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Algebra for All?

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In Arkansas, students graduate from high school at a relatively high rate – 72% versus the national rate of 69%. However, according to the ACT, only 35% of Arkansas graduates are ready for college-level work (based on Arkansas’ College Readiness Benchmark Scores). Our state’s rate of completion from college also ranks below the national average (See Table 3.5 in OEP’s report card [here](#)).

There is a strong correlation between the successful completion of an algebra course and readiness for college-level work. Because of this, there has been a great deal of interest recently in the question of whether educators in Arkansas should require all of our students to take an algebra course early in their high school career, or even in junior high.

Across the state and the nation, there is a push for every student to take algebra – a push heralded by the phrase, “algebra for all.” The idea is that students who take algebra early are more likely to enroll in advanced math courses in high school, and those students who complete advanced math courses in high school are more likely to enter college.

This broad policy question is, of course, relevant to our school leaders across the state. For example, a local middle school principal recently approached the OEP asking if there was any evidence that motivates Arkansas school leaders to place so many eighth grade students in Algebra I. He noted that 30% of the eighth grade students in his school are currently taking Algebra I; a number of these students do not appear ready to handle this type of course work. At the same time however, this principal continues to feel pressure to enroll more of his eighth grade students in Algebra I.

Thus, in this policy brief, we will first provide an overview of algebra enrollment in Arkansas. We then discuss the rationale for early algebra, and also identify the concerns associated with having younger students take algebra. Finally, we conclude with a look at research on this topic to offer suggestions to Arkansas school leaders.

ALGEBRA IN ARKANSAS

All students in Arkansas are required to take four units of high school math (beginning with Algebra I) in order to graduate. Traditionally, this process began in 9th grade; however, due to the increased prevalence of AP courses and more students seeking additional years of math, students are currently able to take Algebra 1 in 8th grade.

In the current school year, there are over 35,000 students in Arkansas taking the traditional Algebra I course. Of those students, approximately 10,000 are students in the 8th grade. There are an additional 2,500 8th graders enrolled in the Algebra A and B alternative track.ⁱ

Course	Total Enrollment	Grade 8 Enrollment
Algebra 1*	35,845	10,253
Algebra A	35,341	2,454
Algebra B	30,922	27

*A small number of these students may be from grade 7.

This information was provided by the Arkansas Department of Education.

TRADITIONAL METHODS VS. EARLY ALGEBRA

The traditional approach to the teaching of mathematics has been to use tracked classes. In these classes, students are grouped according to academic ability. For example, the more advanced students in Arkansas may take Algebra I in eighth grade, whereas the remaining students would take pre-algebra. Thus, using tracked classes allows students to enroll in courses appropriate for their level of learning, which creates classes with groups of students with similar backgrounds and abilities. This allows the teacher to modify his/her teaching

ⁱ Algebra A and B is an alternative track to traditional algebra. Instead of the Algebra Frameworks being taught in one year, students can take two courses, Algebra A and B, which covers the material over a two-year period. Students in the A and B track don’t take the Algebra End-of-Course exam until after the second course.

approach to best fit the needs of the class. High-ability classes can move at a faster pace with more challenging material, while low-ability classes can offer enrichment activities as needed. Additionally, students in tracked classes are only compared to similar students, which reduces the likelihood that students will experience self-esteem issues within the class (that may occur because a student feels “inferior” to another student).¹

Contrary to the traditional approach to teaching mathematics is a newer approach often referred to as “algebra for all,” or early algebra. In this scenario, all eighth grade students take the algebra course at the same time. The premise behind early algebra is if students take these preparatory math courses earlier in their schooling, they will be more likely to be better prepared for – and attend – college.

Early algebra classes then would be comprised of a wide variety of students with dissimilar academic abilities. Some educators believe that students might learn better from each other in these mixed-ability classes.² For example, a group of researchers suggested that the overall learning experience for students is enriched by being exposed to students of different levels of learning and understanding.³

Overall, supporters of this approach feel that early algebra is a valuable experience for all students. A study published by the American Educational Research Association “indicates that all students benefit from taking algebra; among those with very low prior achievement, the benefits are somewhat smaller, but algebra is still worthwhile for all students.”⁴

CONCERNS ASSOCIATED WITH EARLY ALGEBRA

While there is currently a move for more students to take algebra in early grades, there are several concerns associated with this approach, which include:

- The quality of algebra courses
- The quality of algebra teachers
- Student engagement

Opponents worry that the quality of mathematics courses will not be maintained when all students take algebra. They fear that teachers will be forced to lessen the rigor of the course to allow all students to succeed, potentially diluting the algebra curriculum.

