



# Teacher's Science Talk and Preschoolers' Engagement and Learning

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with

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# Developmentally Appropriate Practice – Teaching Approaches

- Balance between child-initiated and teacher-guided opportunities for learning
- Combination of responsive teaching and explicit instruction



# Early Childhood Science

- Balance between child-initiated and teacher-guided opportunities for learning
- Combination of responsive teaching and explicit instruction
- Young children in the combined intervention group (RT+EI) learned more science concepts and vocabulary and more content-specific scientific problem-solving skills than children in either RT or Control groups (Hong & Diamond, 2012).



# Closer Look at RT+EI

- The teacher...
  - *Prepares and introduces materials and choices*
  - *Directly poses a problem*
  - *Gives children an opportunity to explore objects*
  - *Teaches vocabulary*
  - *Repeats what children say*
  - *Describes what children do*
  - *Says what else children can do*
  - *Introduces and reviews the tools of measurement*





## Closer Look at RT+EI (cont.)

- The teacher...
  - *Asks questions about characteristics of objects*
  - *Models and explains how to measure and compares the size and weight of objects*
  - *Helps children predict what will happen if objects are put in water*
  - *Initiates the discussion about the results of experiments*
  - *Makes a chart about the result of an experiment or activity and/or hypotheses or ideas*
  - *Helps children make a rule about objects' floating and sinking*



# Teacher Talk

- What types of teacher talk did the teacher use to teach preschoolers science concepts, vocabulary, and skills?
- Are types of teacher talk associated with children's science learning?



# Children's Engagement

- “**the amount of time** a child spends interacting with **the environment** (i.e., teachers, peers, or materials) in a developmentally and contextually appropriate manner at **different levels of competence**” (McWilliam & Casey, 2008, p. 4).
  - *Amount of engagement*
  - *Sophistication of engagement*
- Improved engagement → more positive behavior, higher level thinking and reasoning skills, improved peer relationships, and improved learning



# Children's Engagement (cont.)

- Does the level of children's engagement related to their science learning?
- Does it moderate the association between teacher talk and children's learning?





# Participants & Procedure

- 37 4- and 5-year-old preschoolers (26 European American; 20 girls) recruited from early childhood programs in a mid-sized Midwestern community
- Pre-test
  - *Science concepts and vocabulary*
  - *Scientific problem-solving skills*



# Participants & Procedure (cont.)

- Attended 4 sessions of high quality small-group science activities (RT+EI)
  - *Understanding the concepts of size and weight and their relation to floating and sinking*
  - *Making correct judgments about whether an object would float or sink by using scientific problem-solving strategies*
  - *Learning to make an object that floats sink and to make an object that sinks float*
- Post-test
- Videotaped sessions were used to code teacher talk and children's engagement



# Measures

- Science concepts and vocabulary
  - Possible score range = 0 to 42 (22 items)
  - Cronbach's alpha = .77 (pre) and .86 (post)
  - Strong correlation with W-J III Picture Vocabulary subtest scores ( $r = .64$ ;  $p < .001$ )
    - Pre:  $M = 22.48$  ( $SD = 5.49$ )
    - Post:  $M = 33.46$  ( $SD = 5.58$ )
- Scientific problem-solving skills
  - Possible score range = 0 to 22
  - Cronbach's alpha = .83 (pre) and .88 (post)
    - Pre:  $M = 13.49$  ( $SD = 5.19$ )
    - Post:  $M = 18.30$  ( $SD = 3.99$ )

# Measures (cont.)

- Teacher talk
  - *12 small groups (2 to 4 children in each group)*
  - *Coded every 15 seconds for 4 sessions*
  - *278 intervals per small group, on average*
  - *Multiple types were coded within each interval*
    - Modeling
    - Question
    - Repetition
    - Directive
    - Explanation
    - Description

# Measures (cont.)

- Children's engagement
  - *Coded every 3 minutes for 4 sessions*
  - *Inter-coder agreement = 79 to 96%*
  - *Duration of engagement (amount)*
    - 0 = Almost none of the time
    - 4 = Almost all of the time

*$M = 3.61$  ( $SD = .25$ ; range = 3.00 to 4.00)*
  - *Sophistication of engagement (complexity)*
    - 0 = Non-engaged
    - 1 = Unsophisticated
    - 2 = Average
    - 3 = Constructive
    - 4 = Sophisticated

*$M = 3.23$  ( $SD = .45$ ; range = 2.00 to 3.83)*



# Results

- What types of teacher talk did the teacher use to teach preschoolers science concepts, vocabulary, and skills?
  - *Modeling* ( $M = .08$ ;  $SD = .04$ )
  - *Question* ( $M = .62$ ;  $SD = .08$ )
  - *Repetition* ( $M = .36$ ;  $SD = .11$ )
  - *Directive* ( $M = .13$ ;  $SD = .04$ )
  - *Explanation* ( $M = .14$ ;  $SD = .02$ )
  - *Description* ( $M = .59$ ;  $SD = .12$ )

