

Universal screening increases the representation of low-income and minority students in gifted education

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Low-income and minority students are substantially underrepresented in gifted education programs. The disparities persist despite efforts by many states and school districts to broaden participation through changes in their eligibility criteria. One explanation for the persistent gap is that standard processes for identifying gifted students, which are based largely on the referrals of parents and teachers, tend to miss qualified students from underrepresented groups. We study this hypothesis using the experiences of a large urban school district following the introduction of a universal screening program for second graders. Without any changes in the standards for gifted eligibility, the screening program led to large increases in the fractions of economically disadvantaged and minority students placed in gifted programs. Comparisons of the newly identified gifted students with those who would have been placed in the absence of screening show that Blacks and Hispanics, free/reduced price lunch participants, English language learners, and girls were all systematically “underreferred” in the traditional parent/teacher referral system. Our findings suggest that parents and teachers often fail to recognize the potential of poor and minority students and those with limited English proficiency.

gifted identification | universal screening | underrepresentation

Low-income and minority students are substantially underrepresented in gifted and talented education programs in the United States (1, 2). In 2012, 7.6% of White K–12 students participated in gifted and talented programs nationwide, compared with only 3.6% of Blacks, 4.6% of Hispanics, and 1.8% of English learners (ocrdata.ed.gov/StateNationalEstimations/Estimations_2011_12). Some of this gap may be due to differences in measured cognitive ability of students from different backgrounds and biases in these measures. However, the standard processes for gifted screening are based on teacher and parent referrals, and there is evidence of underreferral of qualified students from disadvantaged backgrounds—suggesting that teacher/parent discretion in the referral process may be a further barrier (3–7). If so, then a comprehensive and objective screening program might be able to raise gifted participation rates among underserved groups by increasing their referral rates for gifted evaluation.

We test this hypothesis using data from a unique natural experiment conducted by a large and diverse school district in the state of Florida (hereafter “the District”). State law dictates that students must achieve a minimum of 130 points on a standard IQ test to qualify for gifted status. English language learners (ELLs) and free-or-reduced price lunch (FRL) participants are subject to a lower 116 point threshold, known as “Plan B” eligibility. Even with this lower bar, however, the District’s gifted student population in the early 2000s mainly comprised White children from higher-income neighborhoods. Only 28% of gifted students in third grade were Black or Hispanic, compared with 60% of all students in the District. Thirteen regular elementary schools in the District had no gifted children in third grade in 2004 or 2005, but the gifted rate was nearly 10% at the 13 schools with the lowest fraction of FRL students.

In response to these disparities, the District introduced a universal screening program in spring 2005. Before this, candidates for gifted status were identified through parent and teacher referrals, mainly occurring in first and second grades. Under the new

program, all second graders completed the Naglieri Non-Verbal Ability Test (NNAT), a nonverbal test intended to assess cognitive ability independent of linguistic and cultural background (8). The NNAT takes less than an hour to complete and was administered by teachers in the classroom. The NNAT scores were used to construct a nationally normed index with a mean of 100 and SD of 15, similar to a standard IQ test. All students scoring at least 130 points on the test, and ELL/FRL students scoring at least 115 points, were automatically eligible to be referred for full evaluation and regular IQ testing by District psychologists. Because students could still be nominated for testing by parents or teachers as in earlier years, the aim of the screening program was to supplement the traditional referral system and boost referral rates for underrepresented groups.

The other key features of the District’s gifted identification process remained unchanged. Referred students were placed in a queue for a full IQ test given by a District psychologist, although parents could bypass the queue by paying to have their child tested privately. Students with IQs above the relevant threshold were eligible for gifted status, with the final determination based on parent and teacher inputs and scores on a checklist of “gifted indicators.” (*Supporting Information* provides more details on the District’s gifted screening and identification procedures. See ref. 9 for additional information on the District’s gifted program.) Importantly, the IQ thresholds and other requirements for gifted eligibility were unchanged. Any increase in the number of students identified as gifted following the introduction of the program can thus be attributed to the screening effort, and not to a relaxation of the standards for gifted status. [While the screening program may have raised parent and teacher awareness about the gifted program, the return of gifted rates to their prescreening levels after the program was suspended in 2011 (Fig. 1) suggests that increased awareness cannot explain the rise in gifted rates after the program’s introduction.]

