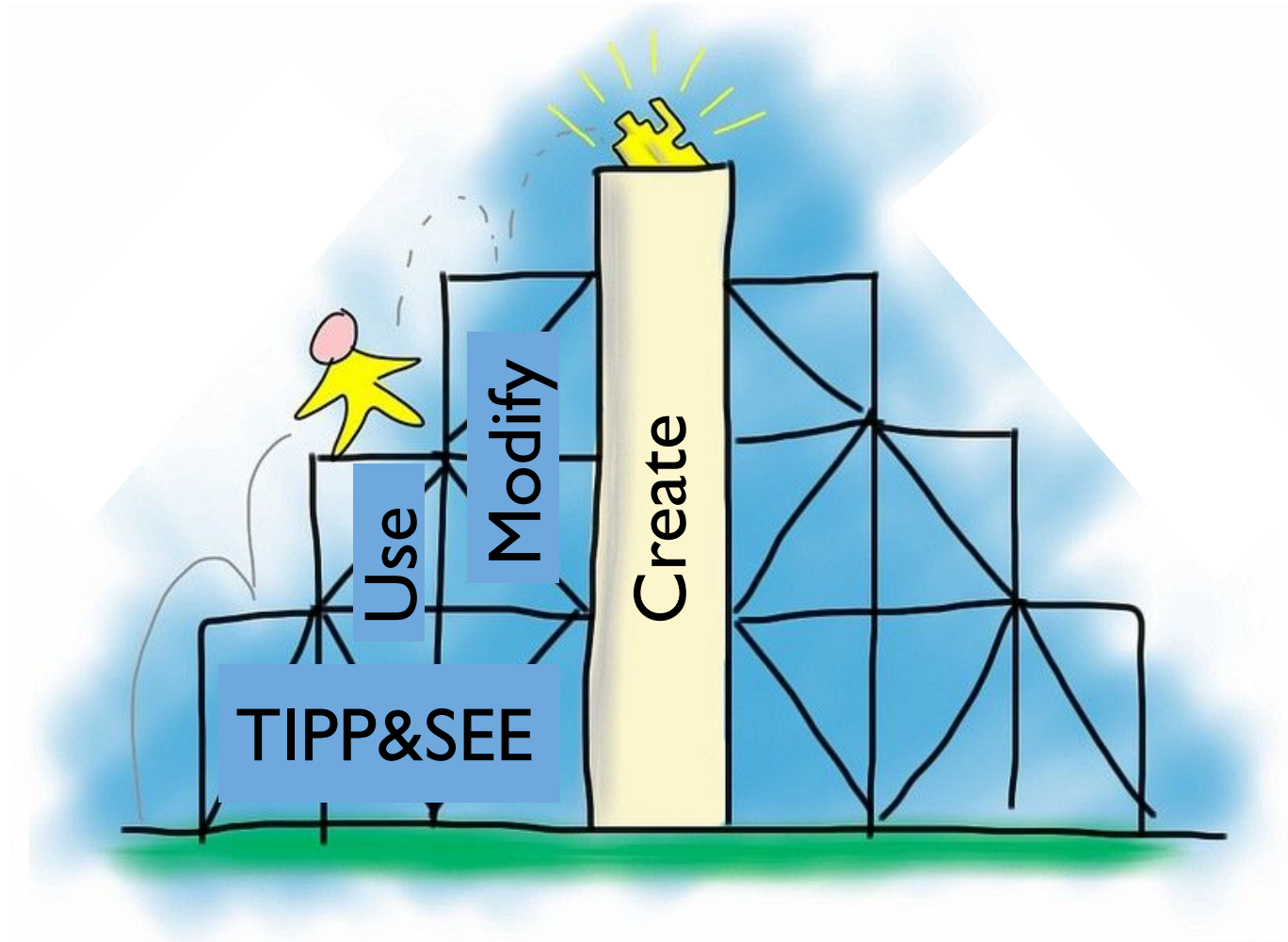


Goal: Explore how CS relates to Reading & Math outcomes

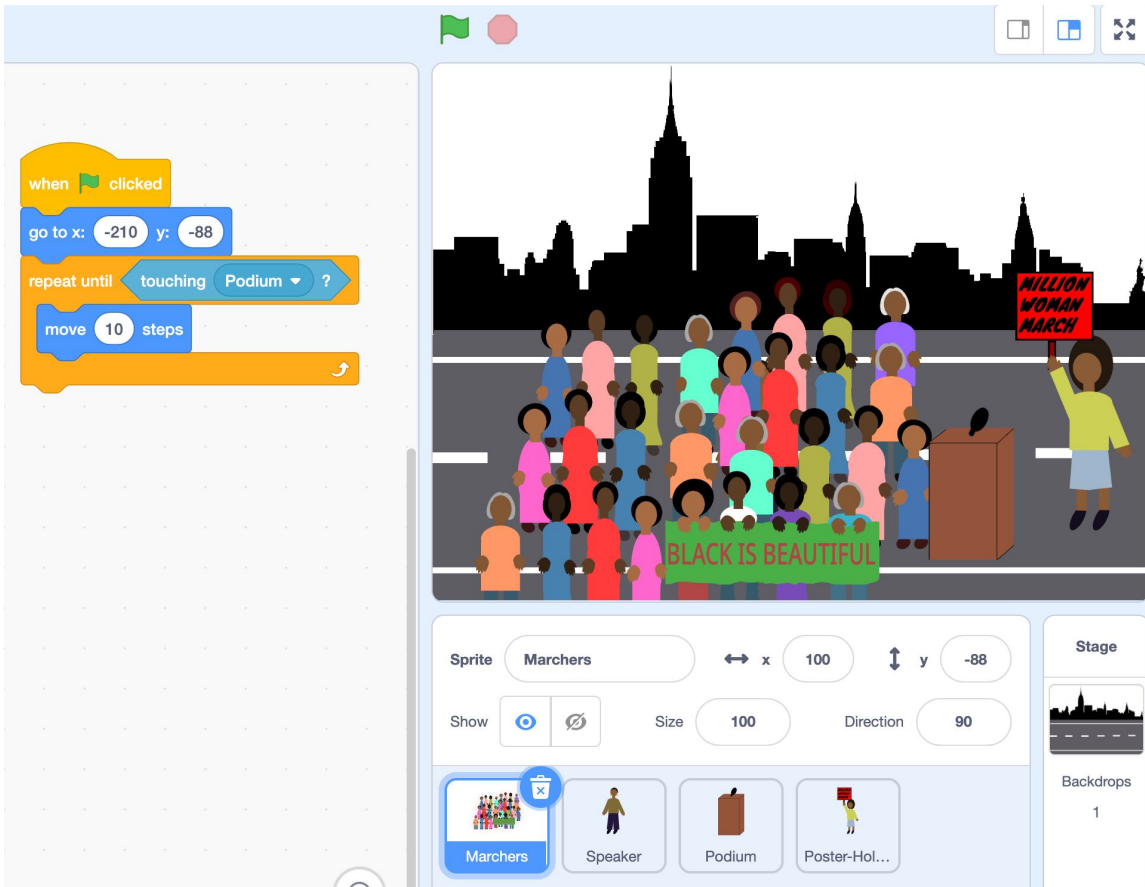
- One way to motivate the inclusion of CS: Demonstrate its impact on important academic outcomes, like reading & math
- Research Questions:
 - How is CS instruction associated with reading and math scores?
 - How do any associations apply to learners with academic challenges?

Two forms of CS: Use → Modify → Create & TIPP&SEE

Learning Outcome



Example Use → Modify



Now implement these changes:	Coded	Tested
Make the <u>Marchers</u> move right across the road to the <u>Speaker</u> .	<input type="checkbox"/>	<input type="checkbox"/>
Make the <u>Marchers</u> stop when they touch the <u>Speaker</u> .	<input type="checkbox"/>	<input type="checkbox"/>
Make the <u>Speaker</u> stay still until the <u>Marchers</u> touch her.	<input type="checkbox"/>	<input type="checkbox"/>
Make the <u>Speaker</u> move right until she touches the <u>Poster Holder</u> .	<input type="checkbox"/>	<input type="checkbox"/>
Change the <u>Speaker's</u> costume to "Speaking" so she is facing podium.	<input type="checkbox"/>	<input type="checkbox"/>



Title

Sprites

Instructions

Events

Purpose

Explore

Play

“TIPP” was inspired by previewing strategies.

Get a **TIPP** from the Project Page:



Title: What is the title of the project?
Does it tell you something about the project?



Instructions: What do the instructions tell you to do?



Purpose: What is the purpose of this activity?
What will this code teach you?



Play: Run the project and see what it does!
Which sprites are doing the actions?

1. Who talks when I click  ?



Catrina



Left



Middle



Right

2. Who talks when I press spacebar?



Catrina



Left






Middle



Right

“SEE” was inspired by text structure strategies.

SEE Inside:

-  **S**prites: Click on the sprite that you want to learn from or change.
-  **E**vents: Look at the event blocks starting the scripts. Which scripts are most useful?
-  **E**xplore: Try different changes to the scripts and observe what happens!

