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RESEARCH ARTICLE

New trends in academic achievement among teachers

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Despite the fact that states have drastically increased their demands on teachers, there is evidence that the profession is currently attracting more academically talented workers than it has in previous decades. This article explores some of the current research on teacher quality as measured by academic achievement and discusses implications for policy. While policymakers seem overly focused on weeding out the worst teachers, they must also give attention to strategies that will attract, retain, and effectively utilize the most promising educators.

Keywords: teacher quality, teacher recruitment

> "In the United States, a significant proportion of new teachers come from the bottom third of their college class."
>
> - U.S. Secretary of Education Arne Duncan, in remarks to National Assessment Governing Board Education Summit for Parent Leaders, January 13, 2014

Every summer across every neighborhood and school district parents and students anxiously wait to find out who their teachers will be in the coming school year. We know little about what makes one teacher better than another, but parents and researchers alike know that a particular teacher can make a big difference in student outcomes. Precisely which characteristics of an educator are most important is a matter of fierce debate in the field of education policy (Rivkin, Hanushek, & Kain, 2005), but there is wide agreement that students benefit from having better teachers. In fact, one study found that students having the least effective teachers for three years in a row, on average and net other factors, scored at the 44th percentile while their counterparts who were taught by the most effective teachers for three years in a row scored in the 96th percentile (Sanders, Wright, & Horn, 1997). While such studies show that there is indeed a difference between the best and the worst teachers, they do little to help us figure out where the line, if any, should be drawn separating the good enough from the truly harmful.

Policymakers have tried to draw that line anyway and devoted resources to the elimination of weaker teachers. Consider the changes that teachers have witnessed since the start

of the millennium. No Child Left Behind (NCLB) led to large-scale accountability measures in classrooms from coast to coast. The Common Core was rolled out with promises of getting every classroom and teacher up to snuff (only be put on the chopping block of short-lived reforms in many states). And now tenure has come under fire. All three of these reforms were intended to weed out bad teachers, but we need to wonder whether they might also discourage our most talented young people from entering the profession. Long before a state judge's decision to toss out teacher tenure, observers in California reported a drastic reduction in enrollments in teacher education programs and interpreted it as a sign that the layoffs, budget cuts, and reductions in benefits have been driving many would-be teachers into other fields (Freedberg, 2013).

The dust kicked up by these changes to the teaching profession won't settle for some time, but nestled within the debate over tenure is a question about how the best teachers and teaching candidates – the people we desperately want working in our schools – will respond. While skillful learning may not necessarily lead to great teaching (Krieg, 2006), multiple aspects of an educator's own academic record provide reliable indications of his or her career potential (Rice, 2003; Rockoff, Jacob, Kane, & Staiger, 2010). In this paper, I discuss the most recent research on teachers' academic achievement and implications for policy, paying special attention to teachers' academic records.

ACADEMIC ACHIEVEMENT AMONG TEACHERS

California's court decision on teacher tenure notwithstanding, the recent and significant changes to teacher working conditions are the results of state and federal legislation and would not come about without substantial public support. The impression that the public has of teachers is complex. On the one hand, individual teachers are celebrated in the news and popular culture. The caring, patient, and inspiring teacher is an archetype we embrace in classic films like *Dead Poets Society* and *Stand and Deliver* as well as in not-so-classic films like *Bad Teacher* and *Summer School*. It is worth noting that the heroic teachers in all of these films are portrayed neither as the norm in their schools nor as instructors complying with standards and regulations. The implication is clear: with precious few exceptions, teachers can't teach and the systems in which they work in are no better. The teachers who actually do manage to help students succeed are so unusual that they deserve to have movies made about them, and it is a rare objection that is raised against how the majority of educators are depicted (Dalton, 2006).

Surveys have shown that the public has doubts about the performance of public schools, broadly speaking. In a 2009 Phi Delta Kappa/Gallup poll, respondents gave low marks to America's public schools. However, when the same people were asked about the schools in their own communities, the scores were much higher. The scores were higher still for respondents whose children attended the local public schools (Spring, 2010). Americans are pleased with the service they get from their neighborhood schools, that is to say from their own teachers and administrators, but have a more negative impression of the effectiveness of other communities' public schools.