Significance

A longstanding concern about gifted education in the United States is the underrepresentation of minorities and economically disadvantaged groups. One explanation for this gap is that standard processes for identifying gifted students, which are based largely on the referrals of parents and teachers, tend to miss many qualified students. Consistent with this hypothesis, we find that a universal screening program in a large urban school district led to significant increases in the numbers of poor and minority students who met the IQ standards for gifted status. Our findings raise the question of whether a systemic failure to identify qualified students from all backgrounds may help explain the broader pattern of minority underrepresentation in all advanced K–12 academic programs.

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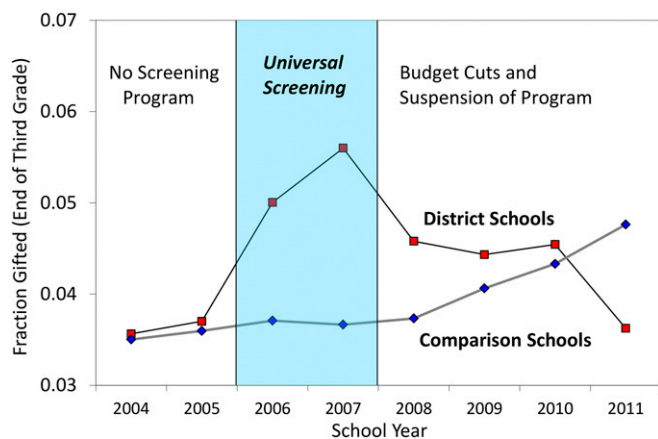


Fig. 1. Fraction gifted by end of third grade, District schools vs. matched comparison schools. (See *SI Materials and Methods* for details.)

As shown in Fig. 1, comparisons across cohorts of third graders suggest the introduction of universal screening led to large increases in the number of gifted students in third grade in the District. In contrast, the gifted rate in a matched comparison group of schools from other Florida districts was quite stable. However, because of financial pressures caused by the Great Recession, the District cut funding for IQ testing in 2007 and suspended the screening program in 2010. By 2011, the gifted share of third graders had returned to the level of 2004–2005. Meanwhile, program changes in other districts led to a gradual increase in gifted rates at the comparison schools after 2007.

In light of the history of the District’s screening program and the striking patterns in Fig. 1, we focus on simple “pre/post” comparisons between third graders in 2004–2005 (the two cohorts before the introduction of universal screening) and those in 2006–2007 (the two cohorts after). We confirm that the 2004–2005 (“pre”) cohorts form a valid comparison group for the 2006–2007

(“post”) cohorts. We then use between-cohort differences to measure the impact of the program on gifted participation rates, and to characterize the two key groups: students who were identified as gifted in the post cohort and would also have been identified in the pre cohort and those who were classified as gifted in the post cohort but would have been overlooked in the pre cohort. We refer to the former group as the “always takers” and the latter as the “compliers” [as in a standard analysis of experimental designs with incomplete compliance (10)]. By studying the characteristics of the compliers and their distribution across schools, we gain insight into the types of students who would normally “fall through the cracks” of the traditional referral system.

Our analysis yields three main conclusions. First, the introduction of the screening program led to a large increase in the fraction of students classified as gifted. Second, the newly identified gifted students were disproportionately poor, Black, and Hispanic, and less likely to have parents whose primary language was English. They were also concentrated at schools with high shares of poor and minority students and low numbers of gifted students before the program. Thus, the experiences of the District confirm that a universal screening program can significantly broaden the diversity of students in gifted programs. Third, the distribution of IQ scores for the newly identified students was similar to the distribution for those identified under the old system, particularly among students who qualified under the Plan B eligibility standard. The newly identified group included many students with IQs well above the minimum eligibility threshold, implying that even high-ability students from disadvantaged groups were being overlooked under the traditional referral system.

Materials and Methods

Student-Level Data and Sample Description. We use deidentified longitudinal records of students who were enrolled in the District for third grade between 2004 and 2011. (The research was approved by the Institutional Review Boards of the District and the National Bureau of Economic Research. Since we used only preexisting, deidentified records and did not conduct an experiment, we had no informed consent procedures.) For most of our analysis, we limit attention to students who were in third grade during the spring semester of the years from 2004 to 2007 and attended one of the 140 larger elementary schools in the District, excluding charter schools and other special schools.

