Methods for Assessing Scientific Reasoning in Preschool Children

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Our labs work with teachers to embed science learning opportunities in the preschool classroom. One aspect involves designing learning experiences to support preschoolers’ emerging understandings of the notion of variable. Here we present preliminary results using three tasks developed to tap early-emerging knowledge.

Method 1 - Choosing a Comparative Test

Participants
• 19 preschoolers (mean = 4;11 range = 4;4-5;4, 12 girls)
• Ethnically and socioeconomically diverse sample
• Before assessment, all participants engaged in educational activities designed to illustrate that comparative tests are more informative than demonstrations to answer “find out” questions (Figure 1).

Method
• Children heard 6 simple stories with photographs. Each had the goal of finding a “superior” contestant: cream that heals boo-boos faster; sponge that cleans up more juice; toy car that goes faster; wind-up toy that travels farther; glove that keeps hands warmer, and ball that bounces higher.
• Memory probes were asked and stories repeated as necessary to support comprehension.
• Children chose the best tests and justified their responses.

Q: Remember, he wants to find out if one of the cars, the blue or the yellow, goes faster. If you had to find that out, which way would you do it? This way or that way?

Findings
• Children generated a reasonable scientific explanation for their choice of a comparative test after 24% of their correct test choices. Examples are given in Figure 3.

Method 2 - Try It Task

Participants
• 17 preschoolers from the same sample

Method
• Short, scaffolded interactions between child and experimenter
• The experimenter presented a testable question (e.g., Which pads work better to protect your hands?) and asked the child to “find out” using the materials provided. The procedure varied slightly between schools due to changes after piloting at one school.

Findings
• 7 children engaged in the best kind of test (simultaneous comparison of two levels of the variable). Two more did so with minor prompting
• As a point of comparison, among children who did not participate in our educational intervention, only 1 (out of 14) designed a simultaneous test.
• Sequential testing seemed the default response to the materials. Five intervention and 9 non-intervention students employed this method.

Method 3 - Prompted Recall

Participants
• 17 preschoolers from the same sample

Method
• Photos and a graduated prompt procedure were used to probe children’s memory for, and understanding of, a previously completed experiment testing the insulating properties of gloves created with plastic bags and various filler materials such as feathers and solid vegetable shortening (Figure 5).

Findings
• 12 children answered the “What did we do to test which gloves keep hands warmer?” question, and 3 did so after a prompt was given.

Discussion
Our preliminary results encourage us with respect to our goal of identifying components that contribute to the understanding of experimental method. Learning about variables and controlled tests is a lengthy process, but our results suggest that preschool children have begun this journey in the context of simple comparison situations that answer “find out” questions. Some children this age are able to perform robustly in a straightforward judgment and justification task that does not provide scaffolds. A few can even reflect on their own scientific thinking to justify their responses. Others display their knowledge only under more supportive, interactive conditions. The point, here, is not that one method is superior to the others but that a more complete picture of learning develops when multiple assessment methodologies are employed. Further, the Try It and scaffolded interview techniques lend themselves well to classroom use, both as assessments and as opportunities for further learning.

Acknowledgments
This work was funded by the National Science Foundation REC-0529579.

We thank the schools, parents, children, and research assistants who made this work possible.