


Moving from Equity to Justice in Computing Education for Youth

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Raspberry Pi Seminar
February 7 2023

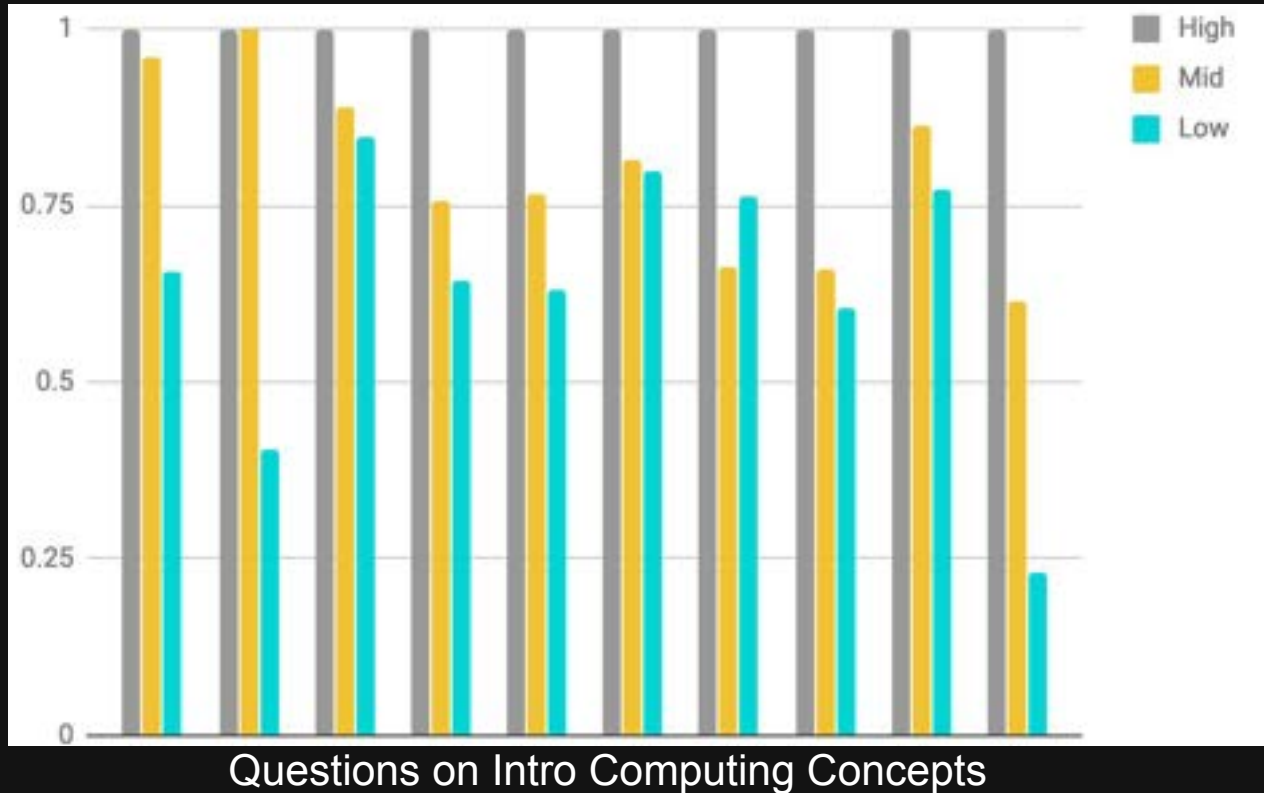


Worldwide, youth access to computing instruction is rising



Access isn't enough; existing inequities still persist.

Average Scores,
Normalized to High-Performing School



Outline

Motivation: Access isn't enough; we need equitable learning outcomes

TIPP&SEE as a Scaffold for Learning Scratch Programming

Improved Student Outcomes with TIPP&SEE

Sneak preview of my current work: Is equity enough?

Open-ended curriculum can be overwhelming for children

BUILD-A-BAND

HOW CAN YOU UTILIZE SCRATCH TO CREATE SOUNDS, INSTRUMENTS, BANDS, OR STYLES OF MUSIC THAT REPRESENT THE MUSIC YOU LOVE MOST?

In this activity, you will build your own music-inspired Scratch project by pairing sprites with sounds to design interactive instruments.