Table 1. Characteristics of third-grade students at larger elementary schools, 2004–2005 versus 2006–2007

	All students		Plan A eligible (non-FRL, non-ELL)		Plan B eligible (FRL or ELL)	
	2004–2005	2006–2007	2004–2005	2006–2007	2004–2005	2006–2007
Student characteristics						
Female, fraction	0.48	0.48	0.48	0.48	0.49	0.49
White (non-Hispanic), fraction	0.35	0.32	0.54	0.49	0.15	0.13
Black (non-Hispanic), fraction	0.34	0.35	0.18	0.21	0.50	0.51
Hispanic, fraction	0.25	0.26	0.20	0.22	0.30	0.30
Asian, fraction	0.03	0.04	0.04	0.04	0.02	0.03
FRL, fraction	0.45	0.44	–	–	0.92	0.92
ELL, fraction	0.11	0.10	–	–	0.23	0.21
Plan B eligible (FRL or ELL), fraction	0.49	0.48	–	–	–	–
Parents speak English, fraction	0.66	0.65	0.76	0.74	0.55	0.56
School fraction FRL, mean	0.45	0.44	0.31	0.32	0.60	0.57
School fraction Black or Hispanic, mean	0.59	0.61	0.48	0.52	0.70	0.72
Achievement, mean*	0.04	0.03	0.36	0.35	–0.29	–0.32
IQ testing and gifted outcomes						
IQ tested by end of third grade, fraction	0.16	0.24	0.18	0.23	0.13	0.24
IQ score (if tested), mean	103.9	107.2	111.8	112.7	92.8	101.6
IQ tested and IQ ≥ gifted cutoff, fraction	0.038	0.071	0.055	0.077	0.019	0.064
Identified as gifted, fraction	0.033	0.055	0.051	0.066	0.014	0.043
Number of observations	39,933	38,132	20,288	19,830	19,645	18,302

Sample is all first-time enrollees in third grade between 2004 and 2007 at 140 larger elementary schools in the District; 2004 refers to 2003–2004 school year.

*Achievement is the average of reading and math scores on statewide tests, standardized across third graders in the District to have mean 0 and SD 1.

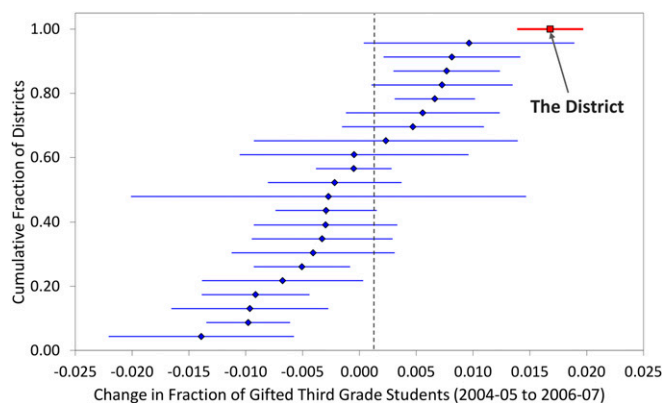


Fig. 2. Cumulative distribution of changes in the fraction of gifted third-grade students between 2004–2005 and 2006–2007. Districts are in the same state, with 20+ elementary schools. Lines represent 95% confidence interval.

Table 1 presents descriptive information on the students in our sample, measured at the end of third grade. Data from the prescreening period (2004 and 2005) show the District's student body was racially diverse, with 35% White non-Hispanic students, 34% Black non-Hispanics, 25% Hispanics, and 3% Asians. Some 45% were eligible for FRL, and 11% were ELLs. Altogether, 49% of third graders were either FRL or ELL (or both) and were therefore eligible to be evaluated for giftedness under the state's Plan B standard (with a lower IQ threshold). The other 51% had to meet the regular (Plan A) eligibility requirements. [Because FRL and ELL status may change over time (e.g., as English learners transition out of the language program), a student can be referred for IQ testing and placed in the gifted program as Plan B eligible in second grade but recorded as Plan A eligible in third grade. We note in *Results* when changes in student status are important for interpreting our results.] Overall, about 16% of students in the prescreening cohorts had an IQ score on record by the end of third grade, and 3.3% were classified as gifted.