Additionally, there is a concern about the quality of teachers in algebra classes. Because there is already a shortage of algebra teachers (even in Arkansas), as student enrollment in algebra increases, there may not be enough qualified teachers to fill those courses. Moreover, algebra teachers may not be accustomed to teaching an algebra class with such diverse backgrounds. While there is the belief that students can learn from their peers with more advanced math skills, the teacher may have more difficulty effectively meeting the needs of each student.

There is also a concern that students may become disengaged if all students take algebra at the same time. Low-ability students may withdraw from learning if the material is beyond their

understanding, and high-ability students may do the same if the material is below their skill.⁵

SUGGESTIONS FOR ARKANSAS

There are certainly reasonable arguments both for and against taking algebra in early grades. A review of research from schools that have implemented early algebra (or some kind of college-

preparatory mathematics in early grades) shows mixed results with respect to student achievement. For example, course enrollment increased, particularly for students previously underrepresented in algebra, and more students completed the algebra requirements. However, with this increase in students taking algebra, the rate of course failure also increased, grades dropped, and in some cases, absenteeism rose for those students enrolled in algebra.⁶

So should Arkansas push students to take Algebra earlier? Well, there isn’t a simple answer, but here are some considerations.

School leaders may consider preparation for eighth grade algebra in earlier grades, thus ensuring that

“Algebra for all” might be *a* way, but it might not necessarily be the *only* way.

these students are more able to understand the concepts presented to them when they get to the algebra course. Examples of this might include implementing transition classes (or classes where students receive additional instruction in math), providing extra tutoring, or gradually increasing the course enrollment rather than requiring all students to take algebra in one year.

The problem of inadequate preparation may not begin with algebra. Students entering eighth or ninth grade may not be ready for the college-preparatory curriculum. Simply requiring students to take algebra at a younger age, in the absence of other interventions, may not help prepare them for greater success.⁷ If Arkansas aims to help students become more prepared for college and a career thereafter, school leaders might consider modifications to the entire K-12 math approach (not just algebra), and make the curriculum more rigorous at all grade levels. As Dougherty and Mellor put it, “An emphasis on *access* to courses has not been accompanied by a suitable emphasis on course *rigor* and student academic *preparation* to succeed in the courses.”⁸

Some considerations...

- *Add transition/enrichment classes*
- *Offer tutoring*
- *Gradually increase in enrollment*
- *Increase course rigor and college/career preparation in earlier grades*

In summary, there is still much debate on whether it is truly beneficial to press our eighth graders to take higher-level math as a step toward increased preparation for higher education. Parents and students agree that higher education is a more common goal now than it ever has been. As a result, schools are taking steps to better prepare their students for a college-level education. However, many other factors are present in the context of preparing for college beyond just requiring all students to take algebra. In short, “algebra for all” might be *a* way, but it might not necessarily be the *only* way.

For more information about this policy brief, please contact the Office for Education Policy at oepe@uark.edu

¹ Ansalone, G. (2003). Poverty, tracking, and the social construction of failure: International perspectives of tracking. *Journal of Children and Poverty*, 9(1), 3-20.

² Burris, C. (2004). Math Acceleration for All. *Improving Achievement in Math and Science*, 61(5), 68-71.

³ Lee, V.E., & Smith, J.B. (1993). Effects of school restructuring on the achievement and engagement of middle-grade students. *Sociology of Education*, 66(3), 164-187.

⁴ Gamoran, A. (2000). Algebra for everyone? Benefits of college-preparatory mathematics for students with diverse abilities in early secondary school. *Educational Evaluation and Policy Analysis*, 22(3), 241-254.

⁵ See Gamoran, A. (2000).

⁶ Allensword, E. (2009). College preparatory curriculum for all: Academic consequences for requiring algebra and English I for ninth graders in Chicago. *Educational Evaluation and Policy Analysis*, 31(4), 367-391.

⁷ Dougherty, C. (2010). Using the right data to determine if high school interventions are working to prepare students for college and careers. *National High School Center*. American Institutes for Research.

⁸ See Dougherty, C. (2010).