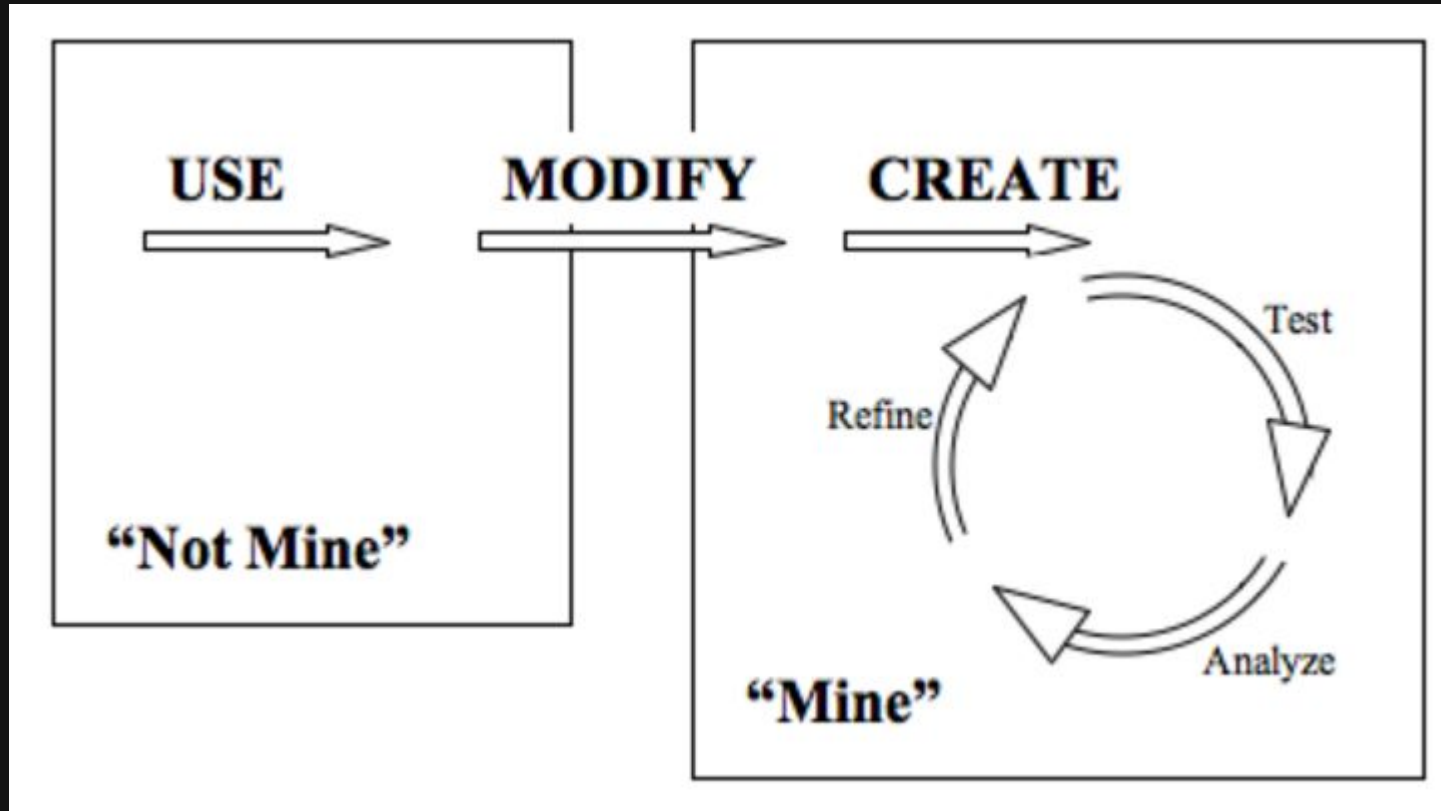


START HERE

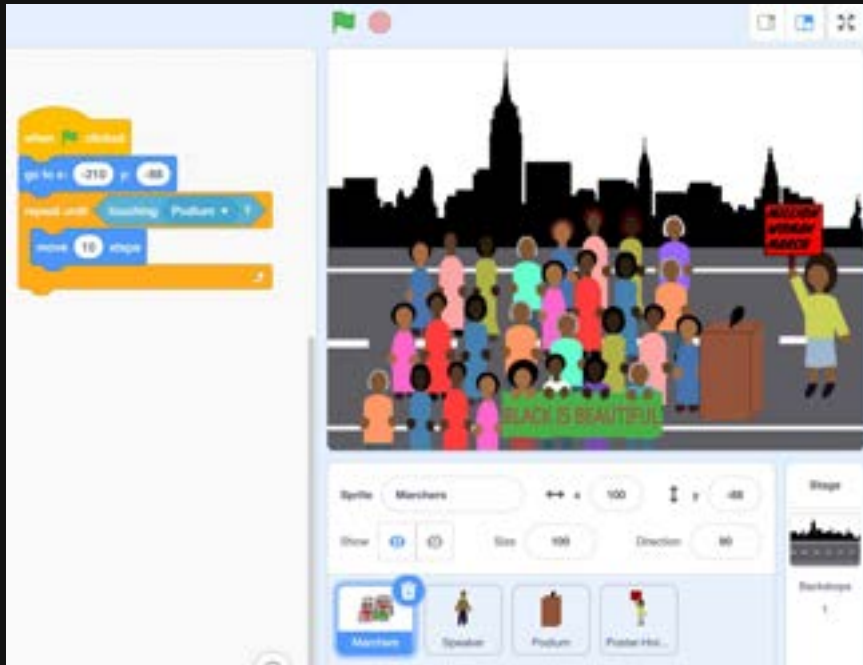
- Create a sprite.
- Find the music blocks by clicking into the Extensions menu.
- Select "Music blocks."
- Add sound blocks.
- Experiment with ways to make your instruments interactive.



