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Research Brief

THE *PROSPECTIVE* TEACHER PIPELINE: SIMULATION EVIDENCE ON LEVERS TO INFLUENCE TEACHER DIVERSITY

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The *Prospective* Teacher Pipeline: Simulation Evidence on Levers to Influence Teacher Diversity

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1. Introduction

The teacher workforce in the United States does not reflect the increasing diversity of the nation's K-12 students. As a simple, but telling marker of what is often referred to as the "teacher diversity gap": Students of color enrolled in public schools represent over 50% of the student body (U.S. Department of Education National Center for Education Statistics, 1997, 2021) whereas only about 20% of the United States teacher workforce are teachers of color (U.S. Department of Education National Center for Education Statistics, 2016).

The last decade has seen increased policy focus on this diversity gap (Boser, 2011, 2014; Carver-Thomas, 2018; Gist, 2019). Academic attention to the implications of the diversity gap is longstanding (e.g., Cole, 1986; Ehrenberg et al., 1994; Irvine, 1988), but there is also a growing body of high-quality research pointing out benefits to increasing the diversity of teachers, particularly for students of color. Numerous studies find, all else equal, that students of color (and Black students in particular) have increased test scores when they receive instruction from a same race teacher (Dee, 2004; Egalite et al., 2015; Yarnell & Bohrnstedt, 2018). Other studies suggest that Black students who are assigned to Black teachers are significantly less likely to drop out of high school and are more likely to go to college (Lindsay & Hart, 2017). One study measured that for the most disadvantaged Black males, exposure to Black teachers may reduce high school dropout rates by 39%, a sizable impact compared to other educational policy and social sciences interventions (Gershenson et al., 2018).

There are a number of potential explanations for race-match (or also sometimes referred to as role modeling effects) of teachers. For instance, some evidence points to the potential that having a race match leads teachers to have differential expectations of students (Beady & Hansell, 1981; Ferguson, 2003). There is also evidence that teachers may interpret student behavior differently, depending on race. For instance, exposure to same-race teachers was shown to reduce the rates of exclusionary discipline for Black students (Lindsay & Hart, 2017; Shirrell et al., 2021), and eliminate bias in assignment to gifted and talented programs (Grissom & Redding, 2016). Teachers of color were also shown to improve Black students' enrollment in rigorous academic courses (Klopfenstein, 2005), provide better teacher assessments and evaluations of their students (Dee, 2005; Ouazad, 2008), and even reduce teen pregnancy (Atkins & Wilkins, 2013).

Other studies point to the critical function of teachers as role models, and the lack of such models for students of color that are less likely to meet teachers who share their race (Pitts, 2007; Villegas et al., 2012) . Cultural differences between teachers and students may also lead to less effective instructional practice, and phenomena such as unfair disciplinary treatment, and biased evaluation of students' ability (Gregory, 1997; Losen & Skiba, 2010; McCarthy & Hoge, 1987; Skiba et al., 2011), which may be affected by the demographic match of teachers and students (Shirrell et al., 2021).

Districts, states, and the federal government have been promoting policies of diversification. For example, in 2021 alone, eight states including Arkansas, Colorado, Kentucky, Minnesota, Montana, New Jersey, New Mexico, and Oregon have passed legislation aiming at diversifying the teacher workforce (DeRamus-Byers, 2021). Other states have created "Grow Your Own" programs, teacher residencies, programs to improve retention of teachers of

color and other initiatives aiming to diversify their workforce (Carver-Thomas, 2018; Gist, 2019; Griesbach, 2021). A focus on teacher diversity is not new; policy and research on the diversity of the teacher workforce dates back decades (e.g., Haselkorn & Fideler, 1996; Villegas & Clewell, 1998). But while the workforce is more diverse than it was 20 years ago, it fails to keep up with the diversification of the student population.[1] And while the representation of some groups, such as Hispanic teachers in the workforce, has increased, other groups have not seen similar growth. In fact, the rate of Black teachers in the workforce dropped by one percentage point between 2003 and 2012 (Goldhaber et al., 2015).