For many Americans, the intellectual quality of teachers is a big piece of the puzzle, and many assume that teachers couldn't cut it in other professions. The old adage, "those who can, do; those who can't, teach" has remarkable staying power, perhaps in part because the media and politicians constantly feed us the impression that schools are broken and teachers don't teach, despite the fact that most of us seem quite satisfied with the services we get from them (Spring,

2010). A 2012 Phi Delta Kappa survey found that most Americans would like to see the admissions to teacher training programs become more rigorous. When it comes to math and sciences, the disciplines that for decades have been the focus of political and media attention (Bybee, 2013), a survey by the Public Agenda Foundation (2009) found that a full third of respondents blamed a lack of good teachers for students' struggles in math and science.

The public's impression that there is so much room (and need) for improvement in the academic quality of teachers originates in multiple sources, many imbedded deep within popular culture, but some from more authoritative sources. Darling-Hammond's (2010) work, for example, doesn't say that American teachers are academically weak, but she does point out that they don't come from among the academic elites in the numbers that other countries generate, such as Finland and South Korea. In these countries, not only do the teachers come from among the highest levels of academic achievement, but their students consistently score extremely high on the Programme for International Student Assistance (PISA) tests, the exams that researchers and policymakers rely on to compare educational achievement in one country to that in another. In short, Darling-Hammond warns that our current teaching workforce may not possess sufficient human capital for the United States to compete with the best internationally. Other scholars have raised similar concerns (Hanushek, 2011; Ingersoll, 1999).

More critical of the teaching force are two reports that come from the McKinsey consulting firm (Auguste, Kihn, & Miller, 2010). These documents are the ones often cited when pundits argue that teachers come from the bottom of their graduating classes. In both analyses, the researchers compared the SAT scores of new teachers who had recently graduated from college to those of their non-teaching counterparts. The earlier report found that the newest teachers in 1993 were slightly underrepresented in the top half of SAT scores and slightly overrepresented in the bottom quartile. The later study, which compared workers who had graduated in 1999, was more critical of the teaching workforce; it found a larger gap between teachers and non-teachers in their SAT scores. Only 23 percent of new teachers were from the top third of SAT scores and 47 percent were in the bottom third of SAT scores – it is this figure that is so often cited by pundits lamenting the dismal state of teacher quality in the United States. One difference between these two studies is that the first included individuals who were teaching within four years of their college graduation while the latter study included individuals who were teaching within two years of graduation. It's possible that a different caliber of employee, on average, enters teaching within two years of graduation. Furthermore, neither analysis looked at teachers who entered the profession more than four years after graduating from college, and thus would not have included anyone who had delayed teaching for longer periods of time to do other things like travel, raise children, attend graduate school, start a business, perform volunteer work, or explore other careers. As Matthew DiCarlo suggests, it may be that the teaching profession's higher achievers begin their career after participating in such activities, while lower-achievers enter teaching immediately after graduating from college (as cited in Strauss, 2011).

Despite such explanations, some older studies validate the McKinsey claim that teaching simply has not attracted high academic achievers. Schlecty and Vance (1982), for example, found that individuals who graduated high school in 1972 and were teaching in 1979 had SAT scores that were disproportionally in the bottom two quintiles. Studies by Hanushek and Pace (1995) and Manski (1985) similarly found a negative relationship between standardized test scores and entry into the teaching profession. More recently (but still a decade ago), Podgursky, Monroe, and Watson (2004) used ACT data from Missouri to show that lower academic achievement is more common among elementary teachers than secondary teachers.

