How do children's concepts of zero relate to their understanding of integers?

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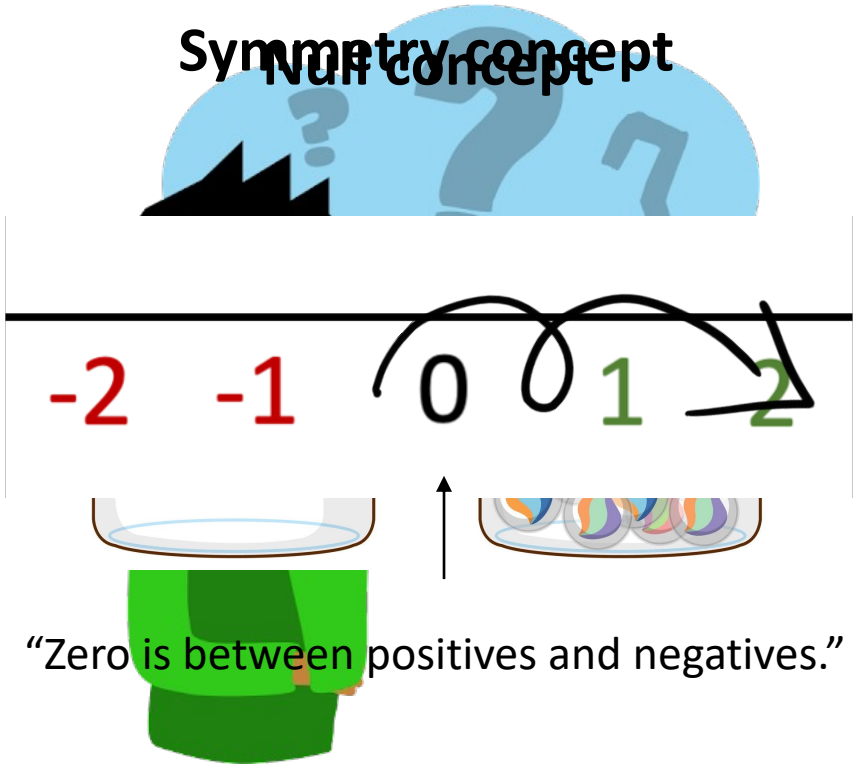
Concepts of zero

“Zero is nothing.”

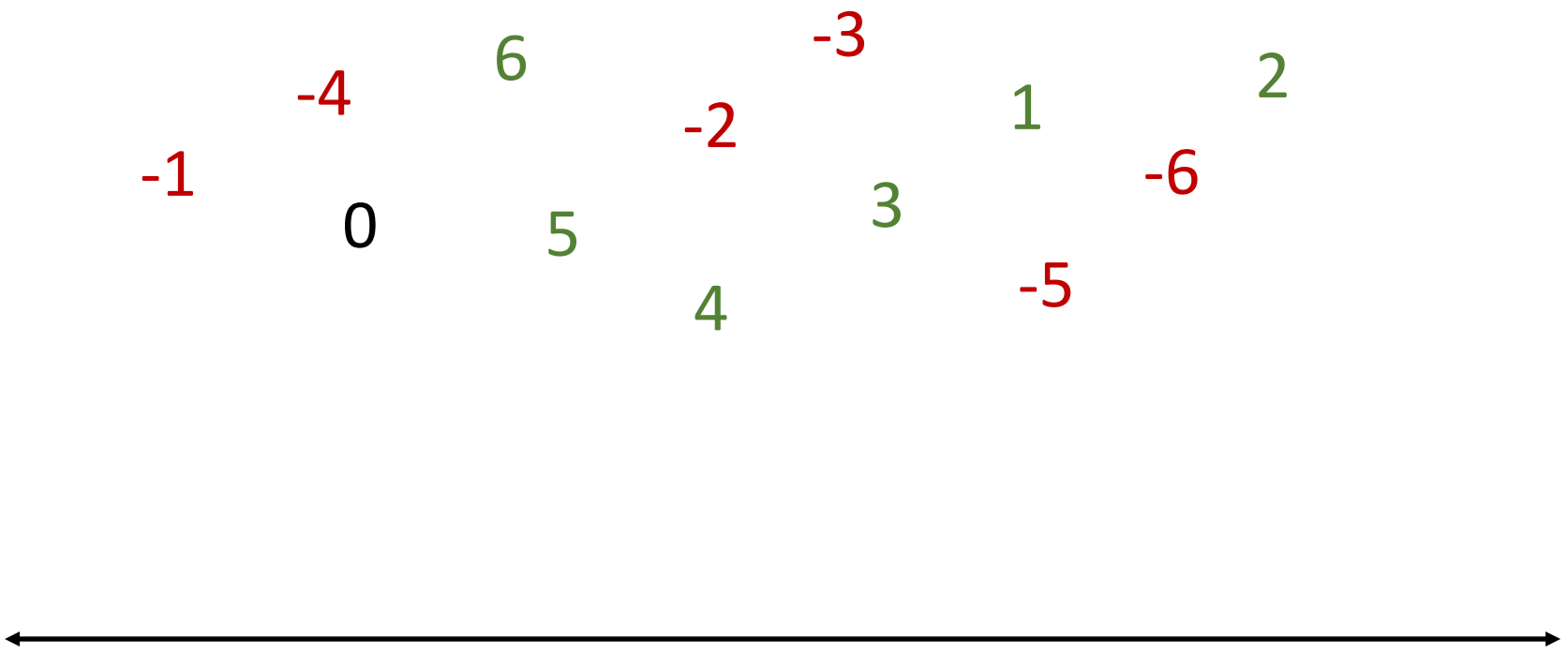


“Zero is between positives and negatives.”