Scaffolding with Use → Modify → Create

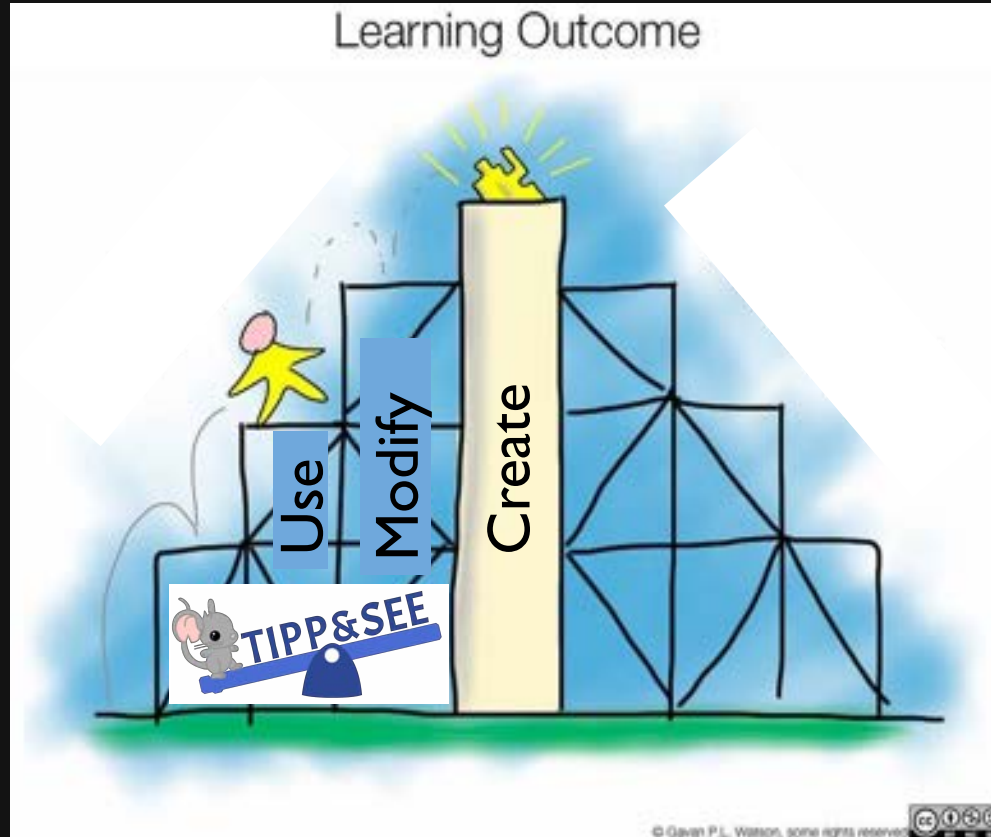


Example Modify Task



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"/>

TIPP&SEE further scaffolds Use → Modify → Create

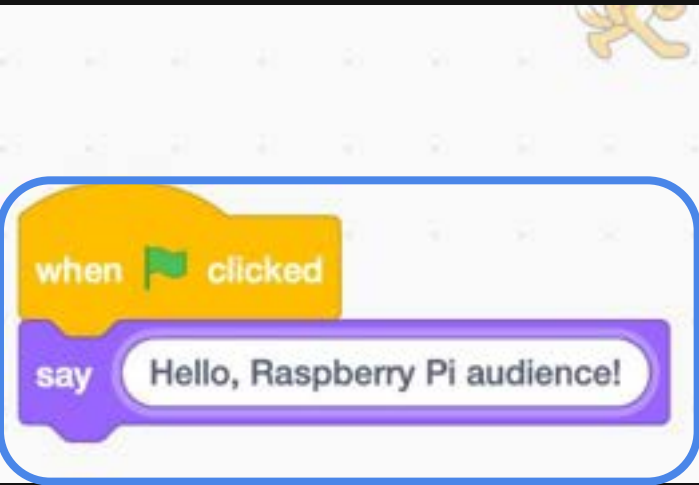


TIPP&SEE draws on metacognition

- Metacognition is an understanding of one's own thought processes
- Metacognition involves both self-regulation & motivation
- Expert learners are metacognitive & strategic
- Strategic learning is covert & non-obvious to less strategic learners
- Learning strategies make these implicit processes explicit
- Learning strategies enable a student to learn, solve problems, and to complete tasks independently



TIPP&SEE guides students in exploring Scratch projects





Title

Sprites

Instructions

Events

Purpose

Explore

Play

TIPP: Inspired by previewing strategies from reading

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?

Previewing strategies
help students set goals
& activate prior
knowledge before
reading new texts

TIPP in the Scratch Project Page





Conditional Loops_ Carnival
by ScratchEncore

Title

Instructions

Click on the green flag and the floats will line up for the parade! Click on King Momo to learn more about Carnival!

Purpose: To view a sprite programmed with a conditional loop.

Notes and Credits

Scratch Encore via UChicago STEM Education & University of Maryland - College Park

15 8 320 884

Aug 09, 2019

Copy Link

SEE: Inspired by text structure strategies

SEE Inside:



Sprites: Click on the sprite that you want to learn from or change.



Events: Look at the event blocks starting the scripts.
Which scripts are most useful?

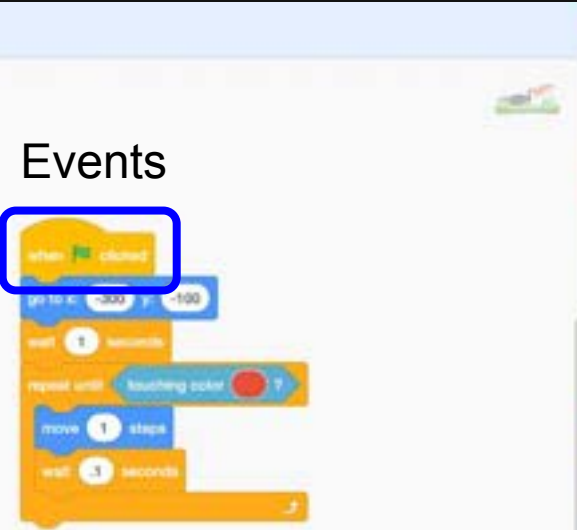


Explore: Try different changes to the scripts and observe what happens!

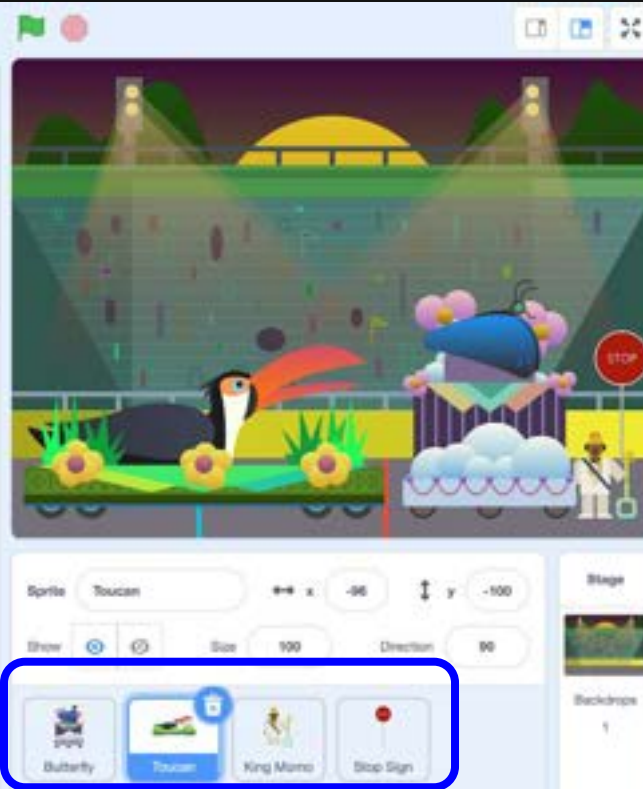
Text structure
strategies help
students recognize
different kinds of text

SEE in the Scratch code

Events



Sprites



The image displays the Scratch code editor interface. On the left, the 'Events' tab is active, showing a script for a Toucan sprite. The first block, 'when green flag clicked', is highlighted with a blue box. The script continues with 'go to x: 100 y: -100', 'wait 1 seconds', 'repeat until touching color (red) ?' (with a red circle in the color picker), 'move 1 steps', and 'wait 1 seconds'. On the right, the stage shows a Toucan sprite on a cart. Below the stage, the 'Sprites' tab is active, showing a palette of four sprites: Butterfly, Toucan, King Marmoset, and Stop Sign. The Toucan sprite is selected and highlighted with a blue box. The Toucan sprite has a small '1' icon in the top right corner.

Outline

Motivation: Access isn't enough; we need equitable learning outcomes

TIPP&SEE as a Scaffold for Learning Scratch Programming

Improved Student Outcomes with TIPP&SEE

Sneak preview of my current work: Is equity enough?

We studied TIPP&SEE in schools in Austin, TX, USA

- We integrated TIPP&SEE into Scratch Act 1
- Scratch Act 1 covered events, sequence, and loops
- Each concept was taught using Use → Modify → Create
- There were assessments at the end of each unit
- Fourth-grade (ages 9-10) classrooms were randomly assigned to control (Use → Modify → Create only) or TIPP&SEE conditions



Students worked on Use → Modify → Create projects



Scratch Projects

Your Quest: Put your family members in the Ofrenda!