But those patterns may not be the reality anymore. New evidence suggests that teachers no longer lag behind their peers in other professions in terms of their academic achievement. A recent report by Goldhaber and Walch (2014) announced that the average academic ability of new teachers in 2008, as measured by SAT scores, was higher than that of earlier cohorts, and higher than that of college graduates entering other professions. While the crop of new teachers in 1993 had an average SAT score at the 45th percentile and in 2000 new teachers' scores were at the 42nd (findings similar to the McKinsey analyses), the 2008 group was at the 50th percentile. A direct comparison of average SAT scores between teachers and non-teachers showed teachers trailing non-teachers in 1993 and 2000 but then surpassing them in 2008. Still more encouraging, this reversal is true among STEM majors and non-STEM majors alike, reflecting the fact that more high-achieving STEM students are opting into the teaching profession than in previous cohorts.

A study of teachers in the state of New York made similar observations (Lankford, Loeb, McEachin, Miller, & Wyckoff, 2014). Even when accounting for school setting, race, poverty, and subject and grade level, the research team found that the SAT scores of candidates earning teaching licenses and entering the profession have been increasing since about 2000. Furthermore, as in the Goldhaber and Walch study, they found that teachers in hard-to-staff subjects had some of the strongest improvements.

STEM DATA FROM NORTH CAROLINA

What follows is a description of a study I conducted using data from North Carolina intended to test whether the patterns observed by Goldhaber and Walch (2014) and Lankford et al (2014). The data come from the Roots of STEM Project, an NSF-sponsored (#0969286) investigation into the factors that influence college students' pursuit of STEM (Science, Techonology, Engineering, and Math) fields.[1] The data include individual, classroom, high school, and district data for all students who graduated from North Carolina public high schools in 2004. The data also include college records for the students who matriculated into the UNC system soon after graduation from high school.

Within this longitudinal dataset, I examined two sets of subjects, one made up of the teachers of North Carolina's class of 2004 and the other made up of the students themselves. The first included more than 2,000 math and science teachers working in North Carolina's public high schools from 1999 to 2004, roughly the same generation of teachers who might have appeared in the McKinsey studies. Using a simple histogram in the Stata statistical software package, I examined those teachers' math and verbal SAT scores and found the distribution of each to be normal and roughly average. The vast majority of scores on the math portion fell between 400 and 600 – precisely where most takers of the SAT tend to land (Dorans, 2002). Their scores on the verbal (now called "reading") portion were slightly lower. The teachers included in this portion of their study were at all stages of their careers. Some had completed college decades earlier and others were just starting their careers. Thus, not much can be said about trends in academic preparedness of teachers other than that science and math teachers in North Carolina at the turn of the millennium were quite similar to most college-bound students, at least in terms of SAT scores, in math and slightly weaker, on average, in verbal skills.

[1] The principal investigators of the Roots of STEM project are Drs. Elizabeth Stearns, Roslyn A. Mickelson, Melissa Dancy, and Stephanie Moller. Please visit https://clas-pages.uncc.edu/rootsofstem/ for more information.

The second group of subjects I examined in the dataset consisted of the roughly 1,800 students who graduated from North Carolina public high schools in 2004, enrolled in the University of North Carolina (UNC) system, and had declared majors in math, biology, chemistry, physics, or earth sciences. These majors are eligible for teacher certification programs in North Carolina and represent some of the hardest-to-fill positions in schools (Ingersoll & Perda, 2010).

Using multilevel logistic regression modeling (again in the Stata software), I estimated the effects that various measures of academic achievement had on the likelihood that a student in these majors would also be taking a sequence of three education courses, which I considered to be at least a serious interest in pursuing a license to teach. The independent variables I tested included SAT scores, high school GPAs, class ranks, and academic tracks. Control variables included student gender, race (with White as the reference category), and socio-economic status (defined as receiving free/reduced lunch or having parents who dropped out of high school). The multilevel models accounted for the mixed effects of the high schools attended.

When I compared the effects of academic measures on the odds that a student in these majors would take a sequence of education courses, I found that SAT Reading scores and high school GPA had small but statistically significant negative effects. The one measure of achievement that appeared to have a sizable difference between the two groups was the percent of honors courses taken while in high school – the science and math majors in the UNC system who had taken more high school honors courses were significantly less likely to pursue the coursework that could lead them into the teaching profession (see Table 1). While track is not used as often as the other measures of academic achievement in education research, it is found to have implications for opportunities to learn and later academic success (Mickelson, Giersch, Stearns, & Moller, 2013; Giersch, 2012).