Integers

(Bialystok & Codd, 2000; Wellman & Miller, 1986; Wynn, 1998)

What are integers?



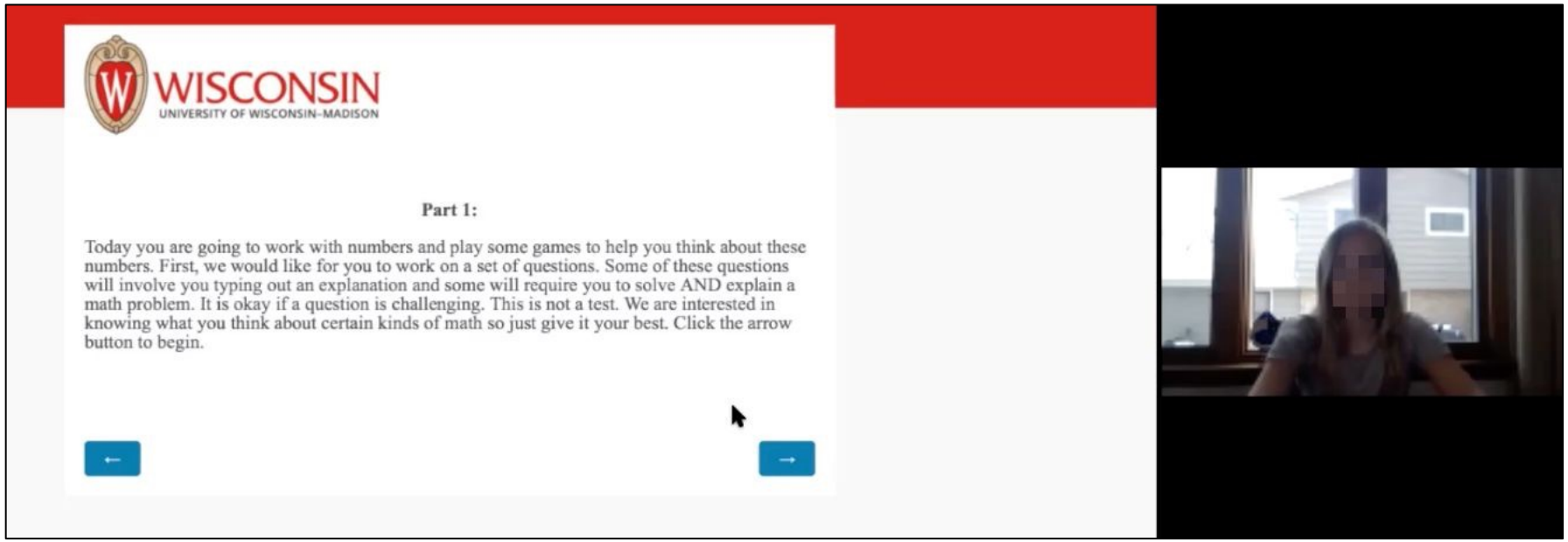
(Sella, Lolliot, & Cohen Kadosh, 2016; Young & Booth, 2015)

Research questions

What are children's (4^{th} through 7^{th} grade) concepts of zero?

Are concepts of zero related to children's understanding of integers?

Method



zoom

N = 80 fourth through seventh graders

(1) Concepts of zero

What is zero?

Is zero a number? Why or why not?

Wheeler & Feghali (1983)

(2) Additive inverse principle (X + -X = 0)

6 + 5 + -5 = ___

Reaction time

What steps did you take to solve this problem?

(Siegler & Stern, 1998)

(3) Number line

Choose the letter where you think the number 3 is on a number line.