4. Which block makes the sprite bigger?

change size by 100 say I am Grandpa John. for 2 seconds change size by -100

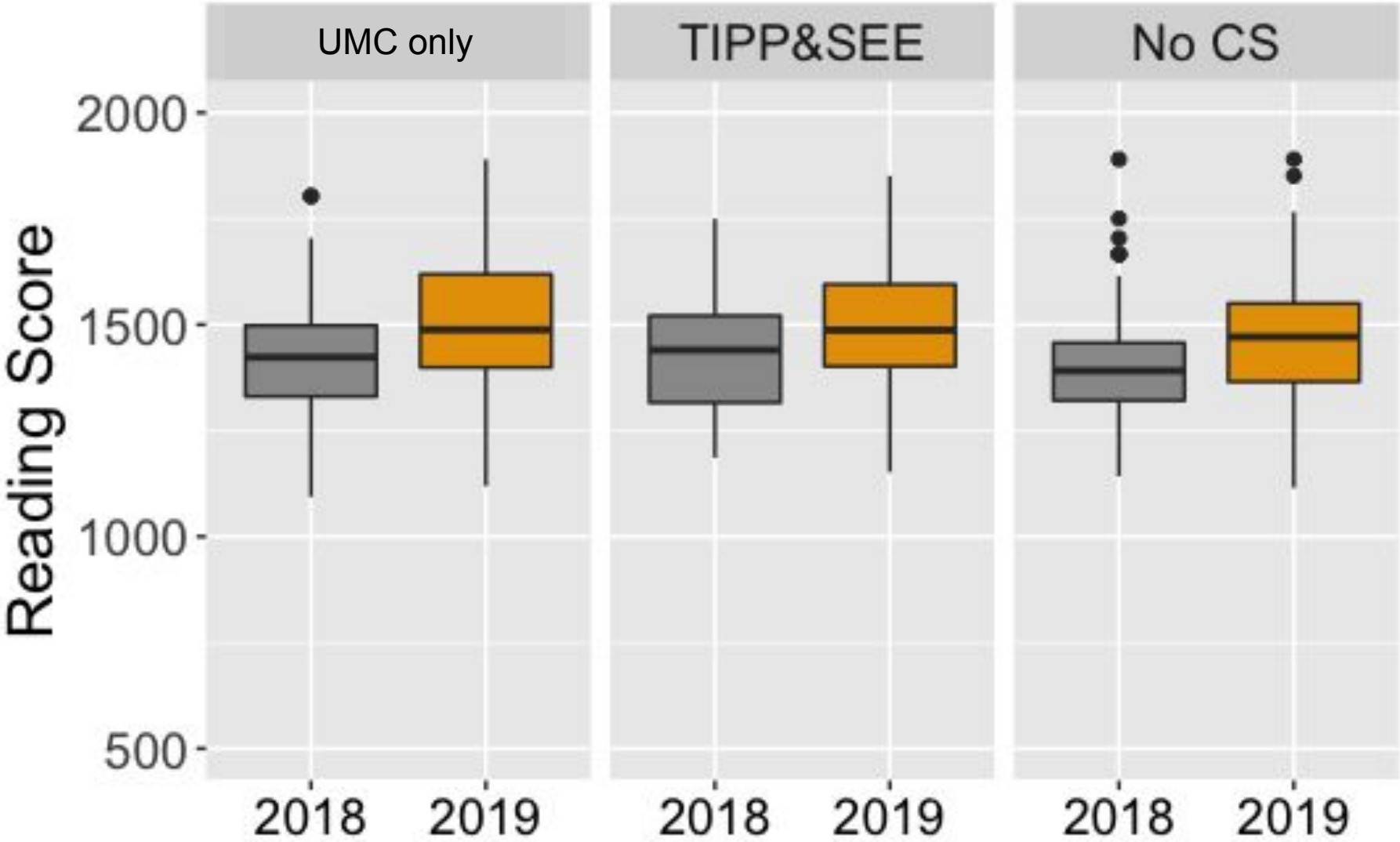
5. Which block makes the sprite smaller?