Research suggests that the drivers of racial disparities in the teacher workforce range across multiple career steps from recruitment to retention: universities struggle to recruit candidates of color for an array of reasons, including concerns on student loan debt and others; those that are recruited experience racial disparities in teacher preparation programs and graduation; and later in passing of state tests and getting licensed; and finally those that do become school teachers experience the disproportionate attrition of teachers of color from the profession in the early years (Carver-Thomas, 2018; Gershenson et al., 2021; Gitomer & Latham, 2000; Ingersoll & May, 2011). Thus, underrepresentation of teachers of color in the workforce is made up of accumulating disparities happening at different stages of their careers with different entities responsible for each disparity (Putman et al., 2016). Without a clear picture of the size of the change of racial demographics in each career stage, practitioners may fail to diagnose the drivers of these disparities and engage in strategies that may prove ineffective.

Most diversification strategies have documented a focus on one level only. For example, states have developed Grow Your Own programs to try and attract people of color to the profession, universities have offered scholarships programs for students of color, and districts and schools have developed teacher mentoring and induction programs to reduce the attrition of teachers of color (Carver-Thomas, 2018). But what is the likelihood for any of these programs, by themselves, to have a significant impact on the diversity of the teacher workforce?

In this research brief, we present evidence on how the diversity of the teacher workforce changes as *prospective* teachers advance through the teacher pipeline: tracking from 12th grade students as some obtain the education and certifications required to be eligible to teach in public schools, and some apply to and are hired into public schools. We are not the first to examine the teacher pipeline in this way (e.g., see, Putman et al., 2016), but we advance the literature by incorporating increased (and more recent) knowledge about how changes in the demographics of individuals who advance through different junctures or "nodes" in the pipeline (e.g., graduating high school and college, taking required teacher licensure exams, etc.) affect the diversity of the teacher workforce. We use this technique to simulate how changes in the likelihood that different

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[1] The teacher workforce is actually far more diverse today than it was in the mid-1980s, when teachers of color represented only about 12% of the workforce Ingersoll, R. M. (2017). A Quarter Century of Changes in the Elementary and Secondary Teaching Force: From 1987 to 2012-Statistical Analysis Report. ; at this point, students of color represented roughly 30% of all public school students (U.S. Department of Education National Center for Education Statistics. (2016). *National Teacher and Principal Survey (NTPS), "Public School Teacher Data File," 2015–16*. https://nces.ed.gov/surveys/ntps/tables/ntps_1t_051617.asp .

demographic groups advance through the pipeline would be expected to affect the diversity of the early teacher workforce.

2.   Nodes in the *Prospective* Teacher Pipeline

To assess the potential influence on the diversity of the workforce of an improvement in diversity in one career juncture, we used data compiled for an interactive CALDER teacher diversity tool that provides an estimation on the rate of teachers of color at each juncture of the teacher career continuum.[2] The data starts with the demographic composition of 12th graders and explores the probabilities of each demographic group to persist towards becoming and remaining as teachers at 9 "nodes,": 1) graduating high school; 2) attending a two- or four-year college; 3) taking a basic skills licensure test often required for entry into a teacher preparation program (TPP); 4) passing the basic skills test; 5) attending a TPP, completing college and their TPP; 6) taking required state subject matter licensure tests; 7) passing required subject matter tests; 8) applying to teach in a public school, getting offered a position, taking the offer, and hence entering classrooms as teachers; and 9) retaining in the teaching workforce after three years.

The data have a number of limitations and require a number of simplifications, drawing on research that is often state-specific and applying it to the national numbers. Indeed, there is no national data system that provides a comprehensive picture of how the prospective teacher workforce is changing demographically as individuals progress through the different nodes in the prospective teacher pipeline (Goldhaber and Holden, 2021). But we argue the data nevertheless provides a useful estimate on how changes in the likelihood of individuals progressing through different stages in the teacher pipeline (described below) would influence the diversity of the teacher workforce.