(4) Symbolic fluency with integers

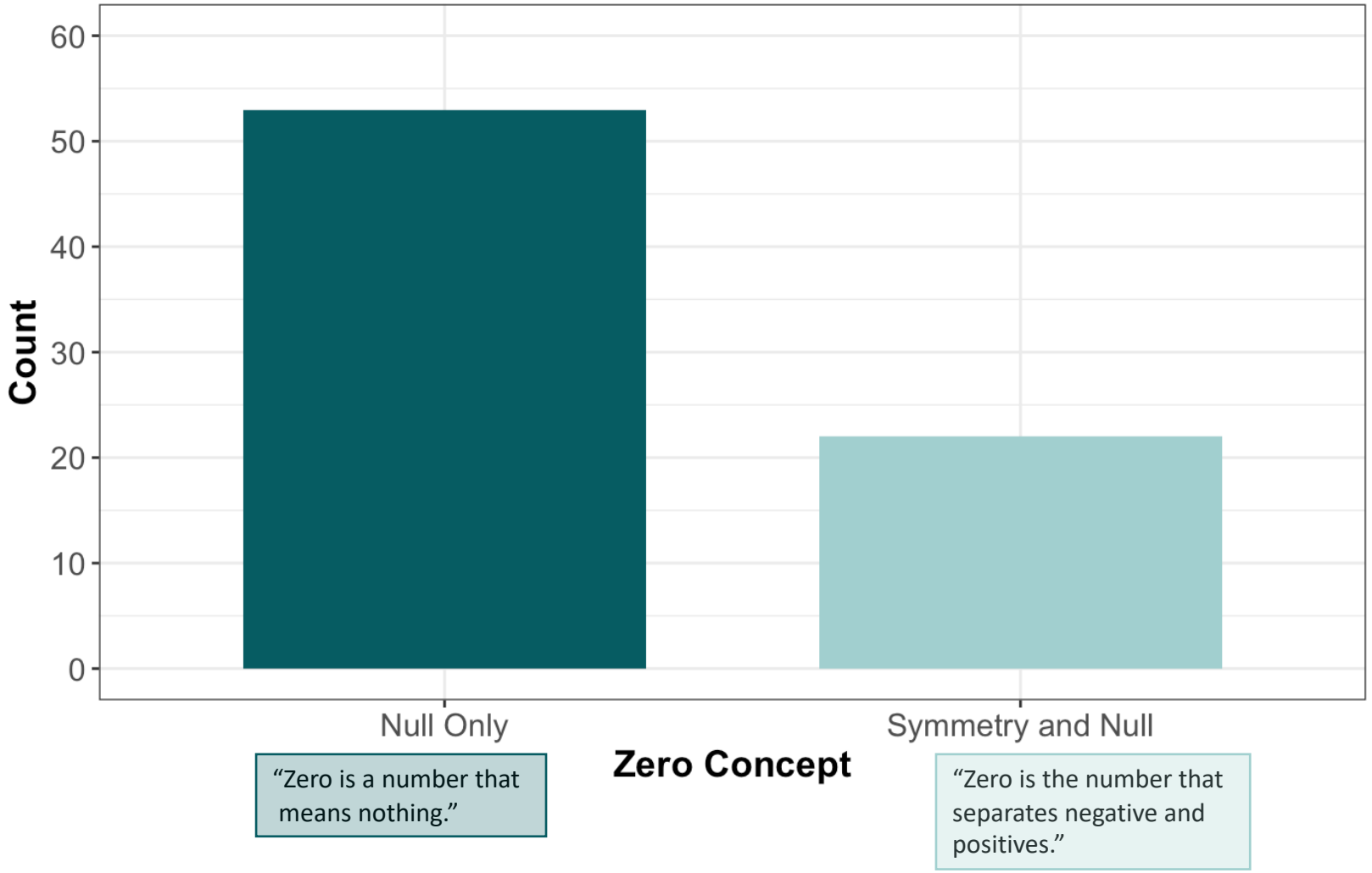
9 + 4 = __
-5 + 2 = __
-2 + 4 = __

-3 + -6 = __
5 + 8 = __
4 + -1 = __

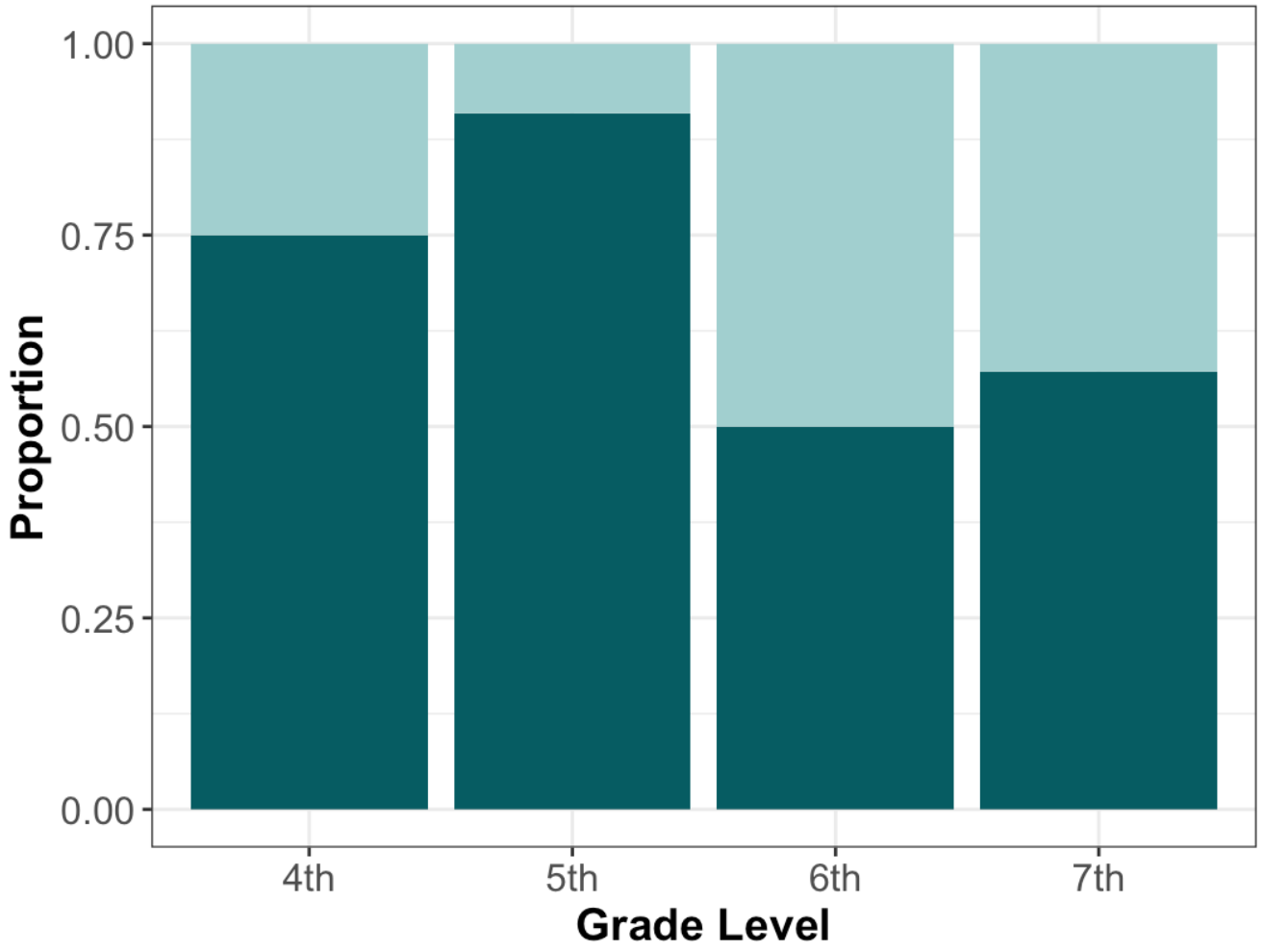
Tsang et al. (2015)

