The researchers examined the associations between teachers’ judgments of children’s math skills using an indirect rating scale assessment and children’s performance on two direct assessments of their number sense and geometry and measurement skills.

Interest in improving children’s early mathematics skills is growing, due in part to research findings linking early math skills with later overall school achievement. The ability for teachers to prepare developmentally appropriate lessons on mathematics topics for individual children is contingent on having access to detailed information about each child’s current level of mathematics understanding.

This information has typically been obtained by one of two methods. One is direct assessment, or a test given directly to children. With direct assessments, for example, children are asked to demonstrate knowledge by counting the number of objects and telling the assessor how many there are in total. Some say, though, that the outcomes of assessments of preschool-aged children are not reliable because some children are unable to sustain attention through a lengthy assessment and may be shy or uneasy about working with a stranger if someone other than the teacher is conducting the assessment.

Another method frequently used to determine children’s knowledge is the indirect assessment. With indirect assessments a teacher or other adult who has observed a child over time rates the child’s skills in a given area. Indirect assessments are an efficient way of collecting information about children’s skills in a short amount of time. They are convenient and inexpensive and avoid the need for pulling individual children out of class for testing. However, little effort has been made to determine the accuracy of teachers’ perceptions of children’s math skills.

Researchers from the University of Virginia’s Center for Advanced Study of Teaching and Learning conducted a study comparing direct assessments and indirect assessments. Given the benefits of indirect assessment, it would be helpful for researchers to know whether teacher reports are valid measures of children’s skills and whether there is any information about children’s skills that is obtained from direct assessments that is not captured in teacher reports.

The Study
This study was part of a larger research project examining the impact of a math and science curriculum on students’ knowledge and skills. Teachers in 33 classrooms participated in the study, and approximately 10 children in each classroom were assessed using direct assessments of their mathematical knowledge, for a total of 318 children between the ages of 3.5 years and 5 years. The children participating in this study attended public prekindergarten programs targeting children at risk of school failure and exhibiting one or more of an established set of risk factors (i.e., low family income, single-parent household, and substance abuse present in the home).

All data included in this study were collected in October. Although school began in September, the time frame for ratings and assessments allowed teachers
approximately a month to get to know the students’ skills and abilities before being asked to complete rating checklists of students’ math knowledge.

**Indirect Assessment.** Teachers were each asked to rate the math skills of 10 students selected for direct child assessments from their classrooms. The checklist was a modified version of the Academic Rating Scale for mathematics that was developed for the Early Childhood Longitudinal Study—Kindergarten Cohort. The checklist also included five items developed to assess specific objectives in the math curriculum. Teachers were asked to rate the skills of students in various mathematical topics on a scale of 1 (the child has not yet demonstrated the skill) to 5 (the child is proficient in the skill).

**Direct Assessment.** Students’ knowledge of number and numerical operations was tested directly using the Test of Early Mathematic Ability—Third Edition, a rigorously tested instrument with high reliability and validity. It is designed to measure a child’s knowledge of both formal and informal mathematic abilities, focusing on the domains of counting, one-to-one correspondence, numeral recognition, number facts, calculation, and understanding of concepts.

Students’ knowledge in geometry and measurement was assessed using items adapted from the Tools for Early Assessment in Mathematics. This instrument uses toys and pictures to address questions about shapes and measurement.

**Results**

Overall, teachers tended to group all children as about the same in math skills, with little recognition of their variation in skills and in different mathematics domains. A perfect 1.0 correlation would indicate that teachers rated the student who achieved highest on the direct assessment as highest on their ratings checklist. Conversely, they would rate the student scoring lowest on the direct assessment as lowest in their rating checklist. Instead, the teachers in this study scored about a .5 correlation, which indicates that their ratings were only moderately correlated with children's actual skills.

Their ratings had about 40% of the variance at the classroom level, which means that only about 60% of the teacher’s rating was actually indicative of the child’s skills. Teachers’ ratings may reflect information about their own feelings and expectations, such as expectations about appropriate behavior, rather than reflecting only the child’s skills. A teacher who sees a child’s behavior problems as troubling may also rate the child’s skills as lower, especially when the teacher is less familiar with the child. This problem could be more noticeable in ratings of children’s math skills because preschool teachers tend to be less familiar with math concepts and how to recognize math competencies in their students.

The teachers were slightly better at rating children in terms of their knowledge of numbers and numerical operations than their skills in geometry and measurement. Possibly, teachers are more familiar with recognizing children’s number-sense skills than those in geometry and measurement.

The findings of this study indicate that teachers may not always be able to trust their initial impressions about student abilities and that direct assessment may provide additional necessary information for teaching plans. Teacher education programs and in-service professional development providers should focus more on preparing teachers to recognize and understand demonstrations of children’s mathematics skills.


For more information about the Center for Advanced Study of Teaching and Learning, see http://curry.virginia.edu/castl