Comparing mean characteristics of nondisadvantaged, or Plan A, students with the Plan B eligible group, we see that White and Asian students are overrepresented in the Plan A group and Blacks and Hispanics are overrepresented in the Plan B group. Consistent with the ELL status of many Plan B eligibles, these students are less likely to have parents whose primary language is English. Plan B students also had lower average achievement (measured as the average of reading and math scores on statewide tests in third grade), and they attended schools with higher fractions of minority and FRL participants, reflecting the District's residential segregation patterns and neighborhood-based school assignments. Importantly, despite facing a lower threshold for gifted status, Plan B students were less likely than Plan A students to have an IQ score on record and were much less likely to be classified as gifted.

Analysis of Student-Level Data. We use a simple pre/post differences or interrupted time series approach to analyze the student-level data from the District. For third graders as a whole and for subgroups, we present estimates from comparisons of the gifted share between the 2004–2005 (pre) and

2006–2007 (post) cohorts, and from models that adjust for a time trend. We use the same data to analyze the characteristics of the students who are impacted by the program (the compliers). Controlling for a smooth trend (reflecting longer-run demographic factors), any change in the mean characteristics of the gifted population can be attributed to disparities in the impact of the screening program across students with different characteristics. We estimate the fraction of compliers with a given characteristic as the trend-adjusted change in the population share that is both gifted and has the characteristic, divided by the trend-adjusted change in the share that is gifted (see *SI Materials and Methods*). We then compare the characteristics of compliers to those of the always takers who were identified under the traditional referral system. SEs are adjusted to allow for school-level error components in the fraction of gifted students.

The validity of the interrupted time series design is supported by evidence, presented in Table 1, that, among District third graders as a whole, students in the two post cohorts are very similar to those in the two pre cohorts. The only notable difference is a small decline in the fraction of Whites, offset by small rises in the fractions of Blacks and Hispanics. This stability suggests that student outcomes in the pre cohorts (2004–2005) represent a plausible counterfactual for the outcomes of students in the post cohorts (2006–2007), particularly if we adjust for a trend to capture long-run demographic shifts. Our approach is further supported by the patterns in Fig. 1, which compares the evolution of gifted participation rates for third graders in the District and in a matched comparison group of schools from other districts in Florida. Between 2004 and 2007, the gifted share of third graders in the comparison group is relatively stable, with only a slight upward trend (3.5% in 2004, 3.6% in 2005, and 3.7% in 2006 and 2007).

Use of School/Grade-Level Data from Other Districts. Fig. 1 is constructed using state data on the numbers and characteristics of students who took the statewide achievement tests in each school, grade, and year. For consistency with our student-level data, we use larger, noncharter elementary schools (≥ 40 third graders in each year). To construct a comparison group of schools from other districts that closely matches the characteristics of District schools, we weight the data using the estimated probability that a school with given characteristics is found in the District (see *SI Materials and Methods*).

We also use these school-level data to construct an alternative, “difference-in-difference” estimate of the impact of the screening program on gifted participation rates. Here the matched comparison group provides a counterfactual trend for gifted rates in the District, and we estimate the pre-post difference in the District's gifted rate net of the rate in the comparison group. As in the student-level analysis, we estimate models that allow for trends and SEs that allow for school-level clustering.

Because our experiment is confined to a single district, the precision of our estimates could be overstated by the presence of unobserved district-wide factors that cause the gifted rate to vary from year to year. To assess this concern, we constructed the empirical distribution of changes in the average third-grade gifted rate from 2004–2005 to 2006–2007 for the 23 larger districts in Florida (those with ≥ 20 elementary schools), excluding one other district that adopted a screening program in 2005, but including the District (which, with 140 elementary schools, is one of the largest in the state). We show this distribution in Fig. 2, along with the confidence intervals associated with the changes in each district (based on the variability in changes in the gifted rate across schools in the district). Two features are clear. First, among other larger districts, the variability in the average fraction gifted

