In high school math, more instructional time helps, but the tracking dilemma remains

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For more than a century, educators have struggled to find the best way to organize instruction for students who vary widely in their prior levels of performance (1). In a pioneering line of research focused on children in the Chicago Public Schools (CPS), Nomi, Raudenbush, and Smith have provided fresh evidence on this age-old problem, and their latest contribution does so with long-term evidence on the consequences of high school classroom organization and instructional time for college-level outcomes (2). This is a rare feat in a field that all too often focuses on short-term gains and losses in achievement with little direct knowledge of long-term consequences (3).

All groups of students exhibit variation, and, because effective teaching meets students at their own starting points and carries them forward (4), instructing students who begin at different starting points can be challenging. In response, schools commonly arrange students into instructional groupings that are more homogeneous in skill level than the age cohort as a whole. This is a common strategy among client-serving organizations: Hospitals, for example, arrange patients by category of medical need, and law firms often differentiate clients by their legal contexts. Unfortunately, this approach in education, often referred to as "tracking," is problematic for two reasons. First, teachers who instruct students in low tracks often provide lower-quality instruction than occurs in other tracks, due to a combination of circumstances including low expectations, less experienced teachers, weak curricular materials, and a slower pace of instruction (5–8). As a result, students assigned to low tracks are not remediated, but, instead, fall farther and farther behind. Second, because of racism, discrimination, and economic inequality in the wider society, which affect children's observed skills as they enter school, when schools differentiate students on the basis of prior test scores, they also tend to divide them by race, ethnicity, and social class. For this reason, tracking tends to compound within-school segregation in racially mixed schools, and to exacerbate inequality (8).

As Nomi et al. (2) report, the CPS in the late 1990s experimented with mixed-ability grouping by placing all ninth graders in a heterogeneous algebra class. The results were disappointing, although perhaps predictable in light of the struggles of other detracking efforts (9). Successful cases of detracking do exist (10), but they are rare (8). In response, CPS implemented a different strategy to help all children succeed in algebra: a "double-dose" policy in which students who scored below the national median on an eighth-grade math test were assigned to both a ninth-grade algebra class and an extra class to provide the skills they needed to succeed in algebra. The design of the policy, in which student assignment depended on a cut score on a test, lends itself to a rigorous evaluation using a technique known as regression discontinuity: Because cases on either side of the cut score are nearly identical, on average, other than the small difference in their prior test score, the analysis can simulate the random assignment of students to the treatment (double dose) or algebra class alone. In a previous paper, Nomi and Raudenbush (11) showed that the effects of this policy depended on how it was implemented, and, in the current paper (2), the authors reveal the policy consequences all the way through college. When median-skill students were assigned to double dose and taught with similarly skilled peers, they were more likely to persist in college, to obtain some sort of degree or certification, and to obtain a 4-y degree, compared to similar students who, because they scored just above the cut score, did not have access to the double dose. These findings show that, if implemented as designed, the policy has large, long-term consequences. However, when median-skill students were assigned to double-dose classes with lower-skilled peers, which occurred if there were many low-skill students in a school or when classes were formed heterogeneously, the policy did not pay off with positive outcomes. Indeed, in the second year of the policy, median-skill students were much more likely to be grouped with low-skill students, and the policy did not carry the benefits that it did in the first year.

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These findings are important on many levels. First, they show that instructional policies enacted in high school can have long-term consequences. Because few natural experiments follow students for as long as 9 y, such evidence is relatively rare. Second, they show that educational interventions in adolescence can benefit young people's long-term futures. This is important because economists have questioned whether interventions with adolescents are cost effective, advocating, instead, interventions in early childhood (12). Third, they show that success in high school algebra can indeed be a gateway to advanced levels of schooling, and, more importantly, that students whose eighth-grade tests are below the national median can use algebra as a springboard to success, if they have the right instructional supports in their first year of high school.

Despite these valuable contributions, the paper does not resolve the tracking problem, because it does not show how to achieve success with students who exit eighth grade with very low scores. Mixing such students with median-skill students appears to dilute the benefits of double dose for the latter, and the study was not designed to reveal outcomes for the low achievers themselves. Prior research has indicated that all students benefit from taking high school algebra, even those with low skills, although students at the bottom of the achievement distribution tend to benefit less than other students (13). How best to advance the success of those who start the year at lower levels of performance remains an open question. However, existing research gives a few clues.

