# Student Mathematics Achievement Test Scores, Droupout Rates, and Teacher Characteristics

**By Mark Fetler**

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Coleman's famous report (1966) raised questions that continue to seek definitive answers. Not the least important of which is, what can be done to overcome the effects of poverty on achievement? Over time educators and policymakers have attempted to address this question with more instructional time, better equipment, modern facilities, improved curriculum materials, and more effective teaching methods. Some recent studies focus on the quality of teachers and teaching (Fetler, 1997a). Haycock (1998) documents the relationship between low standards, low-level curriculum, under-educated teachers, and poor results. Shields (1999) documents the relationship between teacher quality and student learning, and considers policies for increasing both the quantity and quality of the teacher workforce. Darling-Hammond (2000) provides an extensive review of research on teacher qualifications and student achievement.

Because the effects of poverty are pervasive and persistent, effective answers are likely to require thoughtful, coordinated, multiple reforms. Systemic approaches often describe education in terms of indicators of instructional context, processes, and outcomes (Fetler, 1986, 1989, 1991, 1994; Levin, 1974; Murnane, 1987; Office of Educational Research and Improvement, 1988; Shavelson, McDonnell, & Oakes, 1989; and Porter, 1991). Examples of contextual variables are student poverty, urban versus rural location, the ratio of students to teachers, or the number of students enrolled in a school or district. Common measures of process are type of curriculum or teaching methods. Years of teaching experience, the quality of teacher training, and the amount of training received by teachers may influence the effectiveness of teaching. Important student outcomes are graduation (versus dropping out), student achievement, employment, or admission to college.

Curriculum standards and frameworks—"what is intended to be taught"—are teaching tools. The effectiveness of these tools depends on the skill of the teacher. Perhaps because direct measures of teaching skill are difficult to define and obtain, researchers and policymakers use teacher education and experience as plausible proxy measures. Individuals with the same amount of experience and similar teaching credentials can vary in actual skill. Even so, in an aggregate consisting of many teachers in many schools, it is not unreasonable to believe that more highly educated and experienced teachers possess greater skill. Additionally, it is likely that the presence in schools of more educated and experienced teachers is associated with better student outcomes.

## Teacher Quality and Supply

California public school enrollment rose 27 percent from 4.5 million students in 1988-89 to 5.7 million in 1998-99. Student enrollments will continue to grow, although more slowly, over the next decade, increasing by 7 percent to an estimated 6.1 million students in 2008-09 (California Department of Finance, 2000). California public schools employed 284,030 teachers in 1998-99. A significant fraction, 13.3 percent, of these teachers did not meet the requirements for a credential and were employed on the basis of a waiver or an emergency permit (California Department of Education, 2000).

Given that teaching skill is associated with student achievement, school districts and policymakers are interested in how teachers are prepared (Darling-Hammond and Hudson, 1990; National Commission on Teaching and America's Future, 1996; Ashton, 1996; Education Week, 1997; National Center for Education Statistics, 1999). While teaching skill is a goal of preparation, usually a credential only requires an academic degree and coursework. Virtually all public school teachers in the United States have at least a bachelor's degree, and many possess advanced degrees.

Although high demand for teachers is prompting reforms, California's degree and coursework requirements tend to resemble those of many other states (National Association of State Directors of Teacher Education and Certification, 2000). Historically, a California preliminary credential required a Bachelor's degree in a subject other than professional education, and a one-year preparation program with training in educational principles and teaching strategies. Those seeking a clear credential fulfill additional course requirements and a year of educationally related study. Career changers with at least a Bachelor's degree and competence in their subject of instruction may work as paid teaching interns while they receive support and training in pedagogy from school districts or universities.

Credential requirements restrict access to the teaching profession. One way to meet increased demand is to relax the requirements, reducing the time and cost to become a teacher. For example, when there are too few fully qualified applicants California school districts use emergency permits and waivers to hire individuals who lack some requirements for a credential, usually proof of competence in their subject(s) of instruction or pedagogy (Hart & Burr, 1996). In recent years emergency permits and waivers have become more popular. The number of teachers in these categories increased 21 percent from 31,256 in 1997-98 to 37,891 in 1998-99.

Shields (1999) notes that that not all teachers on emergency permits are unskilled, just as not all with full credentials have excellent teaching ability. However, as the proportion of under-qualified teachers increases, schools become less able to support faculty. There appears to be a tipping-point, about 20 percent of under-qualified teachers, beyond which schools lose the capacity to improve student achievement. About one-fifth of California schools appear to fall in this category. Experienced teachers in these schools have too many demands on their time. New teachers have little support and often receive difficult assignments. Turnover is high, breaking continuity in the school's academic program and degrading administrative systems.

## Student Outcomes

Greenwald, Hedges, and Lane (1996) reviewed a number of studies of the relationship between school inputs and student outcomes. Some school resources, i.e., teacher ability, teacher education, and teacher experience were strongly related to student achievement. Hanushek's (1996) synthesis of research studies found mixed support for a relationship between school resources and achievement. Measures of teacher experience were more consistently related to achievement than measures of teacher education. Ashton (1996) notes that teachers with regular state certification receive higher supervisor ratings than teachers who do not meet standards.

Teachers without preparation have trouble anticipating and overcoming barriers to student learning, and are likely to hold low expectations for low-income children. Reducing certification requirements worsens the quality of education of low income children. Darling-Hammond (2000) reviewed national data to conclude that teacher preparation and certification are correlated with student outcomes before and after controlling for poverty and language status.