Table 2. Estimates of screening program impact on gifted share of third graders

	Mean, 2004–2005	Mean, 2006–2007	Model 1: Difference	Model 2: Trend-Adjusted	Model 3: Trend-Adjusted Logit
School level					
District vs. comparison	0.003	0.019	0.016 (0.003)**	0.016 (0.003)**	
Student level					
All students	0.033	0.055	0.022 (0.001)**	0.015 (0.003)**	1.451 (0.136)**
Plan A eligible	0.051	0.066	0.015 (0.002)**	0.006 (0.005)	1.108 (0.115)
Plan B eligible	0.014	0.043	0.029 (0.002)**	0.025 (0.004)**	2.743 (0.446)**
White (non-Hispanic)	0.058	0.076	0.018 (0.003)**	0.007 (0.007)	1.123 (0.128)
Black (non-Hispanic)	0.011	0.027	0.016 (0.002)**	0.009 (0.004)*	1.741 (0.462)*
Hispanic	0.021	0.057	0.036 (0.003)**	0.027 (0.006)**	2.183 (0.349)**

First row shows sample means in the pre and post years of the gap in the fraction gifted between District schools and comparison group schools in other districts, and estimates of the program impact based on the difference in differences. Remaining rows show sample means and linear probability estimates (models 1 and 2) or odds ratios (model 3) using students in District schools only (see Table 1 for sample sizes). Parentheses contain SEs, clustered by school in all models. (** $P < 0.01$; * $P < 0.05$.)

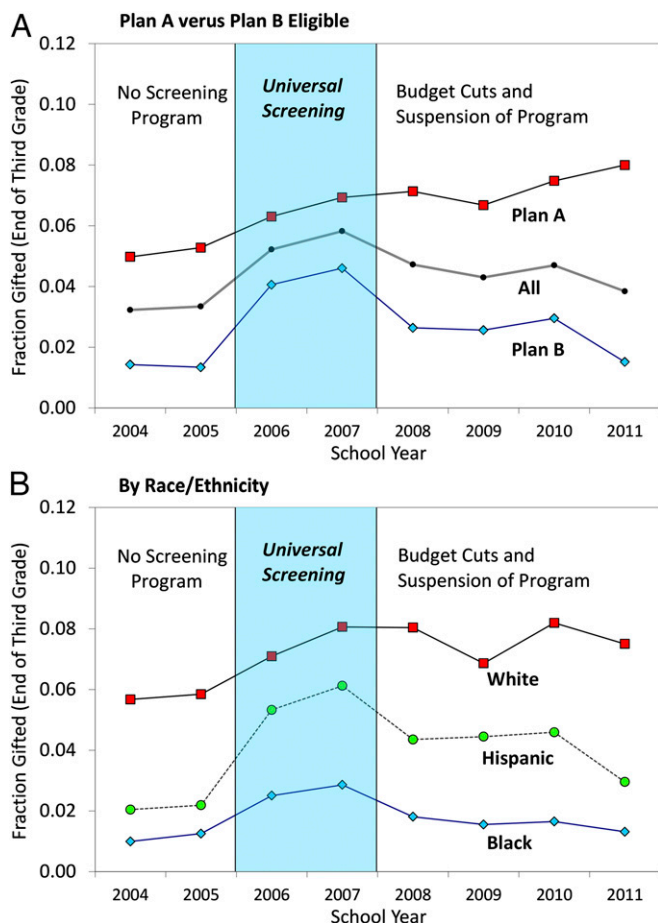


Fig. 3. District trends in fraction gifted by end of third grade.

between the pre and post cohorts is relatively small. Second, relative to this distribution, the change in the fraction gifted in the District is a clear outlier. The empirical mean and SD of the changes across the 22 other districts are -0.001 and 0.007 . The observed change in the District is 2.65 SDs from the mean for the other districts, which can be interpreted as a t test statistic. We

conclude that a simple within-District differences analysis provides a plausible estimate of the effect of the screening program on the overall fraction of gifted third graders.