The distribution of teachers by race/ethnicity at each of the nodes that were used to create the probabilities are displayed in Figure 1. This figure is based on the idea that individuals take a path that entails entering a two- or four-year college and a teacher preparation program through a traditional pathway, in the sense that they graduate with a baccalaureate degree and enter a college- or university-based traditional teacher education program.[3] There are other routes; for instance, in some states community colleges are playing an increased role in providing training for those wishing to teach (e.g., California Commission on Teacher Credentialing, 2020) and in many states there are alternative pathways into teaching that do not entail college- or university-based teacher education (National Academies of Sciences Engineering and Medicine, 2020), and a significant share of teachers of color come through these alternative routes.[4]
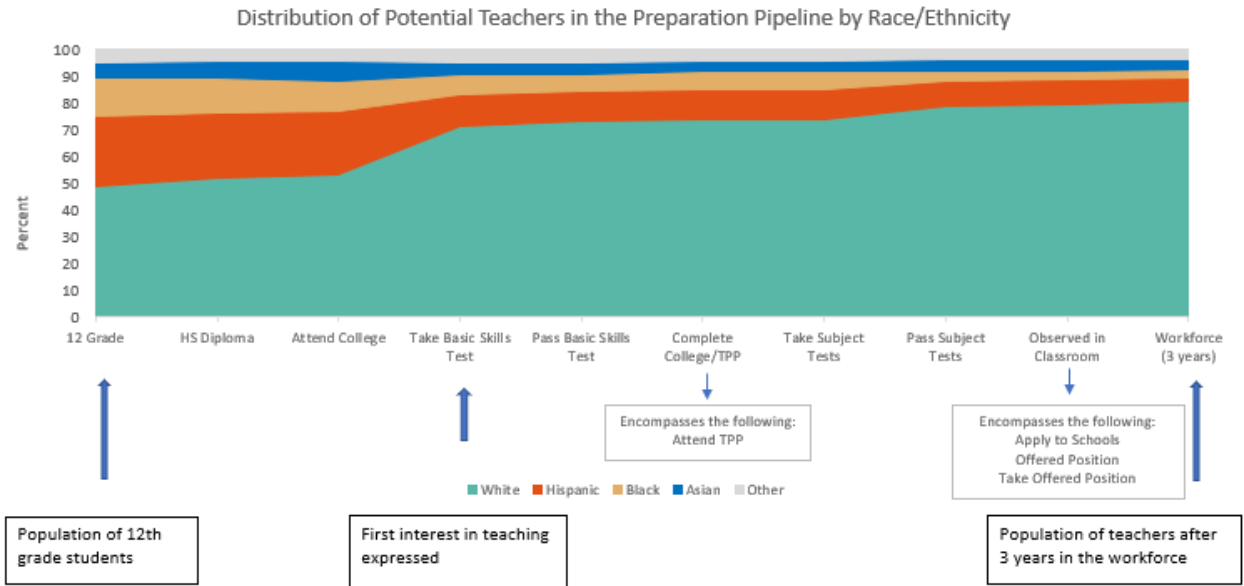
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[2] See https://caldercenter.org/data-visualizations/understanding-how-diversity-teacher-preparation-pipeline-contributes-diversity for the tool, and https://caldercenter.org/data-visualizations/understanding-how-diversity-teacher-preparation-pipeline-contributes-diversity/cautions-and-assumptions for more detail on where information from each of the nodes is described.

[3] Most teachers are credentialed through a Bachelor or Master degree program, though in some states, community colleges are playing an increased role in providing training for those wishing to teach. We include those who attend either 2- or 4-year schools as a starting point, because many individuals who start in a 2-year college transfer to a 4-year college.

[4] See https://caldercenter.org/msis-and-alternative-certification.

Figure 1

Distribution of Potential Teachers in the Preparation Pipeline by Race/Ethnicity

Again, the above figure is created by making assumptions about the likelihood that prospective teachers with different demographics (White, Hispanic, Black, Asian, or Other) are likely to transition through the various nodes in the teacher pipeline. Using the available data on the changes in each step, we estimate the probability that an individual of a certain race will get through each step, and use that probability to simulate changes in individual steps and their impact on the eventual teacher workforce.[5] A simulated policy outcome and change in the number of people advancing through one node in the pipeline will cascade throughout the following nodes using the calculated probabilities.