There are two options for helping low-achieving students succeed with rigorous, college-preparatory academic material in early high school. Both options start with the premise that low-achieving students are capable of mastering rigorous content, a premise that, although provocative, is actually well established in the research literature (8, 14). One option is to provide additional instruction (such as offered in the double-dose algebra policy), delivered in classes with students of similar skill levels. This would maintain the successful version of the policy examined in the current study (with median-skill students grouped with others of similar skill level). It would also group together students who scored far below the median on the prior year's test, and thus would require more effective instruction than teachers commonly provide to low-achieving students. Rigorous content and more instructional time are among the conditions needed to make such an approach succeed. It would also require not assigning the least experienced or least skilled teachers to the lowest-performing students, and holding high expectations for student success (8). Even with these conditions, such an approach is problematic if it contributes to within-school segregation by race, ethnicity, or social class.

A second approach involves grouping all students in the double-dose program together regardless of prior skill level. This is what CPS did in the second year of implementation, and it led to failure. Under what conditions might such an approach, which has the virtue of avoiding intensified segregation, be likely to succeed? Here, too, prior research, although not conclusive, offers guidance. Successful teaching in mixed-ability classes involves further differentiation of instruction within classes (8). Nomi et al. (2) speculate, for reasons well grounded in the research literature, that the main reason double dose failed when median-skill students were taught alongside students with lower skills is that teachers aimed the content and pace of instruction to the middle of the classroom skill level, thereby slowing down the median-skill students who were at the top of the double-dose class distribution. Differentiating instruction within classes is challenging for teachers, but it has invariably been present in the few cases of successful mixed-ability teaching. Smaller classes, which make it easier for teachers to differentiate instruction for varied students within the same class, may also help supplemental instruction pay off within a mixed-ability context (15).

Nomi et al. have performed a great service by testing the effects of a natural experiment in education and showing not only where the policy change succeeded and where it failed, but why.

A final consideration is the cost effectiveness of the double-dose policy. Double-dose algebra is not expensive to implement, but it may incur additional costs to be implemented successfully for low-performing as well as median-performing students. The most important change is not costly at all: a cultural change in which educators come to believe that all students can successfully master college-preparatory mathematics. While essential, this belief is no guarantee of success. Beyond the cultural change, the reform is not costly on its face, because it is simply another high school class that students take, and can substitute for an elective that students might otherwise take. Without denigrating the value of elective courses, it is vitally important that students succeed in a gateway course such as ninth-grade algebra, which is therefore easily worth substituting for an elective. Shifting students from elective courses to an extra math course means hiring more math teachers and fewer teachers in other fields, and that may be mildly more costly for school districts if math teachers, who are more scarce, can command additional pay. However, these resources, while necessary, may not suffice to yield success with low-achieving students. Whether such students are given their second dose in a separate class or in a mixed-ability class, success likely requires two further, more costly elements. First, additional training can help teachers prepare to meet the needs of all students. Differentiation of instruction within classes requires additional planning, instructional tools, and knowledge of how to align instruction with student thinking. Second, if smaller classes are needed to allow for more individualized attention, as has been reported for at least one case of successful mixed-ability teaching in high school math and science (15), that could incur significant additional costs. Tellingly, cases of successful mixed-ability teaching have occurred in schools that either were in affluent communities (10) or had access to additional philanthropic resources that supported their success (15).

Nomi et al. (2) have performed a great service by testing the effects of a natural experiment in education and showing not only where the policy change succeeded and where it failed, but why. The next step is for researchers and educators, working in partnership, to build on this knowledge to implement instructional and organizational approaches that help all students succeed in mastering challenging content so they are prepared for postsecondary education. Nowadays, nearly all high school graduates attend some form of postsecondary education, yet many fail to obtain any degree, certification, or qualification by the time they leave (16). Improving high school preparation is a key to ensuring that students are prepared to succeed in the long term.

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