change size by 100 say I am Grandpa John. for 2 seconds change size by -100

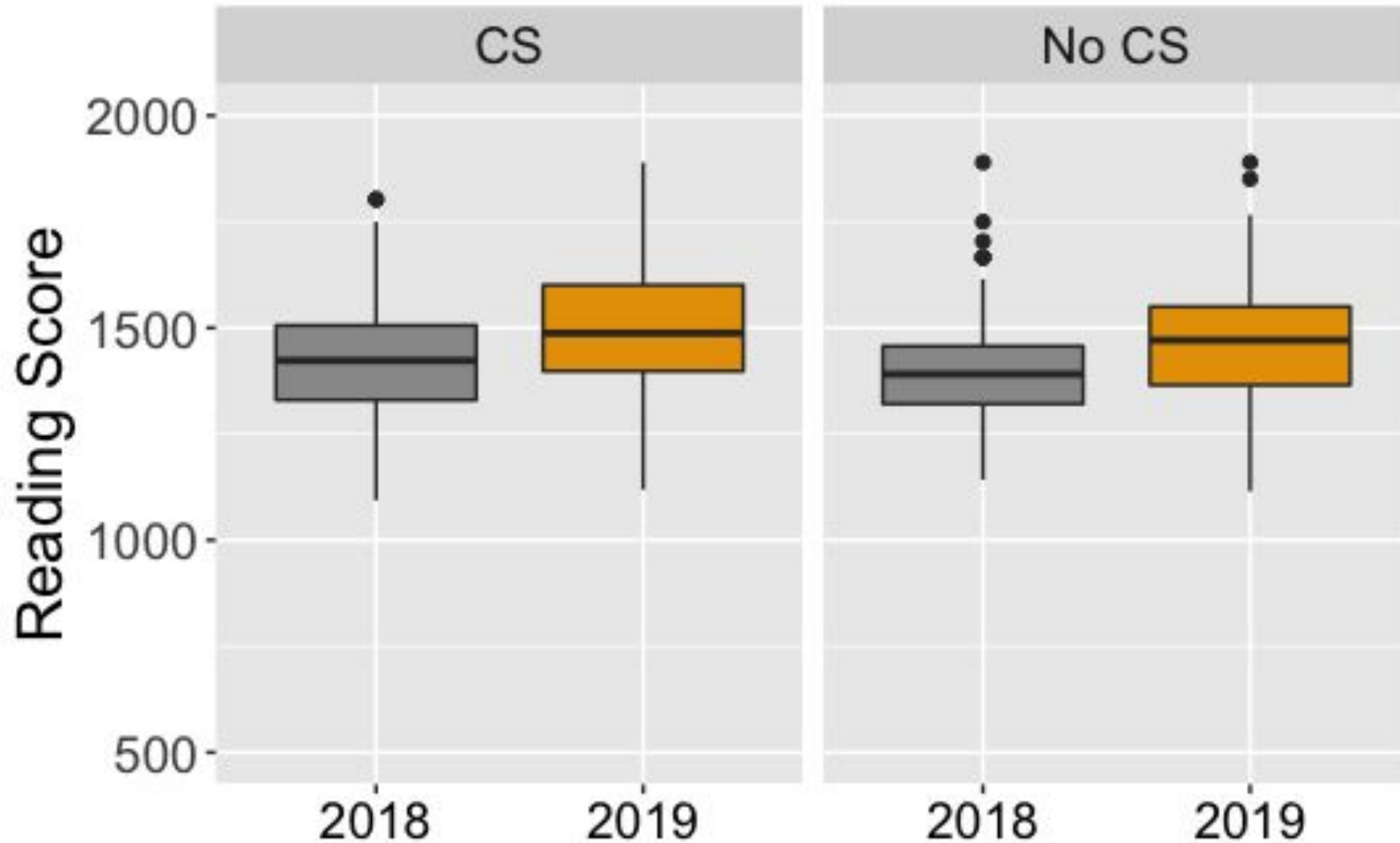
We compared reading & math test scores across conditions

- 3 conditions of students (age 9-10):
 - Use → Modify → Create only
 - TIPPE&SEE
 - No CS
- All students: ANCOVA on reading & math standardized test scores
- Students with academic challenges:
 - Economic challenges
 - Multilingual (limited English proficiency)
 - Disabilities
- Students with economic challenges: parametric ANCOVA
- Multilingual students & students with disabilities: non-parametric ANCOVA