Results

Impact of Screening on Rates of IQ Testing. Table 1 shows differences between the pre and post cohorts in the fraction of students who are IQ tested by the end of third grade, the mean IQ score of those tested, and the fraction who are tested and have an IQ score above the gifted eligibility cutoff. Students are IQ-tested for a variety of reasons, including assessment for intellectual and learning disabilities, so the number with an IQ test in each cohort exceeds the number evaluated for gifted status, and their average IQ score is well below the gifted eligibility threshold. Between the pre and post cohorts, however, the increase in IQ testing was presumably driven by a rise in referrals caused by the screening program (see *SI Results*, Fig. S1). With the introduction of universal screening, the overall fraction of third graders with an IQ test rose by eight percentage points (ppt.), with a much larger gain for Plan B eligibles—large enough to close the testing gap between the two groups. The fraction of third graders with IQs above the gifted threshold also rose in both groups, again with a larger increase among Plan B eligible students. In the post cohorts, 6.4% of the Plan B group had IQs above the threshold, compared with 7.7% of Plan A eligibles. Most importantly, the fraction of students classified as gifted also increased in both groups, rising from 5.1% to 6.6% among Plan A students and from 1.4% to 4.3% in the Plan B group.

Impact of Screening on Gifted Participation Rates. Table 2 presents estimates of the impact of the screening program on gifted placement rates from different models and for various subgroups. The first row shows the difference-in-differences estimates based on the school-level data. The simple difference of differences between District and comparison group schools is 1.6 ppt., with an SE of 0.3 ppt. The estimate from a model that allows gifted rates at schools in the state to have a trend over time is virtually the same.

The remaining estimates in Table 2 are from models that use student-level data from the District; Fig. 3 shows the time series patterns in gifted rates based on these data. The simple difference estimate for all District third graders shows an increase of 2.2 ppt. The trend-adjusted difference (model 2) is 1.5 ppt. with an SE of 0.3 ppt., which is nearly identical to the difference-in-differences estimate. The final column (model 3) shows odds ratios estimated using a logit model that adjusts for a trend as in model 2. The

Table 3. Characteristics of all gifted third-grade students and those identified through screening

Student characteristic	Full sample				Plan B eligible only			
	All gifted		Compliers (newly identified)	Difference, compliers–always takers	All gifted		Compliers (newly identified)	Difference, compliers–always takers
	2004–2005 (Pre)	2006–2007 (Post)			2004–2005 (Pre)	2006–2007 (Post)		
Plan B eligible	0.21	0.38	0.79	0.59 (0.16)**	–	–	–	–
Female	0.45	0.47	0.56	0.11 (0.13)	0.44	0.47	0.52	0.08 (0.08)
White (non-Hispanic)	0.61	0.43	0.08	–0.53 (0.15)**	0.28	0.18	0.09	–0.19 (0.08)*
Black (non-Hispanic)	0.12	0.17	0.23	0.12 (0.10)	0.36	0.31	0.24	–0.12 (0.10)
Hispanic	0.16	0.27	0.46	0.30 (0.11) **	0.24	0.39	0.45	0.21 (0.09)*
Asian	0.08	0.08	0.14	0.06 (0.07)	0.08	0.08	0.18	0.10 (0.05)
FRL	0.20	0.35	0.67	0.47 (0.13)**	0.95	0.93	0.84	–0.11 (0.05)*
ELL	0.02	0.05	0.18	0.16 (0.06)**	0.10	0.14	0.23	0.13 (0.06)*
Parents speak English	0.74	0.62	0.29	–0.45 (0.14)**	0.57	0.47	0.30	–0.27 (0.10)**
School fraction FRL	0.28	0.34	0.47	0.17 (0.08)*	0.55	0.51	0.48	–0.07 (0.05)
School fraction minority	0.45	0.54	0.70	0.25 (0.08)**	0.65	0.67	0.66	0.01 (0.04)
Achievement*	1.39	1.22	0.97	–0.42 (0.16)*	1.15	0.91	0.81	–0.35 (0.11)**
IQ score	131.6	129.6	124.3	–7.36 (2.71)**	124.2	124.4	124.5	0.38 (1.14)

For full sample, $n = 78,065$; for Plan B sample, $n = 37,947$. Parentheses contain SEs, clustered by school. (** $P < 0.01$; * $P < 0.05$.)
 *Achievement is the average of reading and math scores on statewide tests, standardized across third graders in the District to have mean 0 and SD 1.

