

## EDUCATION WEEK

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# Studies Question Value of Early Algebra Lessons

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Mastering algebra is widely considered the gateway to higher mathematics and college readiness, but new studies question whether low-performing students benefit from exposure to the subject in middle school.

Separate studies of urban middle schoolers in California and in the Charlotte-Mecklenburg, N.C., schools suggest that placing struggling math students in algebra class does not improve their test performance on state math tests, and significantly hurts their grade point averages and the likelihood of their taking and passing higher math courses in high school.

California has led the country in efforts to introduce algebra concepts in lower grades. In 2008, the state board of education included algebra as part of the 8th grade end-of-year math test, thus requiring all students to take algebra by the end of middle school.

While pushback from the state education department and teachers' unions has meant the policy has not been fully implemented, it did increase the number of students taking Algebra 1 and pre-algebra in 8th grade, according to Don Taylor, an education consultant for the California education department, and Michael Kurlaender and Heather Rose, researchers at the University of California, Davis.

The three presented findings from a study of California's early-algebra initiative during an April 15 session at the American Educational Research Association's annual conference here.

Nationwide, the proportion of students taking algebra in 8th grade nearly doubled, from 16 percent to 31 percent, from 1990 to 2007, according to the National Center for Education Statistics and Mr. Taylor's research. In California, however, algebra enrollment in that grade has more than tripled, from 16 percent of 8th graders taking algebra in 1990 to 54 percent in 2009, Mr. Taylor said.

The California researchers analyzed the coursetaking and math achievement of more than 22,000 students who started 7th grade between 2001 and 2004 in more than 20 schools in a large, unnamed urban district. They found that, for the nearly 2,400 students who performed in the lowest 10 percent on state math tests at the end of 7th grade, taking algebra in 8th grade had no significant effect on their state math-test performance at the end of 8th grade. And it caused their average GPAs to drop 7 percent, about the difference between a C and a C-minus.

"What we can see is there's a potential harm to a low-performing student on the GPA," said Mr. Taylor, the lead author of the study. "It's pretty important. The grade point average [is what] parents pay attention to, teachers pay attention to—it's actually more salient to the kids than math [state tests]. So there's clearly academic harm in the short term."

### North Carolina Results

Although the California study is ongoing and has not yet followed the students into high school, **a separate study**  of students in the 141,100-student Charlotte-Mecklenburg schools does.

In 2002, the Charlotte-Mecklenburg district launched a policy to change Algebra 1 from a high school to an 8th grade course.

"They didn't change the course in algebra. They just offered it earlier on the assumption that 'we are really holding kids back by not giving them access to algebra; we know not all students are going to pass this, but we want to have high expectations and err on the side of being more aggressive,'" said Charles T. Clotfelter, a professor of public policy, economics, and law at Duke University, in Durham, N.C., who tracked the policy effects with fellow Duke researchers Helen F. Ladd and Jacob L. Vigdor.

Unlike in the California study, the Duke researchers found that even moderately math-proficient students in Charlotte-Mecklenburg who were put into early-algebra classes performed significantly worse on state end-of-year math tests. Moreover, initially low-performing students who took Algebra 1 in 8th grade were significantly less likely to take more-advanced math courses, such as Algebra 2 or geometry, later.

The Duke study, the first results of which were released as a working paper in January by the National Center for Analysis of Longitudinal Data in Education Research, based in Washington, found that the achievement of students accelerated into algebra who had performed in the lowest 20 percent of 6th grade math tests declined by a full standard deviation in Algebra 1 end-of-course tests. Those students were 46 percent less likely to pass Algebra 1 by 10th grade.

"What we find is that this policy, while it might have allowed more time to take more courses later, on net, had a negative effect on most students, especially those students who weren't stellar in math background," Mr. Clotfelter said. "They went down to get students who, on net, probably should have waited a year. We're giving this [course] and the message to [students] could have been, 'You're just not that good [at math].'"

"For whatever reason, their preparation or their confidence wasn't sufficient to let them do well on it, and it knocked them back on their heels," he said.

In fact, the drop in scores and coursetaking was so dramatic that the Charlotte district changed its policy only two years later. The district now allows, but does not require, students to take accelerated algebra.

Neither Mr. Clotfelter nor Mr. Taylor could say whether the negative effects of early algebra came from a lack of developmental readiness or academic preparation among the low-performing students, but other research points to the latter as a prime suspect.

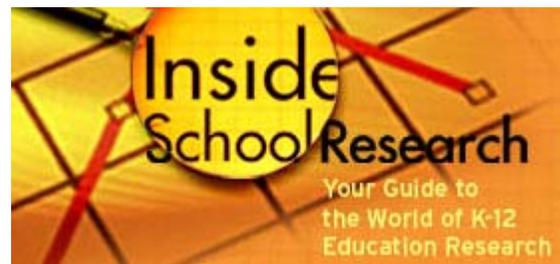
Other countries, such as Japan, integrate algebraic concepts into early elementary school, suggesting there is no developmental reason algebra can't be taught earlier than high school.

In both the California district and in Charlotte-Mecklenburg, however, students were placed in formerly high-school-level courses without a transition from pre-algebra in earlier grades or accounting for students who might be performing at a 2nd grade level in arithmetic, according to a 2009 study by Tom Loveless, a senior fellow at the Washington-based Brookings Institution.

### Preparation Needed

"It is possible for children in 8th grade or even younger to take algebra and do well in algebra, but not all students, and the defining characteristic seems to be prior knowledge," Mr. Loveless said in an interview.

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"If a student is well prepared, algebra is a good thing regardless of the student's age," he said, "but if a student is not prepared, it can be a bad thing, regardless of the student's age. Developmental readiness shouldn't mean a developmental mandate."

In California, the universal-algebra policy is on hold in part because of such concerns.

"The bottom line is: It doesn't appear that being in any [algebra] courses makes a difference in terms of the math [test]," Mr. Taylor said. "Does a universal policy really fit all kids? ... If we're creating policies that don't improve education for every single kid, maybe we should rethink those policies."

The news wasn't all bad for algebra at AERA; the American Institutes for Research's "Back on Track" study with the University of Chicago found that introducing online and face-to-face summer algebra programs in Chicago led to a near-doubling of credit recovery for students who failed algebra in their freshman year, said Jessica B. Heppen, an AIR principal research analyst.