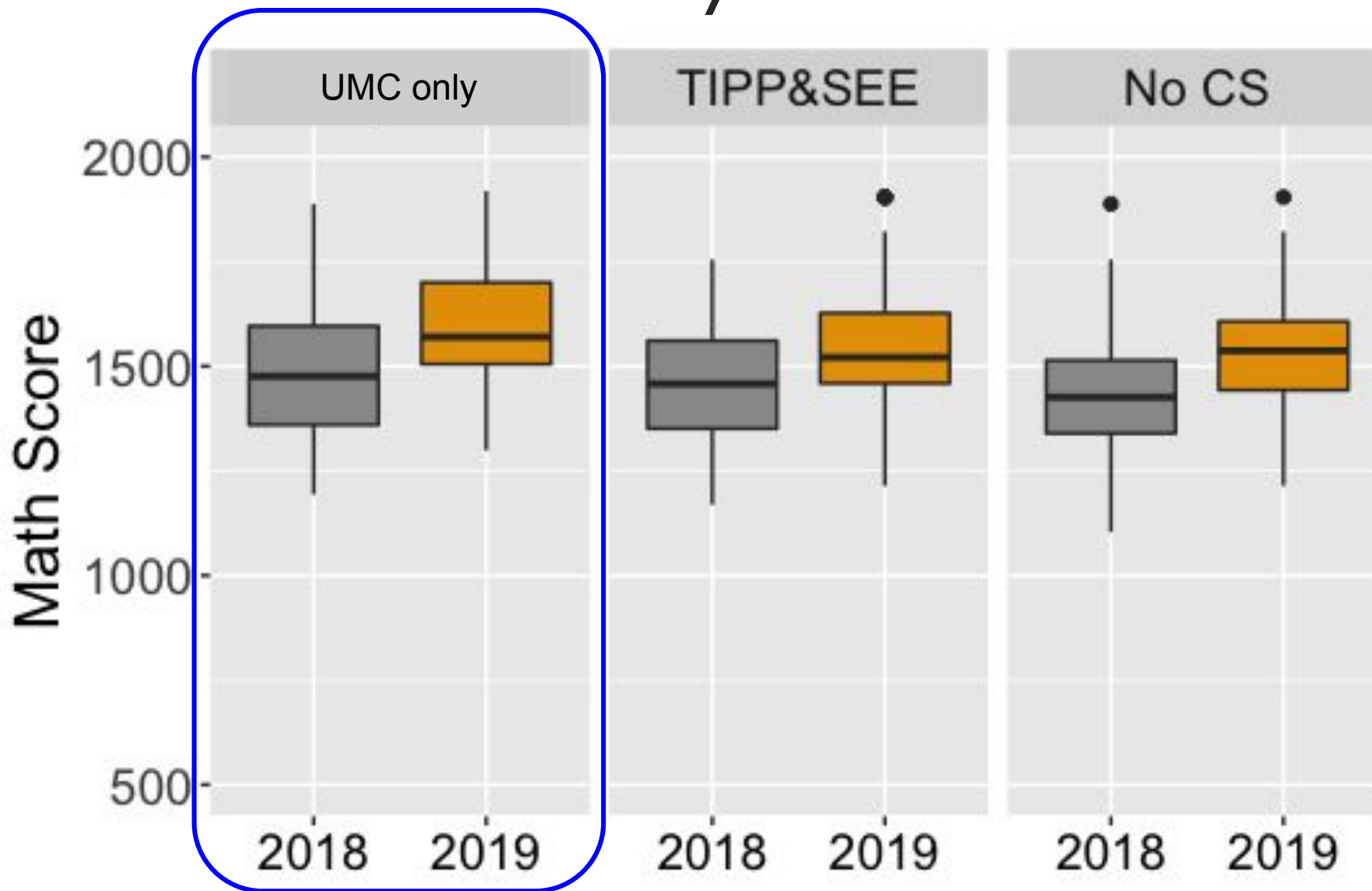
CS not associated with reading across conditions



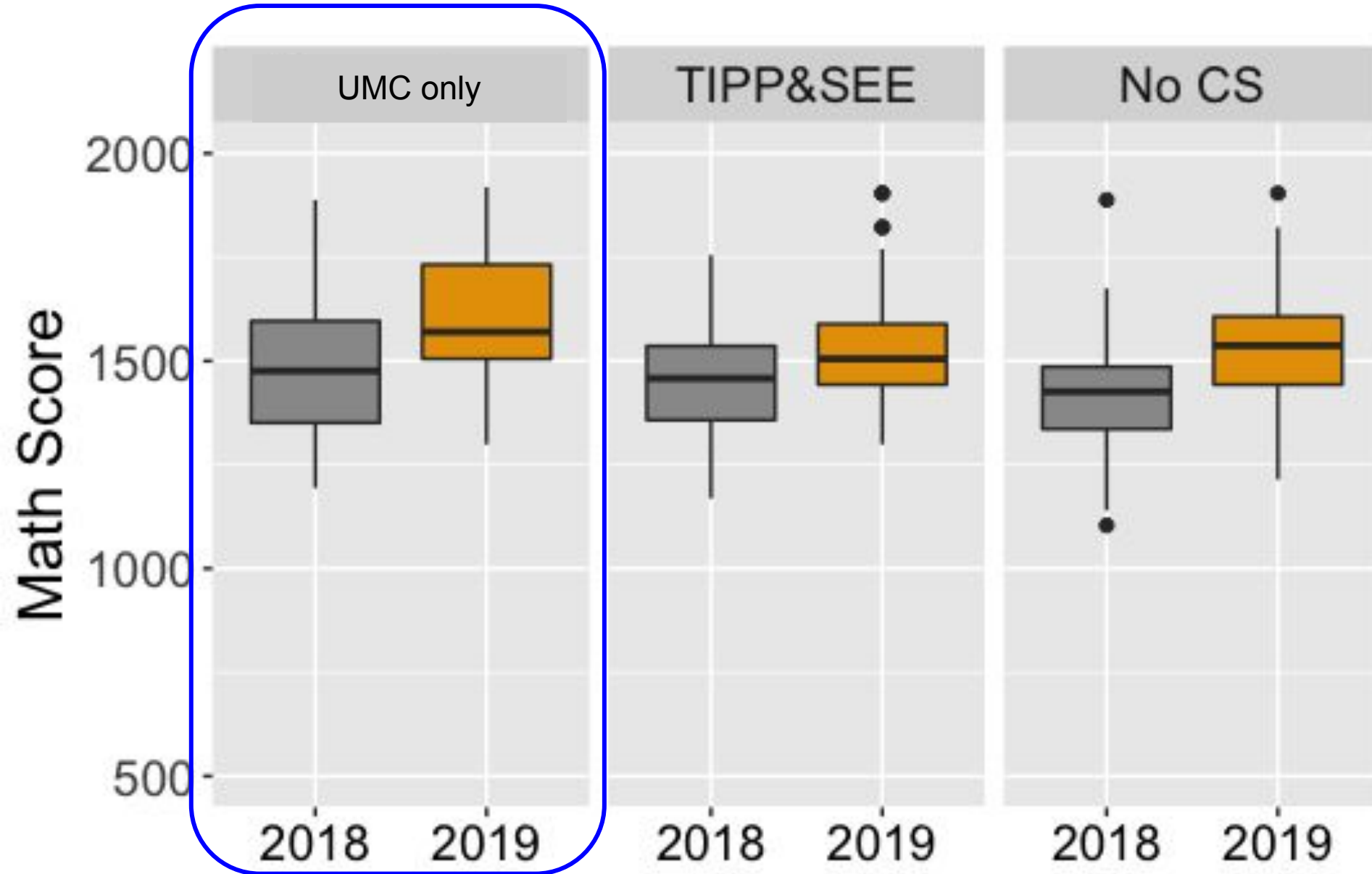
CS not associated with reading with presence/absence of instruction