Impact on School Distribution. A key feature of the District's gifted program before universal screening was the unequal distribution of gifted students across schools. This is illustrated by the blue line in Fig. 5, which plots the cumulative share of gifted third graders in the 2004–2005 cohorts among the District's 140 larger elementary schools against the cumulative share of all third-grade students. The schools are ranked by their fraction gifted, with the first school contributing the largest relative share of gifted students. Half of gifted students in the pre cohort were at schools that enrolled only 18% of the entire third-grade population, whereas half of all third-grade students in the District were at schools that enrolled a total of only 16% of the gifted students.

The impact of the screening program is confirmed by the green line in Fig. 5, which shows the same plot for the 2006–2007 cohorts. This line is much closer to the 45° line, implying a more equal distribution of gifted students across schools. In particular, all 140 larger elementary schools in the District had at least one gifted third-grade student in 2006 or 2007, whereas, in 2004 and 2005, 13 schools had no gifted students. The third (red) line in Fig. 5 shows the distribution of the compliers across schools. This line is mostly below the 45° line, implying that, on average, the compliers were likely to come from schools with relatively low fractions of gifted students in the pre cohort.

Discussion

Critics of gifted education programs have long noted the underrepresentation of minorities, nonnative English speakers, and children from poor families. In response, a substantial body of research has focused on alternative methods for assessing giftedness that are less reliant on standard IQ tests (11–13). Over the past 30 y, states and school districts have introduced new criteria for determining giftedness (e.g., grids using a combination of IQ and achievement) and also adopted different thresholds for minorities and economically disadvantaged groups (14). Nevertheless, the fractions of Black and Hispanic students in gifted programs remain far below the fraction of Whites and Asians, and disparities between socioeconomic groups persist.

An alternative and complementary explanation for the representation gap is that the referral processes by which students are nominated for gifted evaluation tend to systematically miss many qualified minorities and economically disadvantaged students. The experiences in the District following the introduction of universal screening for second graders strongly support this hypothesis. With no change in the minimum standards for gifted status, the screening program led to a 174% increase in the odds of being identified as gifted among all disadvantaged students, with a 118% increase for Hispanics and a 74% increase for Blacks.

A comparison of the newly identified gifted students to those who would have been identified even without screening shows that Black and Hispanic students, FRL participants, ELLs, and girls were all systematically “underreferred” to the gifted program. Newly

identified gifted students were more likely to come from schools in poor neighborhoods with few gifted students, leading to a substantial equalization in gifted participation rates across schools. On average, the newly identified students also had IQ scores that were similar to those of the always takers in the same eligibility group, although they had lower standardized achievement scores. We hypothesize that parents and teachers often fail to recognize the potential of many poor, immigrant, and minority children with less than stellar achievement levels. The large impacts for Hispanics, ELLs, and students with non-English speaking parents suggest that language differences, in particular, are an important barrier to identifying gifted students. At the same time, the combination of large impacts for Blacks and negligible effects for Whites suggests that factors related to race/culture may also play a role. Thus, although our findings show that underrepresented groups fare better under a screening process that places less weight on subjective assessments, they also suggest that training to improve the intercultural competence of teachers may be beneficial. (It is also worth noting that while biases or disparate impact of IQ tests are a common concern, our findings are consistent with the argument often made by proponents of IQ testing that it can serve to limit biases associated with subjective judgment. We thank a referee for this point.)

An important limitation of our analysis is that it pertains to only a single school district. Although the student population in the District is highly diverse, and arguably representative of the student population in many large urban districts, the District's gifted policies have a number of distinctive features. First, both the use of a non-verbal screening test and the lower Plan B referral threshold may have been important factors in the success of the District's screening program. Second, the District has strict IQ thresholds for eligibility, and, before the introduction of the screening program, the District had relatively low gifted rates (around 3.5% for third graders) that reflected the importance of the IQ thresholds. At a minimum, however, our findings suggest that the underrepresentation of poor and minority students in gifted education is not due solely to the lower IQ scores of these students. A substantial share of the gap appears to be caused by the failure of the traditional parent/teacher referral system to identify high-ability disadvantaged students. More broadly, disadvantaged groups are significantly underrepresented in advanced academic programs at all levels of K–12 education (15). Our findings raise the question of whether this larger pattern of underrepresentation is also due in part to a failure to identify and serve capable students from all backgrounds.

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