Despite the limitations of the data and simulations, the figure yields demographics that are not too far off from the demographics of the teacher workforce (U.S. Department of Education, 2017). However, we were unable to find demographics for the early career teacher workforce. The final distribution of early career teachers (those in the workforce in their first three years) based on the simulations in this tool is 81 percent White, 8 percent Hispanic, 3 percent Black, 4 percent Asian, and 4 percent Other. The reason that the simulation overstates the proportion of Black and Hispanic teachers is that a disproportionate share of Black and

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[5] That is, it is equal to the number of 12th-grade Hispanic students times the probability that 12th grade Hispanic students graduate high school times the probability that Hispanic student graduates go on to college and so on, through the probability that Hispanic college graduates who take basic skills tests pass those tests. For instance, the number of students in the Hispanic category (the red color above) who move from 12th grade through the prospective teacher pipeline to the point of passing basic skills tests is assumed to be a simple multiple of the number of Hispanic students nationally times the probability that Hispanic 12th graders make it through each of the nodes through to the point of passing basic skills tests.

Hispanic teachers tend to come into the teaching profession through alternative route teacher preparation providers.[6]

3.   Simulations

As the above section shows, diversity in the prospective teacher pipeline tends to diminish as individuals progress through the various nodes on the path to becoming a teacher. But policymakers and policies typically only have direct influence over certain segments of the pipeline. Indeed, there is disagreement about the importance of different nodes and related policy levers to increase the diversity of the teacher workforce. Media attention, for instance, tends to focus on how hiring practices or attrition contribute to the diversity gap (e.g., Anderson, 2018; Meckler & Rabinowitz, 2019; Walk-Morris, 2017), while others contend that problems are rooted earlier in the pipeline (e.g., Gershenson et al., 2021; Putman et al., 2016).

Here we focus on five simulations that explore different nodes in the teacher pipeline (or combinations of nodes in the case of one of the scenarios) and examine the degree to which changes in the likelihood of individuals representing different race/ethnicity categories progressing through a node would change the diversity of the teacher workforce after three years of experience.[7]

The first simulation assumes that high school diploma and four-year college-going rates are equivalent across all race/ethnicity groups. While aggregate high school graduation and college-going rates have increased over the last several years, gaps have persisted between race/ethnicity categories (McFarland, et al, 2018; U.S. Department of Education National Center for Education Statistics, 2018).

Licensure tests have been the subject of much debate, especially given their adverse impact on test takers and disagreements about their value for predicting teacher outcomes (Cowan et al., 2020; Gershenson et al., 2021; Goldhaber and Hansen, 2010). Thus, the second simulation we examine assumes equal pass rates on licensure tests (both basic skills and subject matter), which is equivalent to the elimination of licensure test requirements of teacher candidates.[8] And the third simulation focuses on teacher education program enrollment and completion. U.S. Department of Education data suggests that Black, Hispanic, Pacific Islander, and American Indian/Alaska Native students are significantly less likely than white students to graduate within 4-6 years of enrolling in college (U.S. Department of Education National Center for Education Statistics, 2008). Thus, in this simulation we assess the scenario where all demographic groups have an equal probability of enrolling in teacher education and graduating from college.

Another driver of racial disparities in the teacher workforce discussed in literature focuses on the disproportionate attrition of teachers of color. For example, some evidence

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[6] See https://caldercenter.org/msis-and-alternative-certification for more information on the demographics of teacher candidates in alternative preparation providers. We opted against focusing on alternative routes because there is very little information about the demographics and progression through these routes and because the definition of what constitutes an alternative route varies across states (Goldhaber and Holden, 2021).

[7] We focus on early career teachers given the fact that even large changes in the makeup of the teacher pipeline would have a limited impact, in the short run, on the entire teacher workforce.

[8] Note that this is a policy reform that has recently been enacted in states such as California and Washington for some licensure tests.

suggest that successes in the recruitment of teachers of color, were completely overturned by failures to retain these teachers (Ingersoll & May, 2011). Thus, the fourth simulation examines the unrealistic scenario where the retention rate for teachers of color in the workforce is 100 percent for their first three years in the teaching profession, while the retention rate for White teachers remains at 87 percent. The fifth and final simulation assumes that all the changes described for scenarios 1-4 occur.