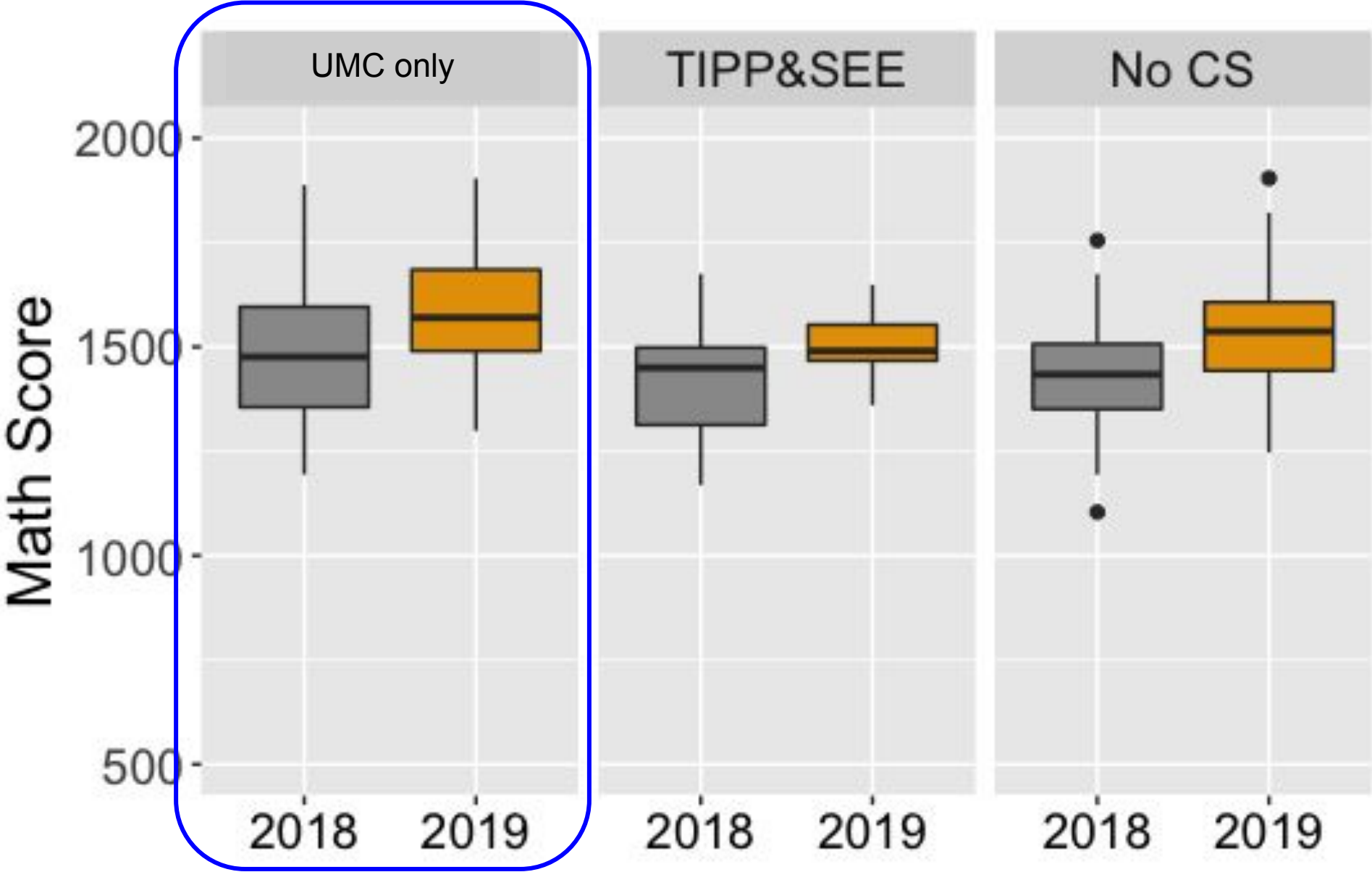
CS associated with math gains for students with less scaffolded Use → Modify → Create instruction



