High hopes and harsh realities:
The real challenges to building a diverse workforce

TECHNICAL APPENDIX

The diversity gap estimates for black and Hispanic teachers in future years were derived from a series of calculations we conducted to approximate the racial/ethnic makeup of the U.S. public school student population and teacher workforce over time. To do these calculations, we first obtained population projections for the U.S. from the Census, which estimate the count of individuals in the U.S. by age and race/ethnicity for each year through 2060.[1] These projections constitute the backbone of our calculations; our approximations of the student population and teacher workforce over time simply apply the current relationships between the population and students and teachers into the future.[2] This Appendix provides details on how these relationships are modeled and pieced together to generate the parity year estimates.

1. Student Population

To generate projections of the population of public students over time, we calculated the ratio of public school enroll-ments based on the Common Core of Data (2012-2013),[3] and Census population estimates (for children between the ages of 4 and 17) for the same year. Calculations were done separately by race/ethnicity, which resulted in the following values: 82 percent white, 97 percent black, and 92 percent Hispanic students are enrolled in public schools. These same ratios are applied to Census projections in the future to approximate the public school student population by race over time.

2. Components of the Teacher Workforce

Modeling the teacher workforce over time and how it may change under different assumptions about the flows of teachers into or out of the profession by race requires that we build a dynamic model of the teacher workforce over time. Our model had four interconnecting components: the demand of teachers over time, inflows into the teaching profession, outflows from the teacher workforce, and a pool of certified but non-working teachers. We describe each of these components below.

2.1 The demand for teachers over time

To estimate the demand for teachers over time, we first find the ratio between the total number of student enroll-ments and the current teacher workforce. The size and demographics of the current teacher workforce are based on statistics provided in the Teacher and Follow up Survey (2012-2013).[4] These numbers combine to calculate a

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1 Available through the Census website: http://www.census.gov/population/projections/data/national/2014.html

2 We assume the same ratios observed in the most recent data between the projected population and students, teachers, and college graduates persist forward into future years. This is a strong assumption, but necessary to keep the calculations straightforward; yet, only if these relationships change by race (for example, more white students attend public schools over time, but black and Hispanic groups to not change) will changes in these assumptions make a qualitative difference on the parity year calculations. A full simulation-based modeling of probabilistic distributions of these relationships over time is beyond the scope of this brief.

3 Snyder, T.D., de Brey, C., & Dillow, S.A. (2016). Table 203.50.

4 Goldring, R., Taie, S., & Riddles, M. (2014). Table 2.

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ratio of 14.73 students to each teacher. We apply this same ratio to the student population projections to model the future demand for teachers. Applying these same ratios to each racial/ethnic subgroup, we generate future demands for teachers of each race/ethnicity—these are the target figures that the teacher workforce of the future must meet in order to achieve parity.

2.2 Inflows into the teaching profession

Teachers are modeled to enter the workforce through one of three paths: an undergraduate bachelor's degree in a traditional teacher training program, a graduate degree in a traditional training program, and alternative certification. As above, patterns of entry into the profession observed currently are assumed to persist forward into time, though the exercise allows these assumptions to be changed to investigate the relationship with parity for racial/ethnic subgroups. Each path will be discussed in turn.

2.2.1 Bachelor's degree in a traditional teacher training program

We model the number of bachelor's degree recipients over time by first finding the ratio between the Census population estimate of adults age 22 (by race/ethnicity) and the number of bachelor's degree recipients by race/ethnicity based on IPEDS (2012).[5] Those graduating with a degree in education are taken as a subset of the first using IPEDS (Table 322.30), again based on race/ethnicity.[6] Not all of these graduates will choose to teach; we model the choice among undergraduate degree holders to enter teaching using responses from the Baccalaureate and Beyond Longitudinal Study (B&B:08/12), which report the share of graduates who report their primary job as a teacher in their fourth year[7] after graduation by race/ethnicity.[8] Finally, we use responses from the same survey to estimate the share of education graduates who indicate they do not want a career as a teacher by race/ethnicity.[9] Table 1 shows the ratios we applied to the data from these sources.

Table 1

Race/ethnicity	Proportion getting bachelor's degree	Proportion of bachelor's degrees in education major	Proportion of new graduates teaching in 4th year	Proportion choosing not to teach
White	46.8	6.89	59.0	5.5
Black	27.8	4.34	52.6	23.9
Hispanic	19.9	3.83	52.4	10.3

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5 Snyder, T.D., de Brey, C., & Dillow, S.A. (2016). Table 322.30.

6 We acknowledge not all students in an education major will become licensed teachers, nor do all bachelor's degree holders that become licensed teachers necessarily major in education (some may major in a subject with an education minor). However, our use of students with an education major is a straightforward way to approximate the flow of undergraduates by race into the profession.

