Many researchers study whether and when children can construct experiments and control confounding variables. We ask a simpler question: Do young children recognize that a comparison is more informative than a demonstration to answer a “find out” question? In other words, do they know that the method of difference is a key first step in designing an experiment?

**STUDY 1**

Participants were 27 first- (mean age = 67.1, range = 60-76 mos., 15 girls) and 24 second-graders (mean = 101.2, range = 87 - 119 mos., 15 girls) from a lower-income, predominantly African-American, neighborhood in West Philadelphia. Children listened to stories, supplemented with photos. In each story, a character faces a specific problem and decides to design a test to get relevant information. Three stories were framed as competitions or races (e.g., Which toy car goes faster?), and three varied a key step in a process to find out if it affected the outcome (e.g., Does adding vinegar to dye affect the color of eggs?). Samples are shown in Figure 1. After each story, children answered questions that tapped understanding. Once understanding was established, participants identified the test that would allow the story character to obtain the desired information and justified their response.

**Findings**

Figure 2 shows that, overall, second graders’ choices were marginally better than first graders’, F (1,49) = 3.271, p = .077. Both groups reasoned more accurately on race tasks than on process tasks, F (1,40) = 43.972, p < .001; this item effect was more pronounced in the Grade 1 sample, F (1,49) = 4.170, p = .047.

Children’s justifications of their choices were scored for whether they referred to the need to use a comparative test to answer a “find out” question. Examples of these are provided in Figure 4. Children found it easier to justify race scenario choices. As shown in Figure 4, the proportion of correct test choices that were followed by a good justification was .63 for first graders and .76 for second graders for race stories. For process stories, these figures were .32 and .28, respectively.

**Discussion & Study 2 Rationale**

We suspect that race stories yielded better performance than process stories because the schema for competitive situations is simpler and more familiar. While both story types require the use of controlled comparisons, they differ in that the outcome of a competition directly answers the question of which contestant is superior; process situations, in contrast, pose the question of whether an added element affects a process which in turn affects an outcome. These items likely involved additional causal reasoning and may have increased verbal load.

Still, first graders’ above chance performance indicates that relevant reasoning skill emerges at even earlier ages for some learners. Study 2 explores the roots of this capacity using simple comparative (i.e., race-type) scenarios to explore the range of performance among 4- and 5-year-olds.

**STUDY 2**

Participants were 19 preschoolers (mean = 57.7, range = 51-62 months, 12 girls) from two schools in central New Jersey - one that serves ethnically diverse, middle income families and one that serves lower income, predominantly Hispanic families.

We generated 6 simple stories with photographs. Like the Study 1 race scenarios, all 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 were asked to justify their test choices.

**Discussion**

Although the present studies were cross-sectional, together they allow us to posit a learning pathway for scientific reasoning skills associated with the notion of a variable. This pathway will be explored longitudinally as part of a larger multi-year research project. The race scenarios, especially, exemplify simple comparisons from which children might build further understandings of experimental design. These include reasoning about the difference between an example and a test and understanding the importance of controlling variables to create fair tests. The simple race stories are also easier for children to talk about, providing supportive opportunities for them to begin to reflect on and talk about their own scientific thinking. Identifying likely learning trajectories for scientific reasoning can inform the design of educational experiences most likely to support growth towards more complex understandings.

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