



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

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Project Title Are There Distinct Categories of Math Ability?	
Abstract Objectives/Goals I am trying to identify what causes people to vary in their math ability, with the goal of developing teaching methods to target specific deficits. Math skills are traditionally taught sequentially, in a building-blocks model, and an early deficit is presumed to preclude mastering later math subjects. However, I hypothesize that if there are distinct categories of math ability, then students can become proficient in subjects after an earlier-taught subject in which they have a deficit. Methods/Materials To distinguish between the building-blocks and distinct-categories hypotheses, I designed a 30-minute math test to administer to consenting high school students that includes basic and advanced arithmetic, algebra, graphing, geometry, and word problems, categories already encountered by my 65 participants. I also collected demographic information to identify correlations with math ability. My scoring rubric allows partial credit for correctly setting up math problems even with arithmetic errors; a category score of 50% or less is considered a deficit. I compiled the best methods for solving the problems and recorded a CD of my explanations. Several volunteers listened to the CD and took the re-test, which contained substituted numbers in the problems. Results Twenty students' results (31%) were inconsistent with the building-blocks model, because they were proficient in categories after an "earlier" deficit. On average, correct problem solvers performed higher level math faster than the corresponding incorrect problem solvers, but both groups performed basic math at about the same speed. Finally, I created a CD with step-by-step instructions to teach the struggling students to overcome specific math deficits. This proved successful in 4 of 5 students who retook the geometry portion of the test and improved their scores by 15-40% after listening to the explanatory CD. Conclusions/Discussion A significant proportion of the students, 31% (20/65), demonstrated distinct math abilities that were "out of sequence" for the building-blocks model, supporting my hypothesis. In a pilot study, most participants who listened once to an explanatory CD showed improvement of geometry scores. Therefore, math abilities can be acquired as distinct categories, and it is not always necessary to improve "earlier" math deficits in order to achieve understanding of a "later" math category.	
Summary Statement I discovered that math skills can be acquired out of sequence, and therefore students may improve their math abilities by using category-specific exercises without necessarily mastering earlier deficits.	
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