1. Left Sprite: Change the **Costume** and **Say** blocks
2. Middle & Right Sprites:
 - Add scripts using a **when this sprite clicked** block
 - Select a **Costume** for each sprite
 - Use the **Say** blocks to tell **your** story

OTHER BLOCKS TO PLAY WITH

- think for seconds
- play sound until done
- go to x: y:
- when space key pressed
 - ✓ space
 - left arrow
 - right arrow
 - down arrow
 - up arrow

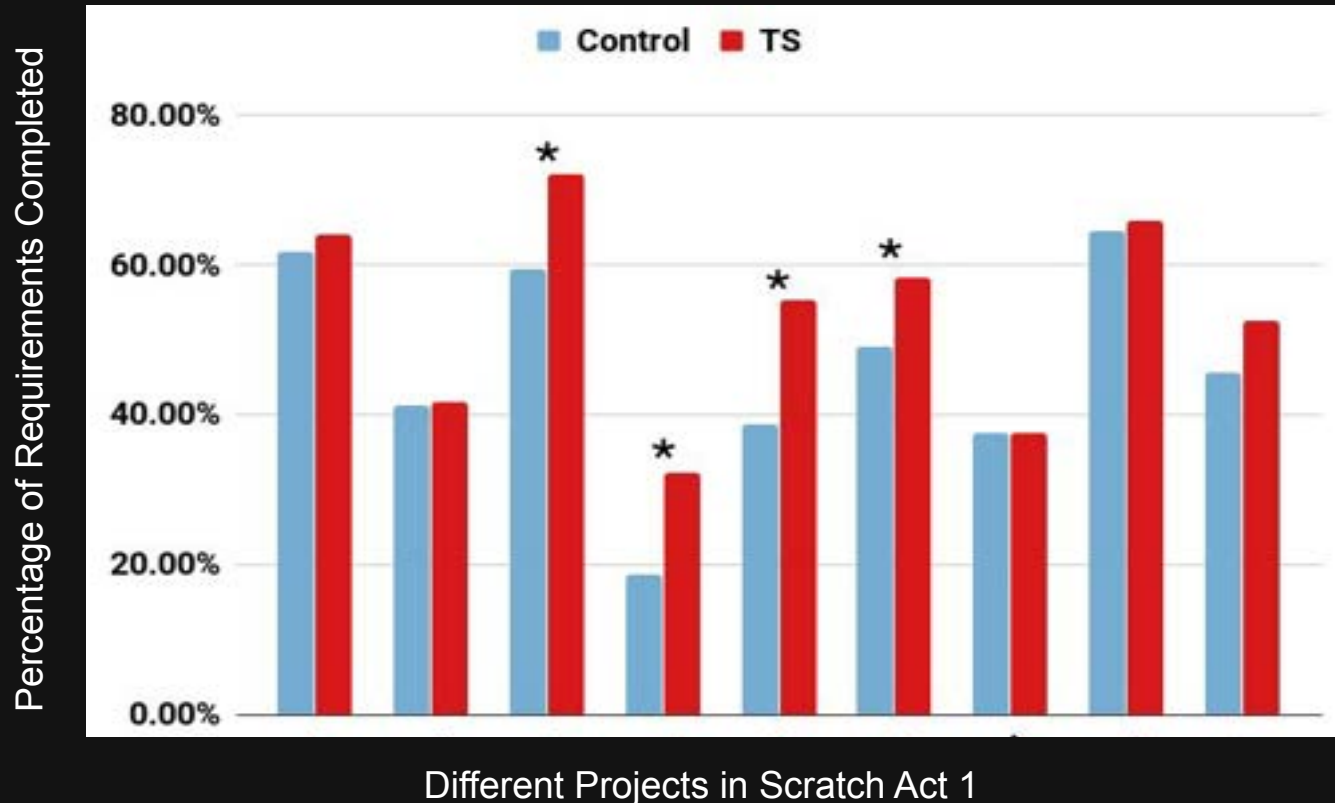
Change Costume:

1. For each Sprite, click on the Costumes tab
2. Then click on a Costume

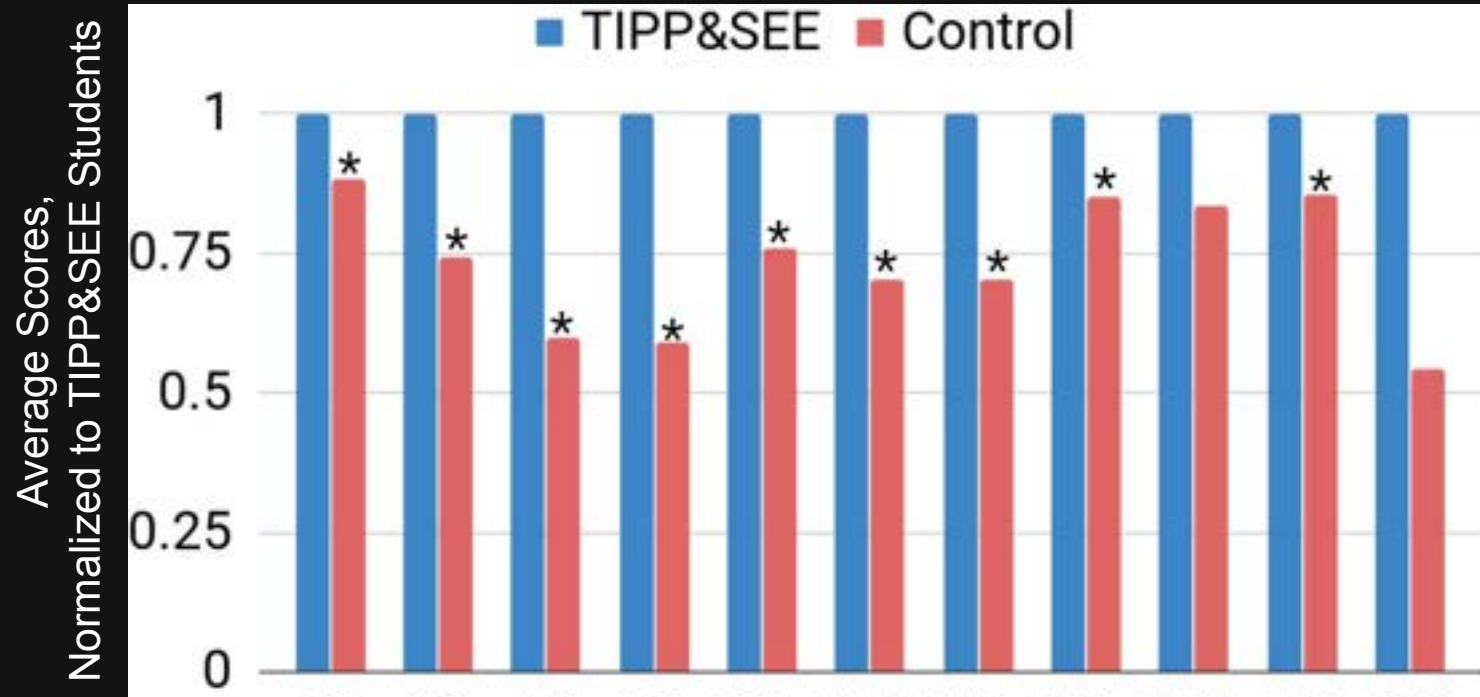
A screenshot of the Scratch costume selection interface. It shows a vertical list of costume thumbnails for a character. A mouse cursor is hovering over the second costume from the top. The interface includes a 'Costumes' tab and a 'Costume' button.