Results

(1) Concepts of zero



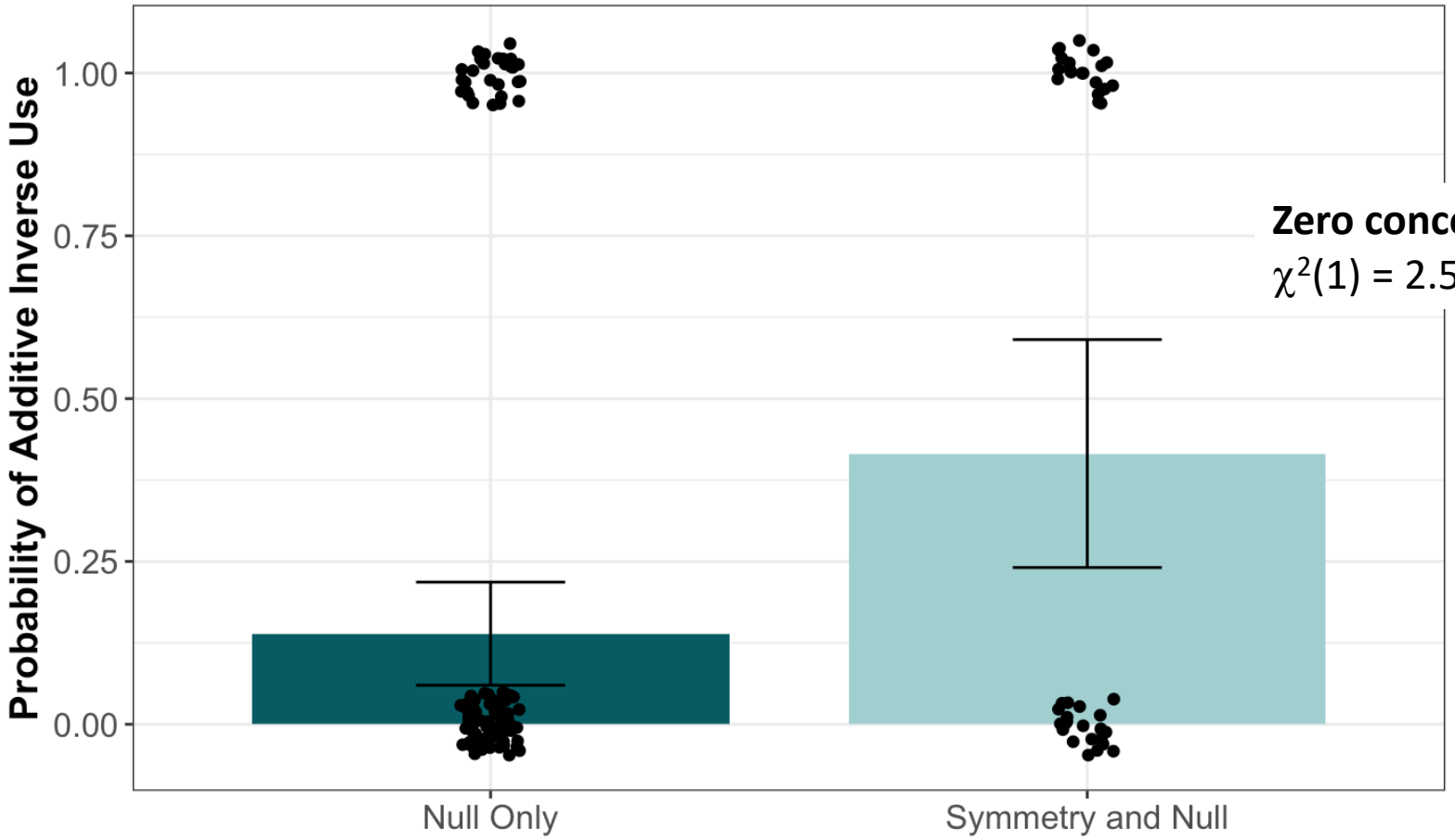
(1) Concepts of zero



Grade level: b = 0.85, $\chi^2(1) = 7.34$, p = 0.007