TABLE 1
Odds rations for STEM majors taking three or more education courses

	Model 1		Model 2		Model 3		Model 4		Model 5	
	O.R.	**95% C.I.**	**O.R.**	**95% C.I.**	**O.R.**	**95% C.I.**	**O.R.**	**95% C.I.**	**O.R.**	**95% C.I.**
SAT Math	.996	(.997-1.001)								
SAT Reading			.997***	(.995-.999)						
HS Rank					.993	(.983-1.003)				
HS GPA							.649**	(.483-.878)		
Honors track									.508*	(.293-.881)
Male	.779	(.553-1.097)	6.773	(.552-1.084)	.754	(.535-1.063)	.729	(.521-1.019)	.805	(.568-1.141)
Asian	.341*	(.146-.796)	.292**	(.124-.687)	.367*	(.157-.858)	.339*	(.146-.791)	.293**	(.116-.735)
Black	2.190***	(1.415-3.389)	1.874**	(1.223-2.872)	2.406***	(1.596-3.625)	2.03**	(1.342-3.075)	2.399***	(1.600-3.599)
Hispanic	.472	(.061-3.635)	.477	(.062-3.682)	.485	(.063-3.752)	.498	(.065-3.837)	.476	(.062-3.676)
Other Race	.849	(.376-1.917)	.746	(.327-1.700)	.759	(.317-1.816)	.780	(.346-1.761)	.931	(.411-2.110)
Low SES	1.050	(.612-1.799)	.992	(.579-1.697)	.908	(.525-1.569)	.867	(.506-1.485)	.894	(.513-1.560)
Constant	.173***	(.132-.227)	.189***	(.146-.244)	.172***	(.127-.233)	.205***	(.152-.277)	.235***	(.157-.352)
Log likelihood	-513.768		-509.427		-504.143		-521.336		-476.531	
n	1338		1338		1325		1383		1244	

*p<.05, **p<.01, ***p<.001

While not terribly distressing, my results suggest that college students who pursue teaching have slightly lower academic achievement than their classmates. In contrast, Goldhaber and Walch found that the STEM majors entering teaching around the same time to have stronger academic credentials than the STEM majors headed for other professions. There are several possible reasons for these differences, and they may be useful for discerning relevant policy implications.

First, my study used data only from North Carolina, as opposed to Goldhaber and Walch's national sample. How did North Carolina differ from other states between 2004 and 2008? Low salaries and low rates of union participation are two important reasons (Helms, 2014). A third is that the state had implemented an accountability program based on high-stakes testing several years before NCLB (Jones et al., 1999), and these students had been taking those tests for most of their school careers. Perhaps higher-achieving students in North Carolina were turned off by the climate created by those policies.

Second, Goldhaber and Walch's (2014) study looks at students actually in the teaching profession, while mine looks at college students and separates them not based on who actually starts teaching, but on who takes the courses that suggest an interest in teaching. If there is a "pipeline" into the teaching profession, my study looks at an earlier point along its length. If both studies are accurate, there is some weeding out of the academically-weaker teaching candidates that occurs between when they are in college (when my study occurs) and when they start teaching (when their study occurs). Many sorting mechanisms could be in play between those points, but two are obvious: graduation and hiring. Both are important gatekeepers. Additionally, Goldhaber and Walch's (2014) data may reflect a temporary shift of top candidates into teaching as they react to the recession and volatility in private sector employment (Rampell, 2011).

Third, my analysis looked only within the majors that were eligible for secondary teaching certificates (that is, to become high school math or science teachers in North Carolina), while Goldhaber and Walch looked at all STEM majors. Had Goldhaber and Walch focused only on disciplines like biology, physics, chemistry, and math (the ones that made up the majority of my data), they might have found the gap between majors and non-majors to be smaller or even reversed, as those particular majors are particularly versatile and likely to carry a lot of weight with a broad range of employers who may attract the top graduates especially quickly after graduation.