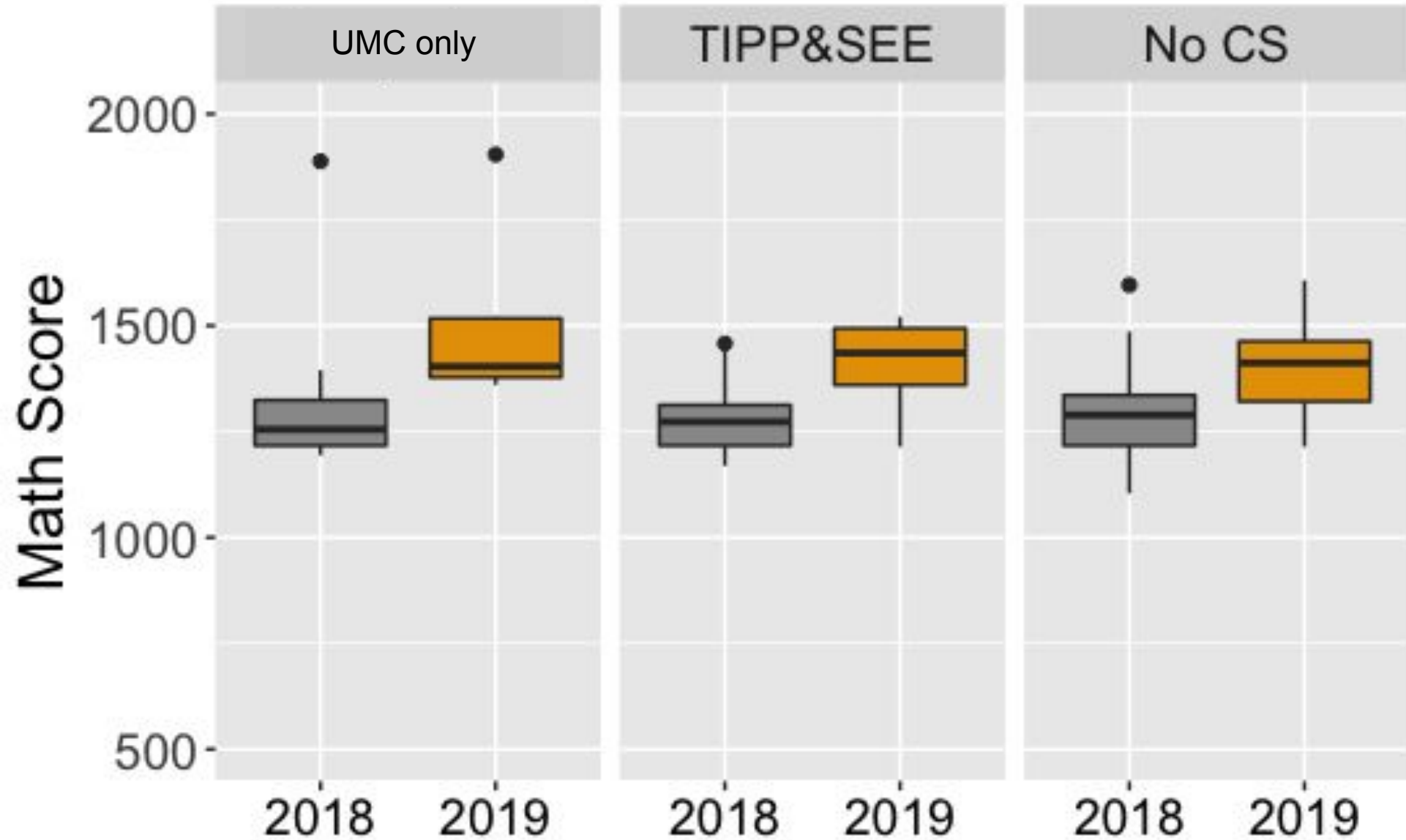
Math gains applied to students with economic challenges