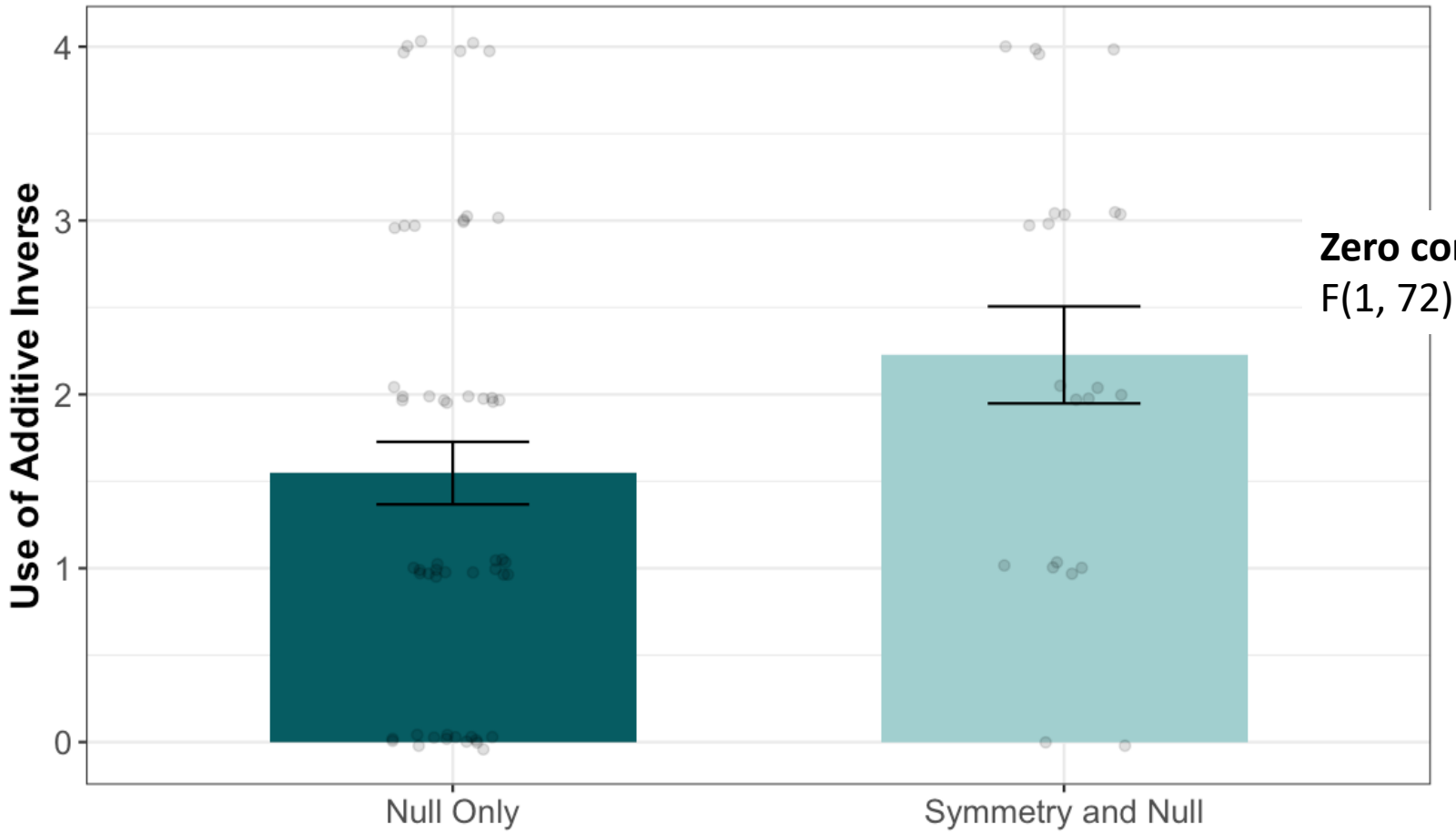
(2) Additive inverse principle (X + -X = 0)

5 + 6 + -6 = 5
"Well, the 6 and -6 cancel out."