Worksheets

TIPP&SEE students had equal or higher project completion.



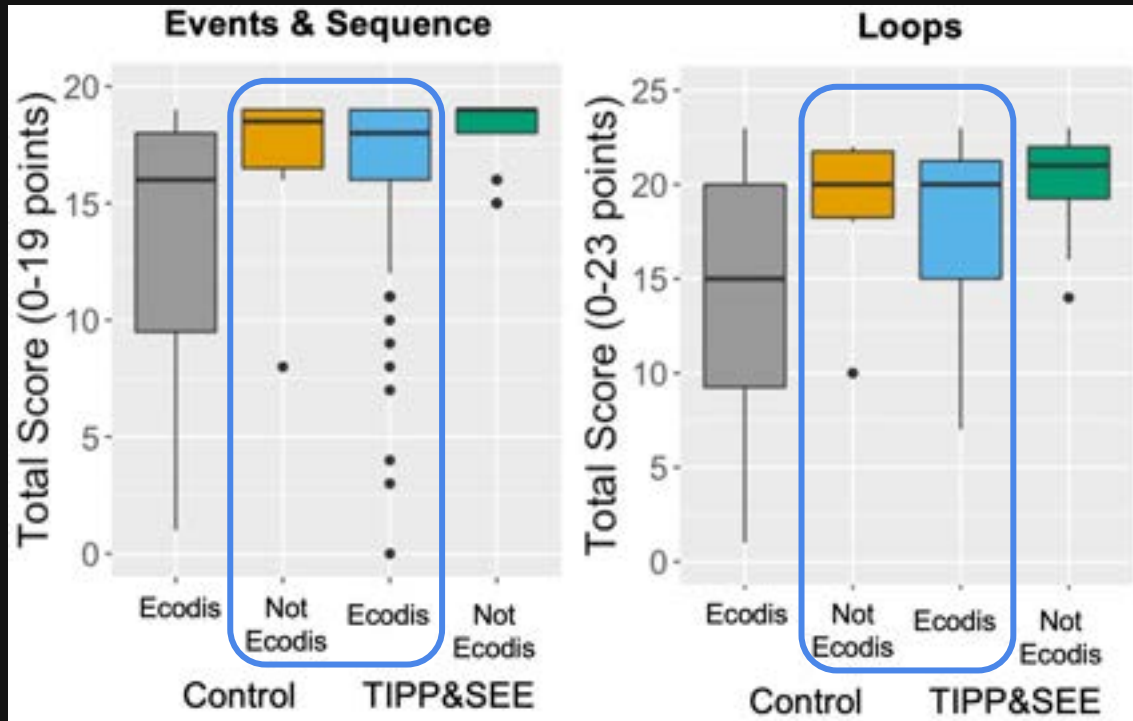
TIPP&SEE outperformed control students in assessments



Questions on Loops

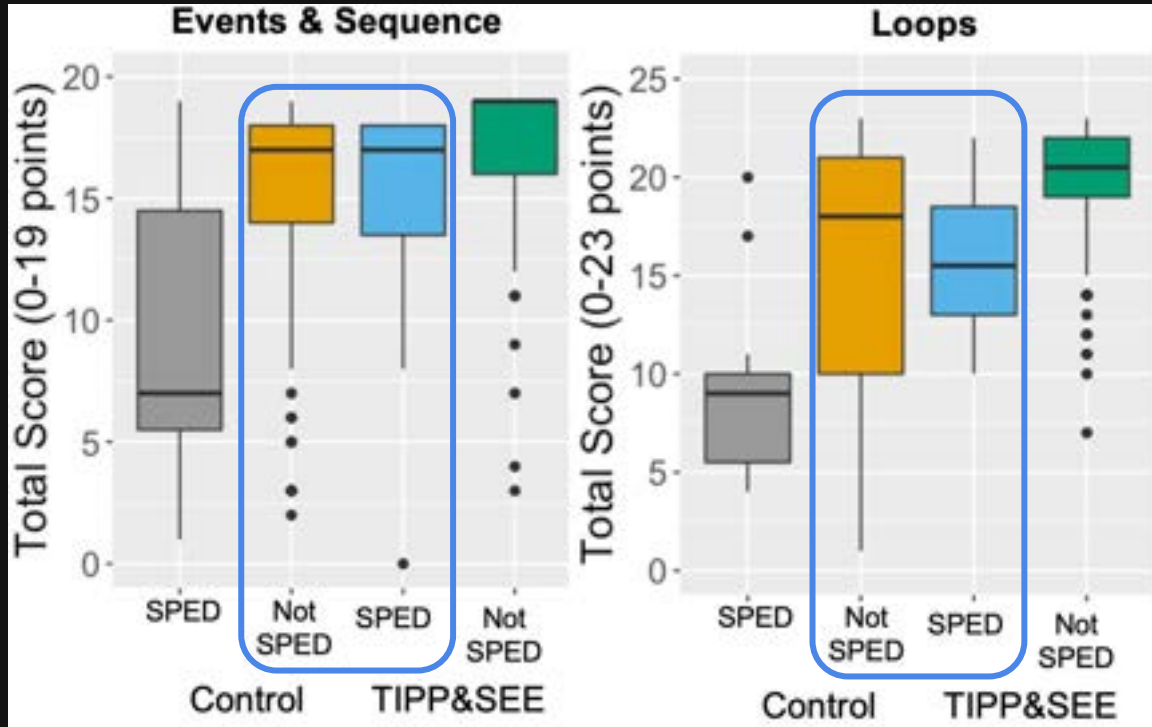
Salac, Thomas, Butler & Franklin (SIGCSE 2020)20