Figure 2 shows the results of the above simulations for the distribution of junior (three or fewer years of experience) teachers in the workforce. The first bar shows the distribution under the baseline assumption and the next five show the distributions associated with each of the five simulations described above. Not surprisingly, each scenario tends to lessen the diversity gap between the distribution of 12th graders and the distribution of individuals projected to become teachers, but some of the scenarios have little impact on the estimated proportion of teachers of color, while others have differential estimated effects on racial/ethnic subgroups.

Figure 2
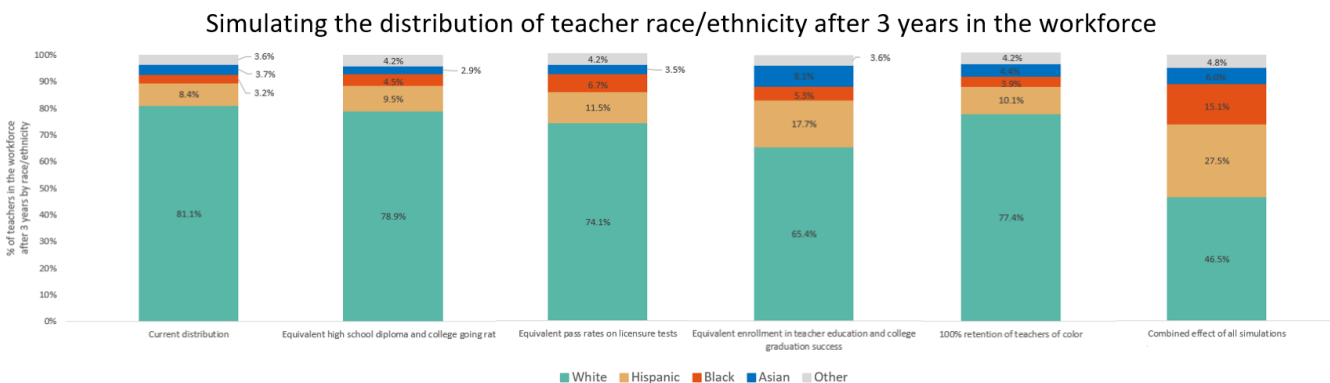
Under simulation 1 (focusing on the very front-end of the pipeline), for instance, the proportion of teachers of color is estimated to increase by about 2 percentage points (12 percent).

Simulation 2 (focusing on licensure tests) also significantly increases the proportion of teachers of color, by about 7 percentage points (37 percent). This simulation shows an outsized effect on the estimated proportion of Black teachers since they have historically not experienced success with these tests (Putman & Walsh, 2019; U.S. Department of Education Institute of Education Sciences, 2021, White, R. et al, 2013).

Simulation 3 (focusing on enrollment in teacher education and college graduation) is estimated to have a much larger impact on the proportion of teachers of color in the workforce. The proportion of teachers of color is projected to rise by 16 percentage points (83 percent), an increase for all non-White categories. This is because both Hispanic and Black college students have historically experienced lower college graduation rates, on average (U.S. Department of Education National Center for Education Statistics, 2018), and, in the case of Hispanic and Other students, in particular, been far less likely to pursue a major in education (U.S. Department of Education Institute of Education Sciences, 2021).

The findings from simulation 4 are interesting given the aforementioned focus on the implications of differential teacher retention rates by race/ethnicity. Again, note that the simulation is extreme in the sense that it assumes that there is 100% retention in the teacher workforce for teachers of color in their first three years. Of course, the simulation does show increases in teacher workforce diversity, but perhaps not as much as one might guess: the share of teachers of color is anticipated to rise by 4 percentage points (19 percent). The reason the effect of changing workforce attrition is small is that the proportion of teachers of color who enter the workforce is relatively low, so even large changes in the attrition rate have limited impact on workforce diversity.

It is only when we simulate all of the above changes (simulation 5) that we see that the early career teacher workforce reflects the demographics of the students in K-12 public schools. This simulation shows that the proportion of early career teachers of color would rise by 35 percentage points (182 percent). Thus, in short, these simulations suggest that changes have to occur at multiple nodes in the teacher pipeline to significantly close teacher diversity gaps.

Table 1 summarizes the impacts of all five simulations.