Zero concepts: b = 1.48, $\chi^2(1) = 2.57$, $p = 0.11$

(2) Additive inverse principle (X + -X = 0)

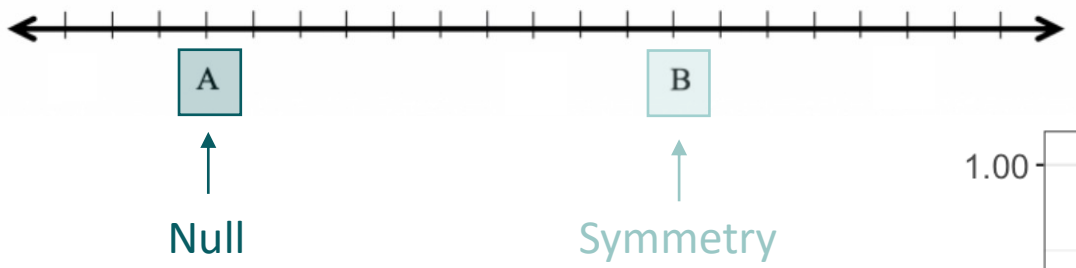


Zero concepts: *b* = 0.69,
F(1, 72) = 4.25, p = 0.043

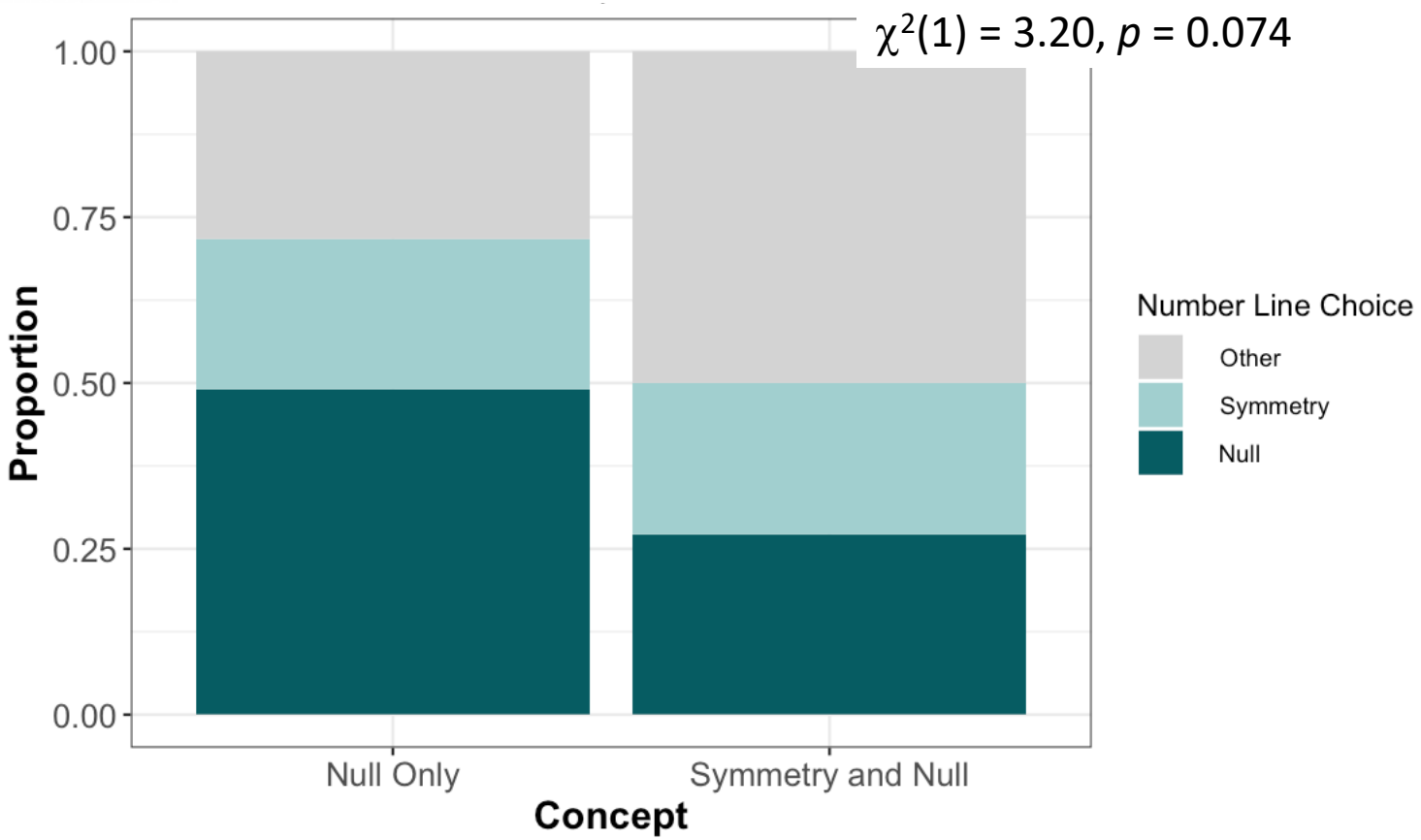
(Siegler & Stern, 1998)