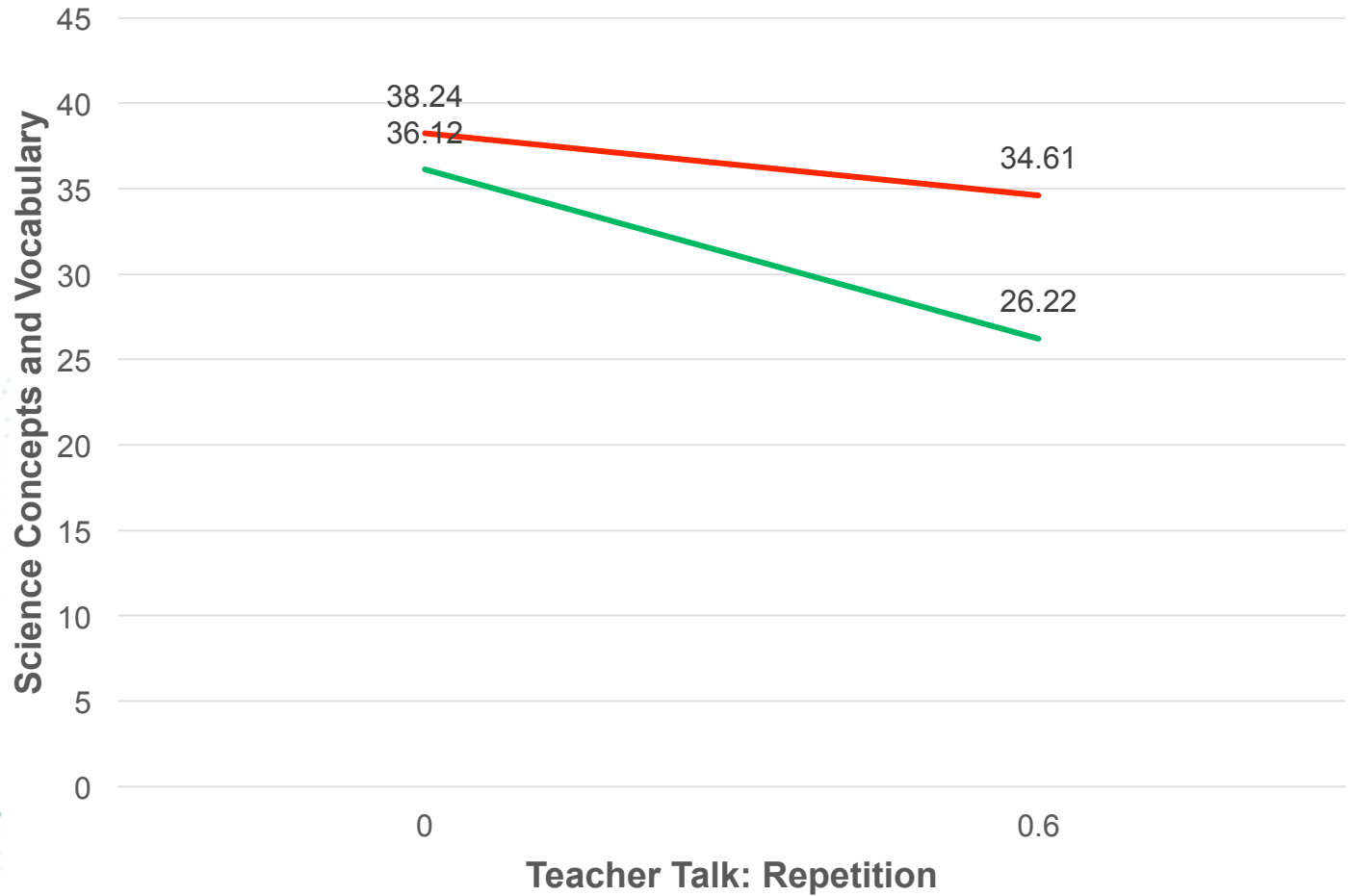
## Results (cont.)