Gap between students with & without challenges narrowed when using TIPP&SEE



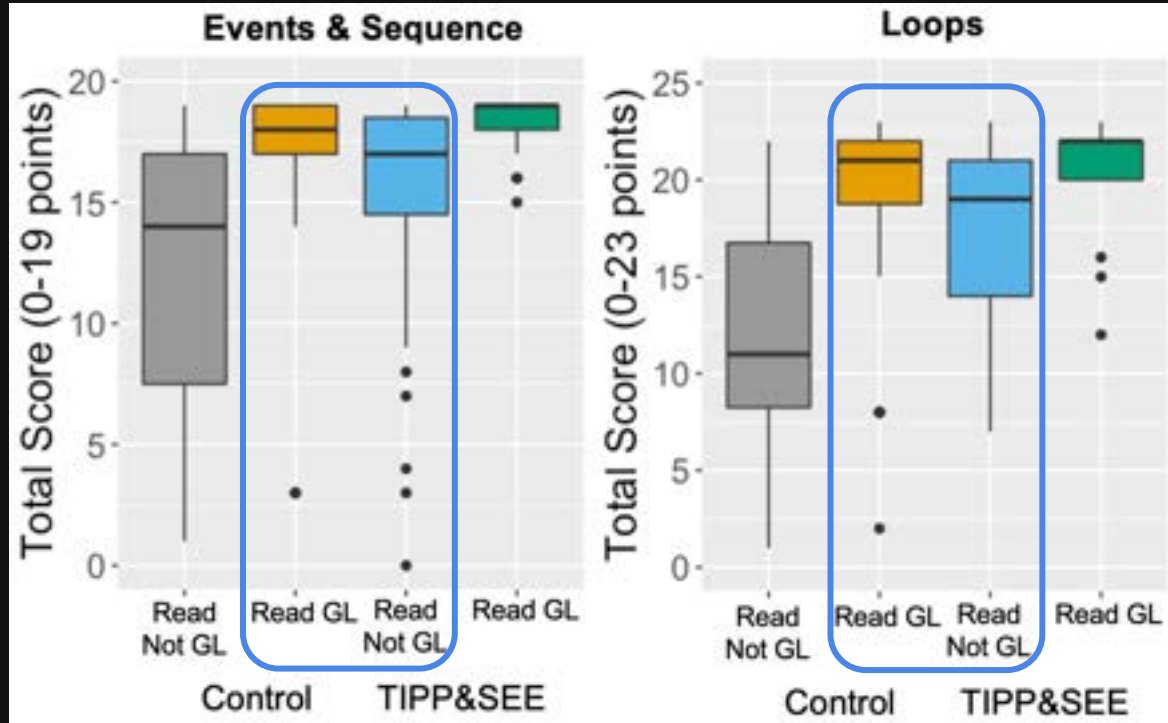
Students with
Economic
Disadvantages

Gap between students with & without challenges narrowed when using TIPP&SEE



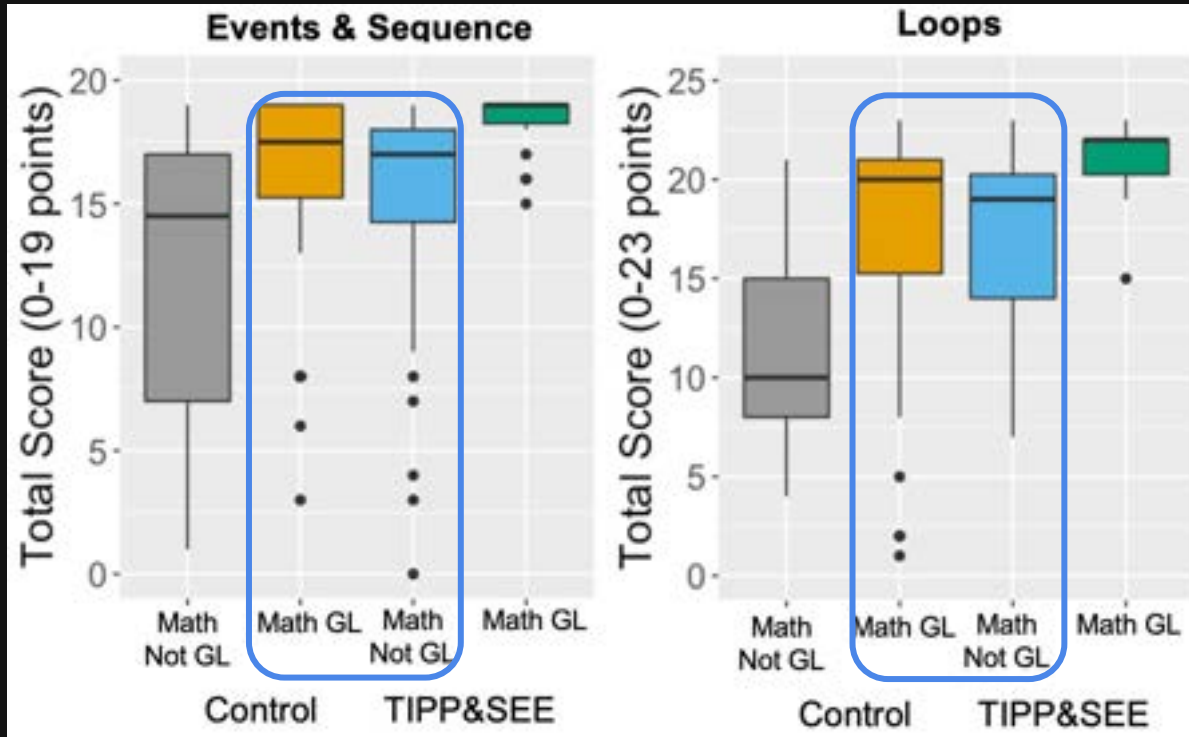
Students with Disabilities

Gap between students with & without challenges narrowed when using TIPP&SEE



Students
Reading Below
Grade Level

Gap between students with & without challenges narrowed when using TIPP&SEE

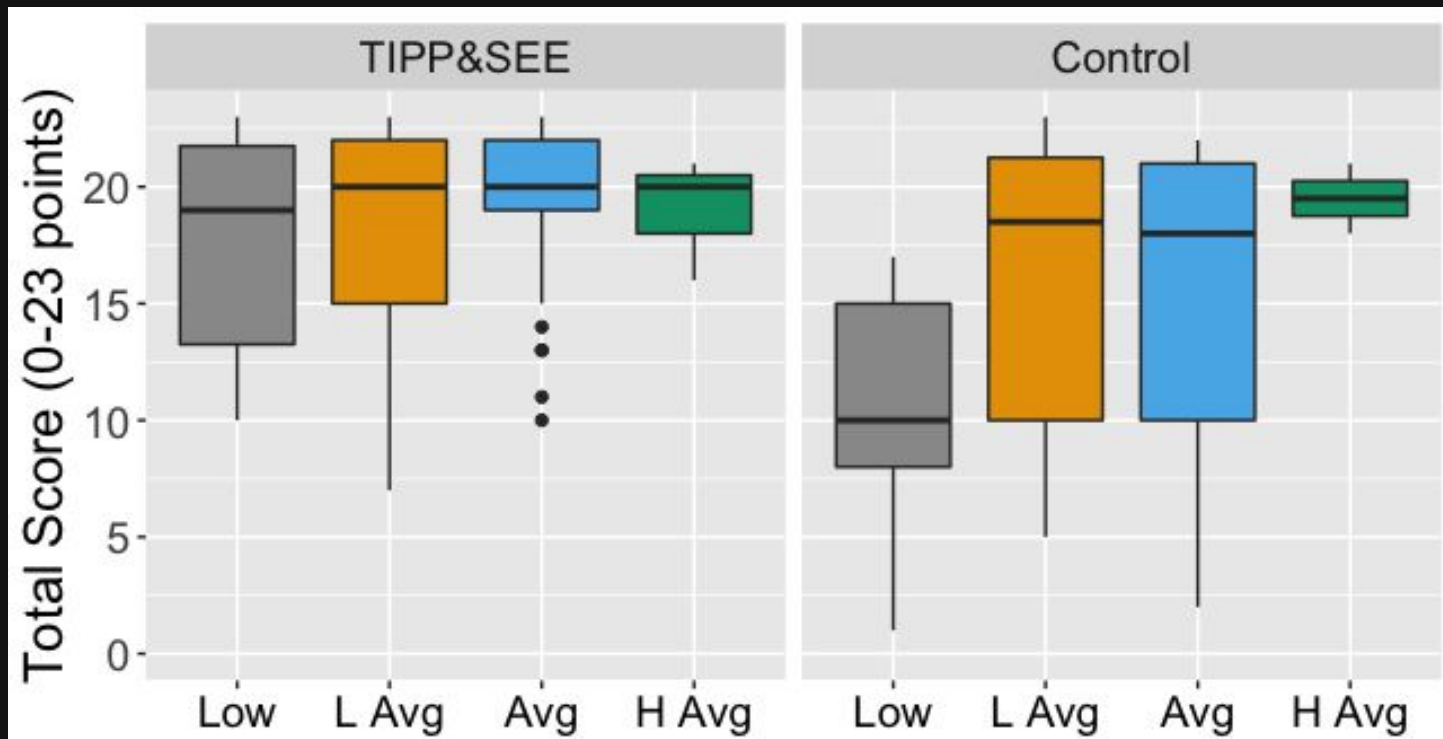


Students with