(3) Number line

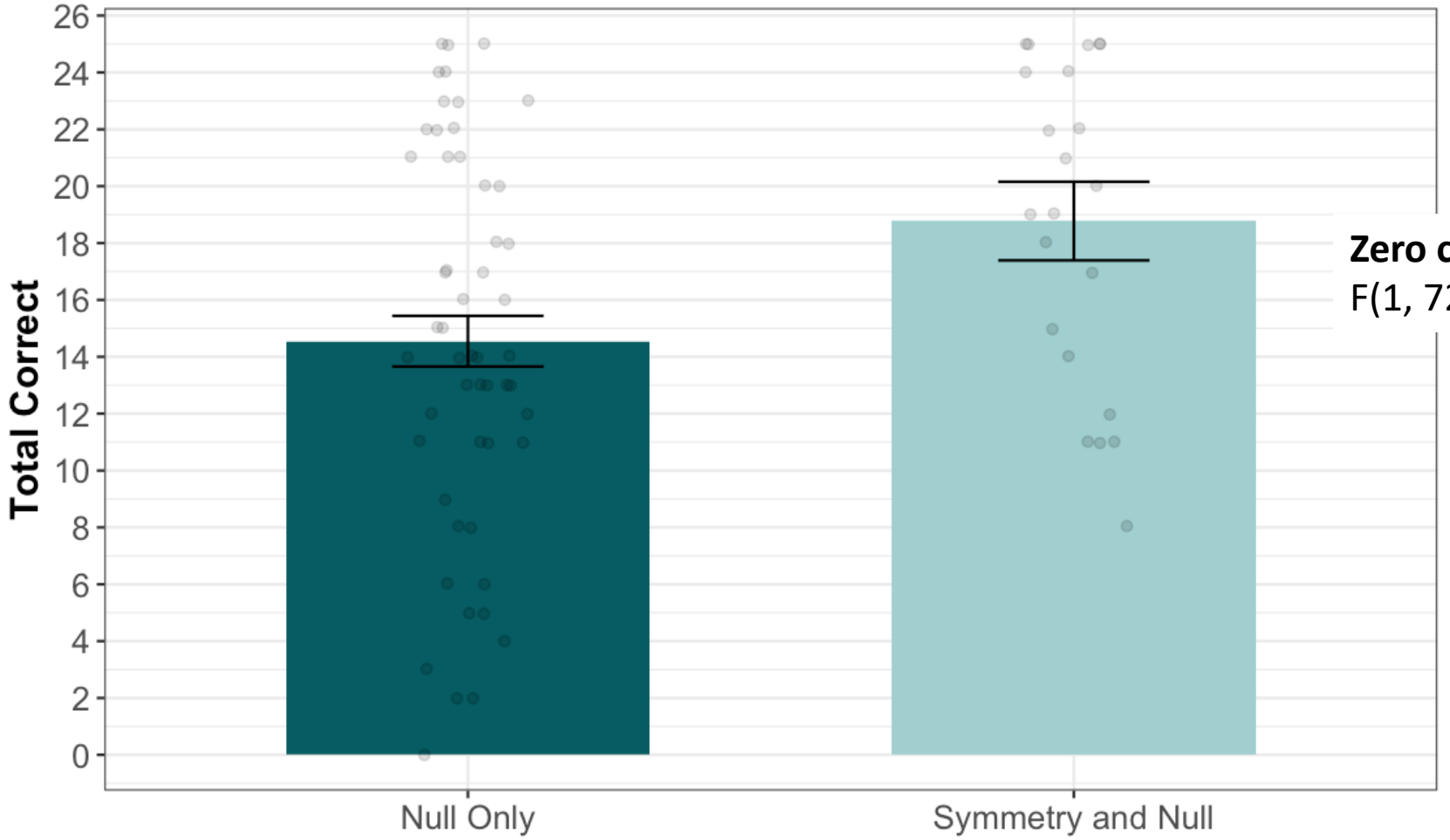
Choose the letter where you think the number 3 is on a number line.