Table 1

Summary of Simulations

	Simulation	Simulated Increase to Workforce Diversity
1	High school diploma and four-year college-going rates are equivalent across all race/ethnicity groups	2 percentage points (12 percent),
2	Equal pass rates on licensure tests (both basic skills and subject matter)	7 percentage points (37 percent)
3	All demographic groups have an equal probability of enrolling in teacher education and graduating from college	16 percentage points (83 percent)
4	Retention rate for teachers of color in the workforce is 100 percent for their first three years in the teaching profession	4 percentage points (19 percent)
5	Simulations 1 through 4 combined	35 percentage points (182 percent)

4.   Discussion and Conclusions

We argue that a primary take-away from the simulations is that large increases in the diversity of the teacher workforce – increases of a magnitude that lead new teachers to more closely mirror the demographics of the nation's students – can only be achieved through a comprehensive approach. Put another way, single-level diversification efforts of school districts, states, or educator preparation programs acting on their own are unlikely to yield significant improvements. And, it is particularly important to focus far more attention on the demographic implications of choices and progress of individuals through the prospective teacher pipeline well before they become teachers.

There are a number of caveats and cautions that apply to our approach to investigating the prospective teacher pipeline. The first thing to note is that "prospective teachers" is an indication of who is on the path to *eligibility* to teach, not necessarily that these are individuals who *intend* to become teachers. For example, as the case in other professions, it is not out of the ordinary for individuals who obtain a degree in education to eventually choose a different career. We are treating taking the basic skills test as the first clear indication indicative of an individual's intention to pursue a teaching career. For instance, those individuals who take a basic skills licensure test required for entry into a teacher preparation program are clearly indicating their intent to become teachers.

Another caveat is that evidence about who progresses through different nodes in the pipeline is quite thin in some cases, and the probabilities utilized to determine the likelihood of individuals from different demographic groups advancing through the pipeline comes from various sources and may not always be reflective of the national picture. For instance, while the evidence about some nodes, such as the likelihood of high school or college graduation, is based on national data, other nodes, such as the likelihood that individuals from different demographic groups attend teacher preparation programs, comes from research from particular states, and is then applied to the U.S. as a whole.[9] Indeed, there are parts of the pipeline that skip over key steps where there is little to no evidence about who progresses from one node to the next, so the inferences are drawn based on observing the demographics of individuals who advance through several of the nodes; for instance, this is the case for applications to schools, job offers, and acceptance of job offers, which we combine into a single node showing the progression from having a teaching credential to being observed in the teacher workforce.

A final caution about the pipeline is that while, as noted above, a change in the number of teachers or future teachers advancing through one node in the pipeline will cascade throughout the following nodes, it does not work in the opposite direction. If indeed improvement in nodes have an impact in the opposite direction, improvements to the diversity of the teacher workforce may be more significant than our estimates. For instance, it is possible that changes in retention of teachers of a particular race or ethnicity could influence earlier nodes in the pipeline, such as the likelihood that people choose to pursue a career in teaching,[10] but the simulation of the pipeline does not allow for this kind of dynamic effect.

There are a myriad of strategies that may be employed to engage prospective teachers of color, encouraging them to pursue a path to becoming a teacher (Gist and Bristol, 2021). But this is also a particularly opportune time for such a focus. The COVID-19 pandemic has simultaneously revealed the particularly large learning losses suffered by students of color and provided significant resources for recovery (Boughton et al., 2021). Indeed, as Rotherham & Gold (2021) point out, there are ESSER resources that may be strategically utilized to try to achieve the objective of diversifying the teacher workforce. But while there are many options

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[9] See https://caldercenter.org/data-visualizations/understanding-how-diversity-teacher-preparation-pipeline-contributes-diversity/cautions-and-assumptions.

[10] There is some evidence of this. For instance, students of color perceptions about the teaching profession are significantly lower compared with White peers, with one explanation being that existing teachers of color do not encourage their students to pursue a career in teaching. Thus, better working conditions and retention rates for these existing teachers of color could potentially have an impact on attracting students of color to the profession (Gordon, 2002)

that may be tried, from Grow Your Own programs to early mentoring of prospective teachers, we know relatively little about the efficacy of different approaches to achieving this objective. Learning about what encourages a more diverse group of people to seek to become teachers, and how they can be successful, is a critical step to crafting policies and practices that lead to greater teacher workforce diversity.

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