Below Grade
Level
Proficiency in
Math

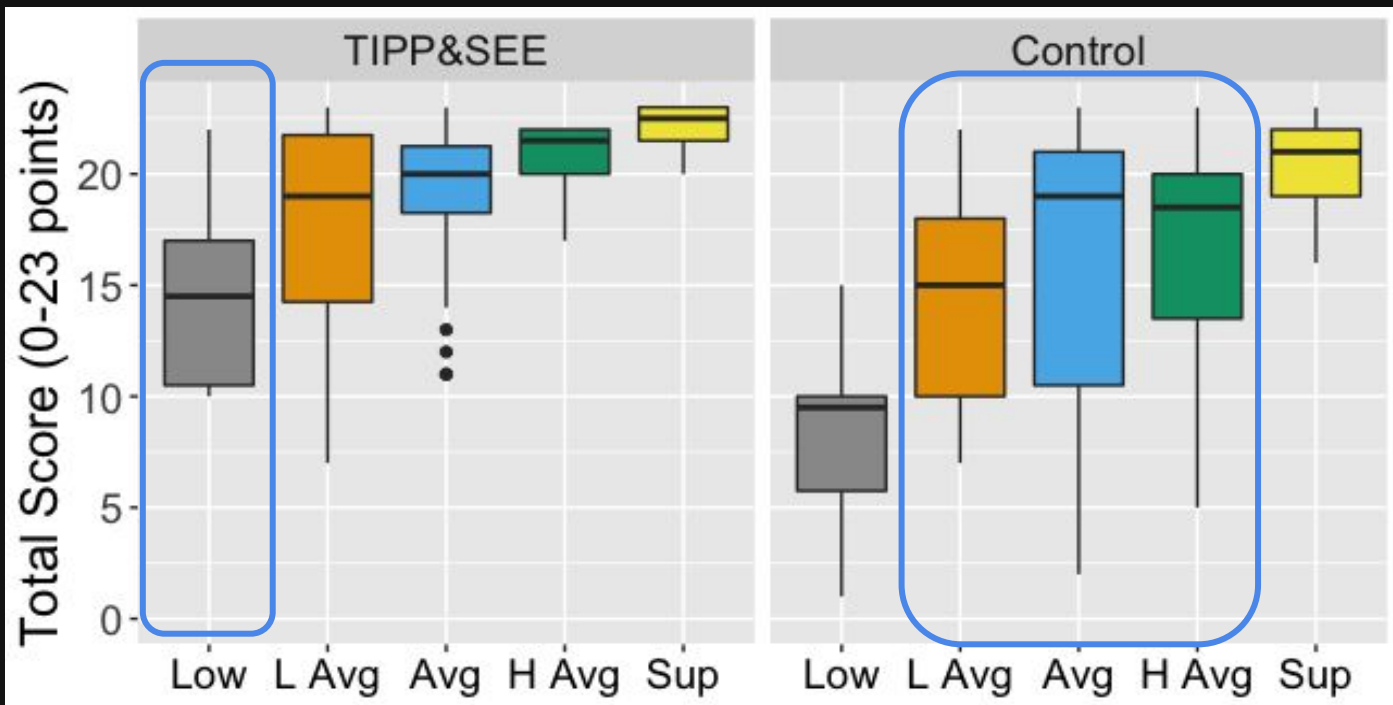
We also compared across cognitive abilities

- We used the Woodcock-Johnson IV Tests of Cognitive abilities
- WJ IV tests are **not malleable to instruction**, but to development
- We conducted 4 tests:
 - Numbers Reversed & Verbal attention: Short-term working memory
 - Pair Cancellation: Pattern Recognition
 - Visual-Auditory Learning: Long-term memory
- These tests group cognitive abilities into 5 categories: Low, Low Average, Average, High Average, & Superior