Zero concepts: b = -0.96, $\chi^2(1) = 3.20$, $p = 0.074$



(4) Symbolic fluency with integers

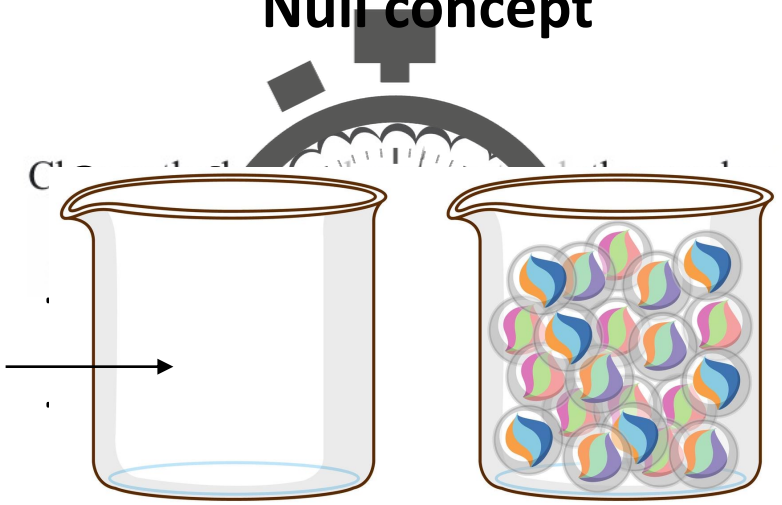


Zero concepts: *b* = 4.3,
F(1, 72) = 6.80, p = 0.011

Summary

4th-7th grade

Null concept



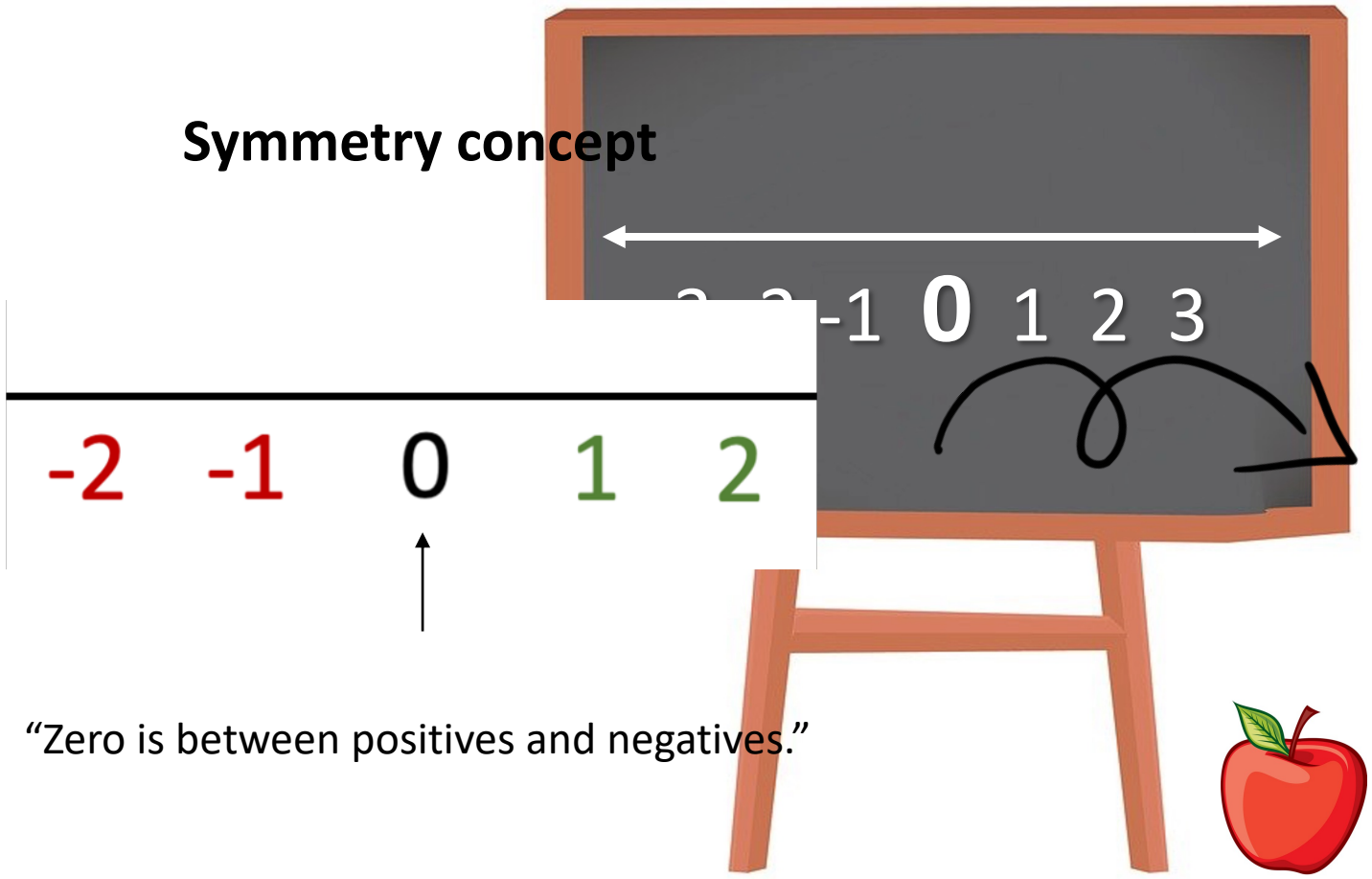
“Zero is nothing.”

Symmetry concept

“Zero is between positives and negatives.”

Implications

Symmetry concept



“Zero is between positives and negatives.”

Integers

Thank you!

- Advisor
  - Dr. Martha Alibali
- Lab mates
- Research Assistants
  - Megan Haas, Holden Manhart, and Lauren Smith

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