Finally, while the Goldhaber and Walch study does not investigate the relationship between academic tracks and the entry into teaching, my analysis suggests that it is likely to be the strongest predictor. Exactly why the students who pursue education coursework are less likely to have taken upper-level track classes in high school is unclear. Given that so many students view teaching as a career that offers little financial benefit (Watt & Richardson, 2007), it could be that students in upper track classes are encouraged by teachers, peers, and parents to view teaching as undesirable compared to other potential opportunities, while students in the lower tracks are told they'll be lucky if they can find a job that is as secure and well compensated as those in education. A related question is whether lower-track students end up making the better teachers. On the one hand, upper-track students are likely to have had more opportunities to learn in their schooling. On the other hand, while success in school may have come easily to the students in upper-track classes, lower-track students may be more aware of the ways in which different students struggle with learning and thus be more attuned to what teaching methods are most effective. These questions seem worthy of future research.

CONCLUSION: GETTING THE BEST INTO TEACHING

One of the most consistent patterns in education policy research is the relationship between students' achievement and who teaches them (Rice, 2003; Rivkin et al., 2005). And while it is difficult to isolate the characteristics that make one teacher more effective than another, other countries seem to have had success with attracting academically high-achieving candidates into the profession (Paine & Schleicher, 2011). Given the lessons from studies briefly discussed in this paper, several policy implications are worthy of consideration.

First, school districts and states need to realize that newly-minted college graduates are highly mobile, perhaps more so than in the past, and will go where the best jobs are. A state with low starting salaries (or low final salaries) will have a harder time attracting talented teachers. Top candidates may still go into the education field, but they may opt for other states with more attractive compensation. Too often debates about teacher compensation deteriorate into arguments about "only working nine months a year" versus "teachers shaping the future" instead of considering the actual market price of a highly qualified employee.

Second, getting the best candidates into teaching isn't just about the moment of hiring, it's about attracting college freshmen and sophomores into education courses that will make them eligible for teaching careers after graduation. Pursuing a teaching certificate carries with it a high cost in the form of lost electives and flexibility in the senior year when student teaching occurs, factors that may be too burdensome for students who are ambitious in other areas or burdened with other responsibilities. The task of recruiting students shouldn't fall only on education faculty, of course; instructors in other disciplines could encourage promising students to consider teaching as a worthy and fulfilling career.

Third, states should consider broadening the range of majors that are acceptable for certification programs. While colleges of education may always favor the better-established majors for teacher preparation, the proliferation of new majors that have sprung up from new technologies and increased job specialization should spell out opportunities, not obstacles, for making teaching careers possible for a larger group of students. Why not allow students studying organizational science to earn a social studies teaching certificate, or a statistics major to earn a math certificate, or a computer engineering major to earn a science certificate? Furthermore, why not allow a sociology major to complete coursework and a practicum leading to an elementary teaching certificate? Deeper pools of teacher candidates may serve to increase the quality of hires. At the very least, it will introduce more people to the realities of teaching.

Even with the goal of getting top achievers into classrooms, it is likely that schools will be staffed by professionals with a mix of academic backgrounds for a long time into the future. Providing existing teachers with opportunities to collaborate will help. It is unlikely that any given school, and especially those with limited resources or poor reputations, will be able to hire a faculty that is made up of nothing but top graduates. Rather than limiting the benefits that accrue from the limited number of academically strong teachers to just the students who will have them in class, allowing teachers to regularly collaborate and share best practices will permit the best ideas of the best teachers to be picked up by their colleagues (see Moller, Mickelson, Stearns, Banerjee, & Bottia, 2013, for more on the benefits of collective pedagogies).

As for whether states should dismantle tenure for teachers, it would be useful to know how that particular perk is perceived by high-achieving college students. Is "guaranteed" tenure an attractive aspect of the teaching profession, or are they confident enough in their abilities (and trusting enough of administrators) that its existence has little effect on their career decisions? So

much of the discussion of tenure focuses on the lower end of teacher effectiveness that it might be helpful to remember such changes may also influence those most likely to be at the top end.

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