- Does children engagement related to their science learning?
  - *Science concepts and vocabulary*
    - Sophistication of engagement:  $r = .35$  ( $p = .04$ )
  - *Scientific problem-solving skills*
    - Sophistication of engagement:  $r = -.37$  ( $p = .03$ )

## Results (cont.)

- Does children's engagement moderate the association between teacher talk and children's science learning?
  - *Covariates: Pretest scores, Expressive vocabulary*
  - Science concepts and vocabulary*
  - *The higher the engagement level*
    - the less negative the association between teachers' repetition and children's learning
    - the less positive the association between teachers' explanation and children's learning

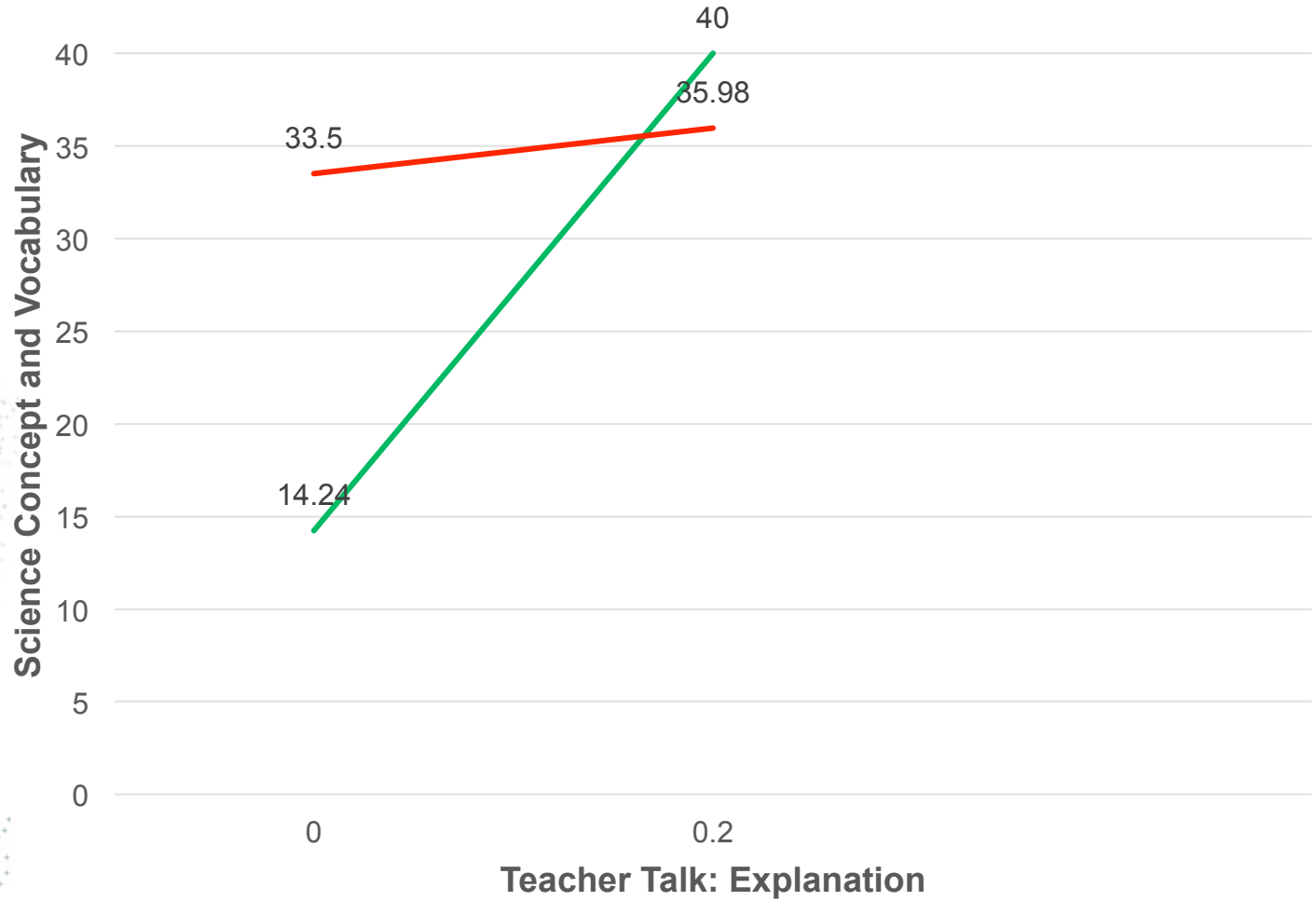
# Repetition X Engagement



— Higher than Mean Engagement

— Mean Engagement (3.23)

# Explanation X Engagement



— Mean Engagement (3.23)

— Higher than Mean Engagement



# Discussion & Next Steps

- The quality of children's engagement in science activities is important for their learning of science concepts and vocabulary, and vice versa.
- The quality of children's engagement in science activities should be considered when teachers choose types of their talk to support children's learning of science concepts and vocabulary.



# Discussion & Next Steps

- Results may look different if science instruction and interactions are examined in a more naturalistic environment with more variability in main study variables and the science content covered.
- Teachers' use of differentiated instruction and scaffolding in science teaching seems important.
  - *Initial level of understanding*
  - *Sophistication of engagement (complexity)*

A green chalkboard with two pieces of pink chalk and some faint white chalk markings. The chalkboard is the background for the text.

# Thank you!

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