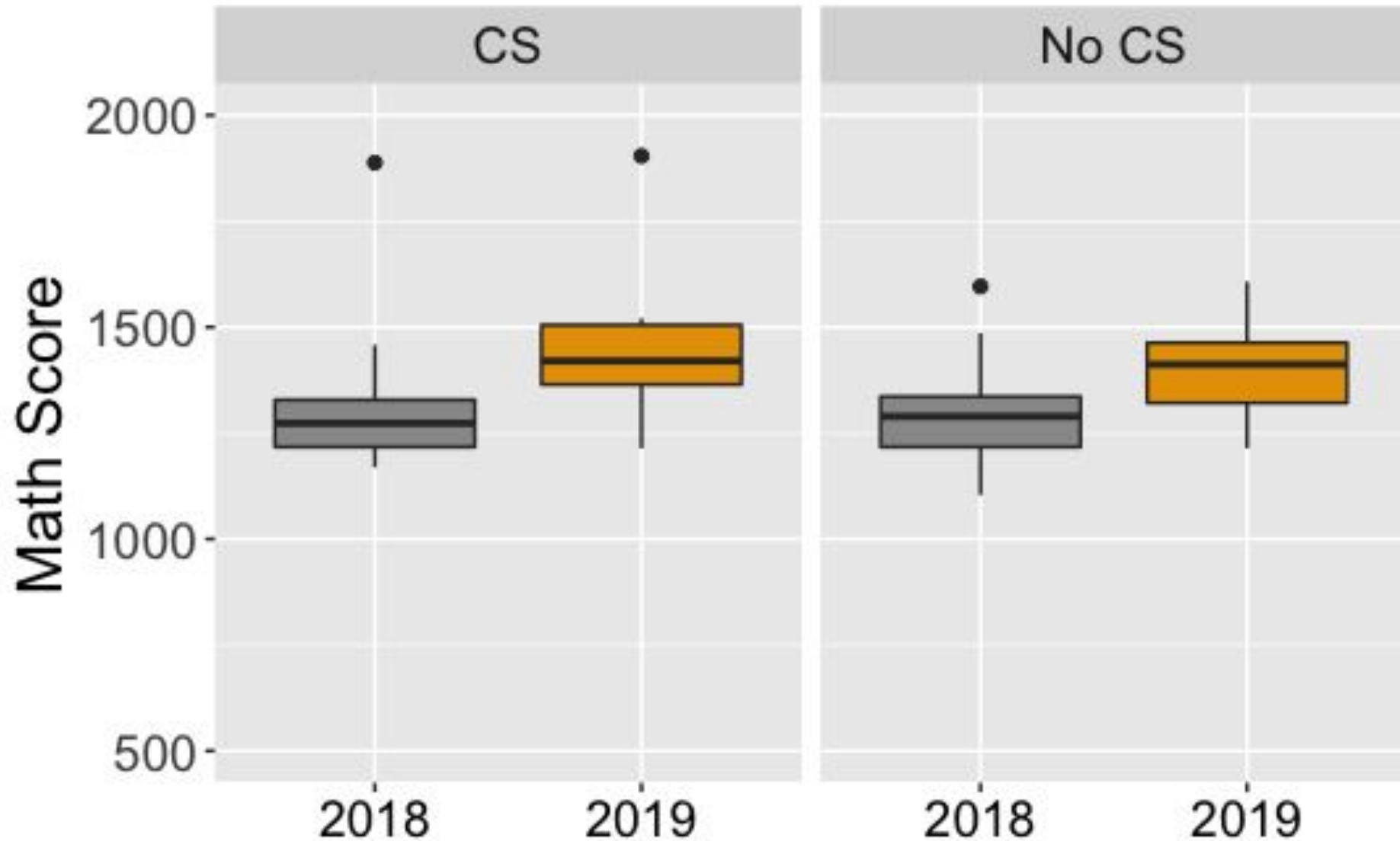
Math gains applied to multilingual students



For students with disabilities, CS was not associated with math across conditions



For students with disabilities, CS was not associated with math across presence/absence of instruction



Why math gains in UMC only condition, not TIP&SEE?

Possible explanations:

- More scaffolded instruction → Less exposure to skills generalizable to math
- Some blocks in Scratch may expose students to new math concepts, e.g. angles
- More structured curriculum → Teachers less likely to add new math concepts



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{salac, dmfranklin}@uchicago.edu, {thomascat, cbb64}@txstate.edu

 *@SaladwithaC*

Key Contributions

- Performance gains in reading were not associated with CS instruction
- Performance gains in math were associated with moderately scaffolded computing instruction.
- Overall trends applied to students with economic challenges & multilingual students, but not students with disabilities.