7 We acknowledge that some teachers could have begun teaching after graduation and left the profession before the fourth year, however, this is the best approximation by race/ethnicity that we could find and matches information we found in other sources. Cataldi, E.F., et al. (2011) report that 50.8 percent of graduates with a major in education by 2008 started teaching in their first year, though this report does not disaggregate results by race/ethnicity.

8 Using the tool NCES QuickStats we created a table with the variable primary job occupation in 2012 by race-ethnicity for respondents who reported having a major in education. We used the values of the category: PK-12 educators. https://nces.ed.gov/Datalab/postsecondary/index.aspx

9 Using the tool NCES QuickStats we created a table with the variable teaching status as of 2012 by race-ethnicity for respondents who reported having a major in education. We used the values of the category: taught or prepared since BA and not currently considering K-12 teaching. https://nces.ed.gov/Datalab/postsecondary/index.aspx

2.2.2 Master's degree in a traditional training program

We model the number of master's degree recipients over time by first finding the ratio between the Census population estimate of adults age 25-32 (by race/ethnicity) and the number of master's degree recipients by race/ethnicity based on IPEDS (2012). Those graduating with a degree in education are taken as a subset of the first using IPEDS (Table 323.30), again based on race/ethnicity.

We do not have a reliable source of information about the share of master's degree recipients who are doing so specifically to enter the teaching profession (some may already have a license to teach, others may be pursuing a master's degree to pursue a career in education leadership or another role that does not include teaching). Nor do we have any information on those who successfully get a job in the classroom. We also lack similar information about entrants into the profession through the alternative certification route. As a result, we must make a series of assumptions about entrants into teaching through both of these routes. We base these assumptions on the composition of incoming teachers by race/ethnicity as estimated by the Schools and Staffing Survey (SASS), 2011–12,[10] and based on the composition of teachers by pathway into the profession as reported in the Profile of Teachers in the U.S. 2011.[11] Though neither source provides complete information, they illustrate that many minority teachers are entering through both master's and alternative certification programs.

Table 2.[12]

Race/ethnicity	Proportion of the population getting a master's degree	Proportion of master's degrees in education	Proportion of master's degree graduates entering the teaching profession (assumed)	Proportion of new graduates teaching first year (assumed)
White	2.31	26.5	33	85
Black	1.99	21.2	33	55
Hispanic	0.75	24.8	33	85

2.2.3 Alternative certification programs

We model the number of alternative certification's degree recipients over time by finding the ratio between the Census population estimate of adults age 25-32 and the number of alternative certificate degree recipients based on the estimates from the National Center for Education Information (2008-09).[13] We use figures from the Profile of Teachers in the U.S. 2011[14] to estimate the share of alternative certificate degree recipients by race/ethnicity (70 percent white, 11 percent black, and 15 percent Hispanic).

Finally, as with master's degree entrants above, we do not have sufficient information to account for the number of those in alternative certification programs who successfully enter the classroom through this route. Based on

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10 U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), Public School Teacher Data File. 2011–12.

11 Feistritzer, C.E. (2011). Chart 5 and Chart 16.

12 We assumed a much lower proportion of Black graduates teaching the first year in comparison to whites and Hispanic to attempt matching the composition of incoming to by race/ethnicity as estimated by the Schools and Staffing Survey 2011-2012 (78.9 percent white, 6.5 percent black, and 11.8 percent Hispanic). U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), Public School Teacher Data File. 2011–12

13 Feistritzer, C.E. (2011). Chart 11.

14 Feistritzer, C.E. (2011). Chart 5.

information provided by The National Center on Education[15], states vary in their use of alternative certifications, with some states using them as a means to license teachers moving in from another state or obtaining a different specialization to teach in the same state. Hence, we know many alternative certification recipients are not doing so as a mechanism to enter the teaching profession. As a result of missing data here and those for master's degree recipients, we must make a series of assumptions about entrants into teaching through both of these routes. As above, we base these assumptions on the composition of incoming teachers by race/ethnicity as estimated by the Schools and Staffing Survey (SASS), 2011–12,[16] and based on the composition of teachers by pathway into the profession as reported in the Profile of Teachers in the U.S.

Table 3.

Race/ethnicity	Proportion of the population getting an alternative certificate	Proportion of alternative certificate recipients teaching first year (assumed)
White	0.21	50
Black	0.15	30
Hispanic	0.13	50

2.3 Outflows from the teacher workforce

We estimate outflows from the teacher workforce by race/ethnicity based on the Teacher Follow-up Survey from the Schools and Staffing Survey (2012-2013).[17] The percentage of those leaving the workforce and into retirement status by race/ethnicity are based on the Teacher Follow-up Survey from the Schools and Staffing Survey (2004-2005).[18] Table 4 presents the values we found to represent outflows.

Table 4.