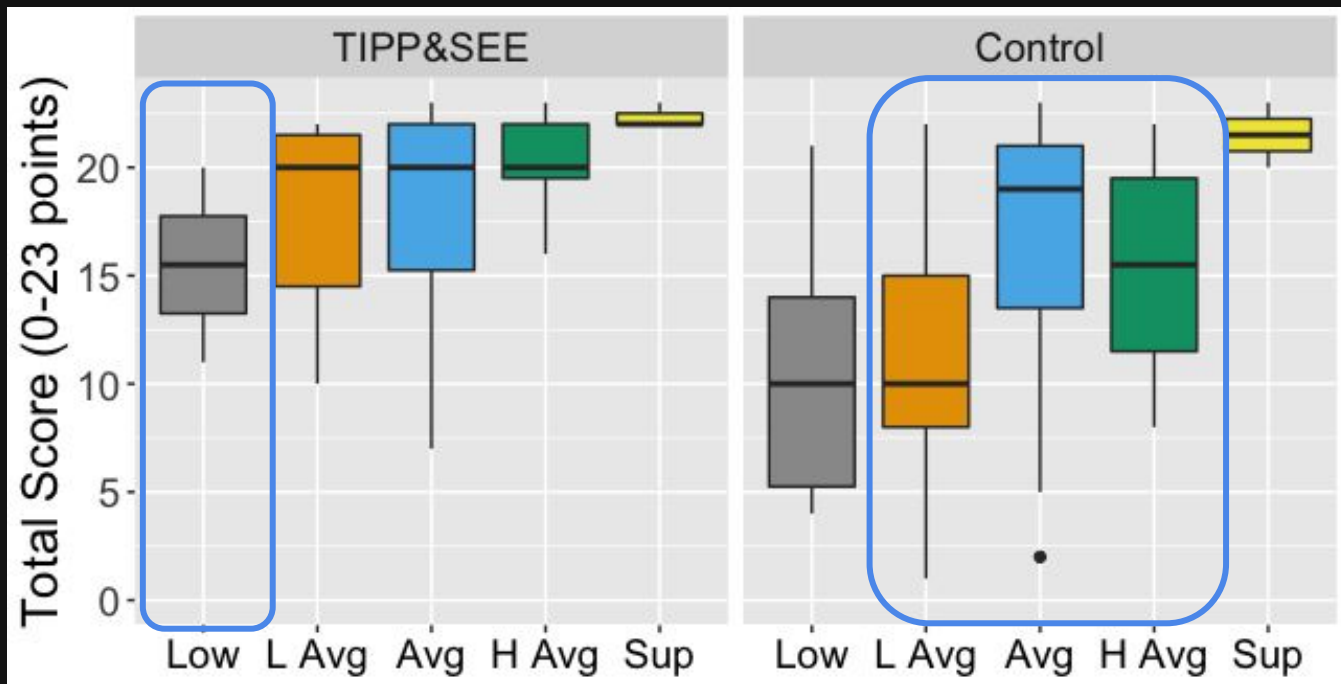
Pair Cancellation (pattern recognition measure) had no effect on performance



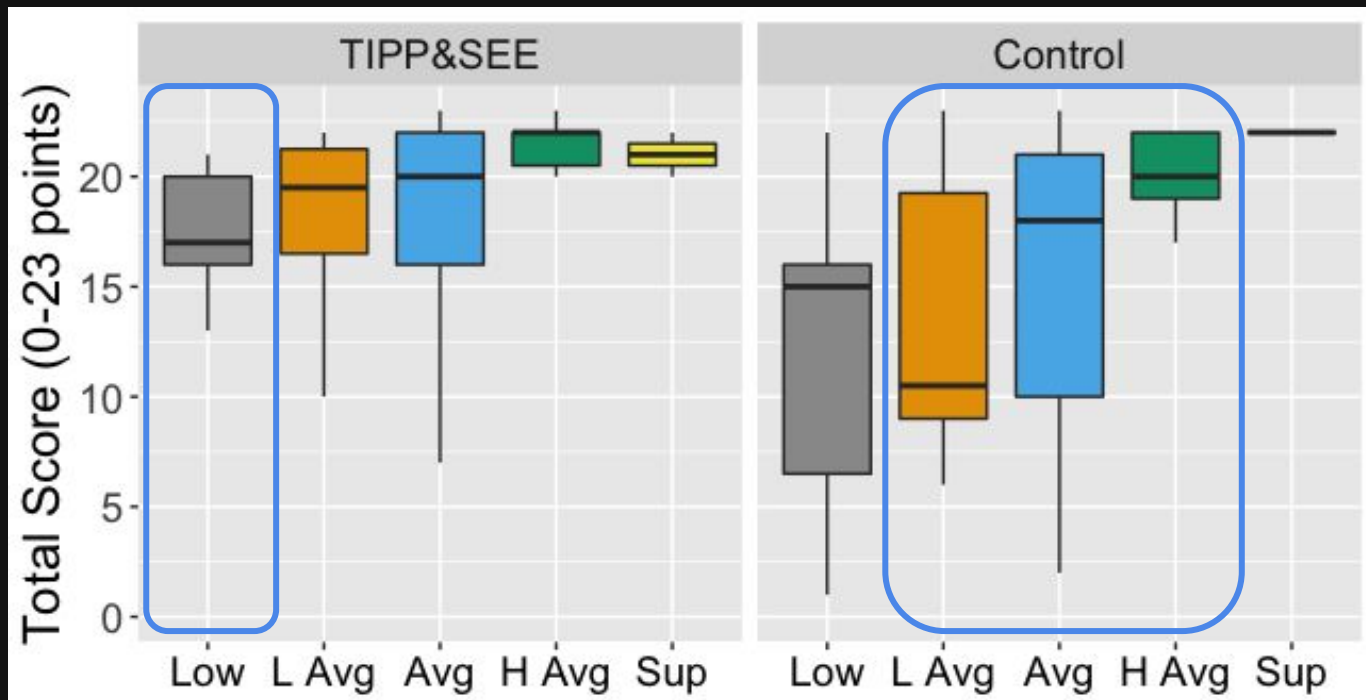
TIPP&SEE students with low scores on Numbers Reversed (short-term working memory measure) performed as well as Control students with average scores



TIPP&SEE students with low scores on Verbal Attention (short-term working memory measure) performed as well as Control students with average scores



TIPP&SEE students with low scores on Visual-Auditory Learning (long-term memory measure) performed as well as Control students with average scores



TIPP&SEE was linked to improved learning outcomes

- Students using TIPP&SEE completed more project requirements & performed better on computing assessments
- Students with academic challenges performed as well as students without academic challenges when using TIPP&SEE
- Students with low short-term & long-term memory abilities performed as well as students with average abilities when using TIPP&SEE

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Key Takeaways:

- TIPP&SEE scaffolds children in exploring example Scratch code, resulting in more equitable outcomes
- Equitable outcomes won't be enough unless we question *what* we are teaching & *why*
- Slow-revealing the layers of algorithmic bias scaffolds children in making sense of & critiquing its impacts

Resources:

Primary Curricula with TIPP&SEE at www.canonlab.org:

- Scratch Act 1: Intro
- Scratch Encore: Intermediate
- Action Fractions: CS + Math

More examples of Slow Reveal Graphs at www.slowrevealgraphs.com