Race/ethnicity	Exiting the teacher workforce	Proportion of those leaving going to retirement
White	7.5	39.1
Black	10.1	47.5
Hispanic	8.0	23.6

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15 National Center for Education Information. (2010).

16 U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), Public School Teacher Data File. 2011–12.

17 Goldring, R., Taie, S., & Riddles, M. (2014). Table 2.

18 U.S. Department of Education, National Center for Education Statistics. Teacher Follow-up Survey (TFS), Former Teacher Data File. 2004-2005. Table 13. This table shows that 39.2 percent of the teachers that are leaving the profession go into retirement status. We found a similar value in a more recent report from NCES, Goldring, R., Taie, S., & Riddles, M. (2014). Table 6. NCES estimates that 38.3 percent of teachers who leave the workforce go into retirement. We could not use this survey because the published data for retirement was not broken out by race.

2.4 The pool of certified but non-working teachers

As will become clear in the following section, we require a fourth component of the labor force that represents certified teachers who are not currently working in the labor force, but who potentially could join in future years. In real life, licensed teachers could exit the workforce temporarily for graduate school, to raise a family, to explore alternate career options, or for a variety of other reasons and then eventually come back to the teacher workforce. We approximate this pool by combining two different sources: 1) all incoming teachers who neither join the workforce nor claim they are not interested in a teaching career; and 2) all exiting teachers who do not claim to go into retirement status. The values for these relationships are presented in Table 5. Note that for simplicity we model the flow of new additions to this pool in each year (to approximate the racial/ethnic makeup of these teacher candidates), but we do not model the cumulative stock of the pool over time.

Table 5.

Race/ethnicity	Incoming teachers through bachelor's degree not in classroom nor interested in different career	Incoming teachers through master's degree not in classroom (assumed)	Incoming teachers through alternative certificates not in classroom (assumed)	Exiting teachers not claiming retirement
White	35.5	15	50	60.9
Black	23.5	45	70	52.5
Hispanic	37.3	15	50	76.4

3. Relationships between Teacher Workforce Components

Starting from the current workforce, projections of the workforce composition require us to model how these various workforce components interact and feed into each other over time.

$$Workforce_{t,r} = Workforce_{t-1r} - Outflows_{t-1r} + Inflows_{t,r} + Hires\ from\ C/NW\ Pool_{t,r}\ (1)$$

This equation shows how the teacher workforce in year *t* is comprised of the workforce present in the prior year (*t-1*) less the outflows, with the addition of new novice teachers into the profession. Note that the workforce is dynamically constructed by racial/ethnic groups (using the subscript *r*).

Note that we have no guarantee that the demand for teachers in a given year will meet the supply on its own based on the assumptions of inflows and outflows over time. To fill the gap, we assume this difference is filled by hires from the pool of certified/non-working teachers. Because we have no data on how teachers are hired specifically from this route, we assume the racial/ethnic composition of these hires are representative of the composition of this pool for each period.

To ensure we hire the correct number of teachers from the certified/non-working pool, we apply the following market clearing condition, equating total teachers demanded with teachers supplied (regardless of teacher race/ethnicity).

$$Demand_t = Workforce_t\ (2)$$

Student and teacher diversity parity is achieved for a particular racial/ethnic group when that group's teacher work-force employed in a year is equal to or greater than the quantity of teachers demanded to be fully representative of student enrollment for that year.

$$Workforce_{t,r} \geq Demand_{t,r} \quad (3)$$

4. Modeling Alternative Scenarios

With the construction of the teacher workforce model described above, our primary thought exercise, as described in the paper, is to understand how fixes to various points in the teacher pipeline translate to reductions in the racial diversity gaps in the future. We do not purport to know what strategies can achieve the representation numbers presented in these scenarios, but we are simply exploring how equality or even more minority advancement might influence workforce diversity in the future. For each of the four points in the pipeline we identify (college enrollment and graduation, choosing a teaching career, hire into a teaching job, and retention in a teaching job), we present two scenarios: 1) a scenario in which minority teacher/prospective teacher representation is equal to that of white teachers; and 2) a proactive scenario in which minority teachers/prospective teachers are promoted slightly above white teachers. The numbers used in the proactive scenarios are detailed in the footnotes of the main report.

5. Caveats and Limitations

The calculations in the workforce model are intended to provide approximations of future student and teacher workforce diversity by applying estimations of current relationships to Census population projections into the future. These calculations are not intended to be actual forecasts of future employment, and will not reflect future student or teacher populations to the extent that the relationships between these components change over time (where we assume they are stable). For example, we assume a constant relationship between students and teachers into the future, even though this number has historically varied over time and may continue to do so in the future. If the future requires fewer teachers to the same number of students, this would imply fewer minority teachers would need to be hired to reach parity (or vice versa).