## Two Studies of California High Schools

The following two systemwide studies examine the relationship between measures of teacher quality and student outcomes in California's high schools. The first study (Fetler, 1999) looks at the characteristics of mathematics faculty in relation to mathematics achievement. The second study (Fetler, 1997b) explores student dropout rates in conjunction with faculty characteristics. Although richly detailed case studies can be useful, the results are often difficult to generalize. Are there special circumstances, an effective teacher or administrator, or a particular instructional program, that are responsible for the findings? Systemwide studies sacrifice the richness of detail, but allow greater generalizability.

### *Study 1: Mathematics Teaching, Curriculum, and Achievement*

Official statements of high school course requirements and curriculum standards permit an inference about the importance of high school mathematics. A national survey of states, conducted by the Council of Chief State School Officers (1998) found that 23 states require more than two credits in math, compared to 13 states in 1989. Forty-two states, including California, have mathematics content standards ready for implementation. Based on the national survey, mathematics should be considered second only to English, and should occupy 20 percent or more of the curriculum.

The National Assessment of Educational Progress (NAEP) has demonstrated influential models of standards-based mathematics assessment (Reese, Miller, Mazzeo, & Dossey, 1997), and has focused attention on student achievement by providing state summaries of the percentages of students at defined performance levels (National Center for Education Statistics, 1998, p. 49). California's 1996 percentages are one point lower than the nation for the most advanced students, and ten points lower for students at or above a basic level. Teacher characteristics may explain some of the variation in NAEP scores. Hawkins (1998) used eighth grade data from the 1996 assessment to show that students taught by teachers with an undergraduate or graduate major in mathematics scored higher than students taught by teachers with majors in education or some other field. Moreover, students taught by teachers with certificates in mathematics outperformed students taught by teachers with certificates in other areas. Finally, students of teachers who rated themselves as knowledgeable or very knowledgeable about the curriculum and evaluation standards published by the National Council of Teachers of Mathematics (1989) scored higher than students whose teachers reported little or no knowledge of the standards.

#### *Mathematics Teachers*

Brunsman (1997) describes California's requirements for a single-subject credential in mathematics and the number of qualified mathematics teachers. In addition to the requirements that apply to all credentials, high school mathematics teachers must demonstrate their competence in the subject either by completing a subject matter program, or they can demonstrate their competence through an examination. Approved subject matter programs include a core with at least 30 semester units of mathematics coursework that is related to subjects that are commonly taught in departmentalized mathematics classes. This core includes courses in first and second year algebra, geometry, first and second year calculus, number theory, mathematics systems, statistics and probability, discrete mathematics, and the history of mathematics. Programs also include a minimum of 15 semester units of supplemental coursework to provide breadth.

California school districts can assign less than fully qualified teachers to mathematics classes by several methods. An emergency permit requires a Bachelor's degree, passing a basic skills test, and completing a minimum of 18 semester hours or 9 upper division/graduate semester units of course work in mathematics. In order to renew the permit, the teacher must complete six semester units toward earning a credential in mathematics. A limited-assignment emergency permit requires that the teacher have a valid teaching credential in another subject. A waiver requires only that the teacher pass or not ever have taken the mathematics portion of a basic skills test.

Brunsman reports that the number of emergency/waiver teachers in mathematics exceeds the number of fully qualified new teachers. Between 1993-94 and 1996-97 California granted credentials to 2,689 fully qualified new mathematics teachers, and granted permits or waivers to 6,339 less well-qualified teachers. Unfortunately, it is not known how many fully qualified teachers actually applied for and accepted jobs in public schools. Fetler (1997a) estimates that less than half of credential recipients go on to work in California public schools. Virtually every waiver and emergency permit represents an employed teacher. Brunsman documents a downward trend in the number of fully qualified teachers prepared and possibly hired, and an upward trend in the number of less than fully qualified people actually hired on waivers or permits.

### Method

The 795 regular California regular high schools studied typically serve 1.3 million students per year. About 93 percent of regular high schools offer instruction in grades 9 through 12, although various other grade configurations are represented, most commonly 10-12, or 7-12. These schools reported employing 56,571 full-time equivalent (FTE) teachers in fall 1998, with 14.1 percent of the FTE dedicated to mathematics instruction.

The web site for California's Standardized Testing and Reporting (STAR) program (http://star.cde.ca.gov/) provided school average mathematics achievement test scores. The Stanford Achievement Test Series, Ninth Edition, (Stanford 9), was administered to all students in grades 2 through 11 between March 15 and

May 25, 1998. The Stanford 9 high school mathematics tests require 45 minutes of examination time and include 48 questions. The content of the tests is oriented towards basic skills and is based on the curriculum and evaluation standards published by the National Council of Teachers of Mathematics. Scaled scores were derived using Item Response Theory Rasch model techniques (Harcourt Brace, 1997).

Teachers with instructional assignments in mathematics were identified from the results of the 1998 Professional Assignment Information Form (PAIF), an annual survey conducted as a part of California Basic Educational Data System (CBEDS). The information requested on the PAIF is required of each certificated staff person, and includes demographics, assignments, and position/credentials. The educational level of teachers with instructional assignments in mathematics was coded as: (1) Doctorate; (2) Master's degree plus 30 or more semester hours; (3) Master's degree; (4) Bachelor's degree plus 30 or more semester hours; (5) Bachelor's degree; and (6) Less than Bachelor's degree. Very few teachers possess less than a Bachelor's degree, so these individuals were aggregated with those who did possess the degree. Years of educational service included service in the current district, other states, and countries, but did not include substitute teaching. School summary statistics for staff with mathematics assignments included the numbers with emergency permits, teaching credentials, and mathematics authorizations. The percent of emergency permits was computed using the headcount of staff with one or more mathematics assignments as denominator and the number of staff with emergency permits as numerator.

Aid to Families with Dependent Children (AFDC) is based on the percentage of students in the school's attendance area who are enrolled in either public or private schools and who are from families receiving aid. As an indicator of poverty AFDC often correlates with student achievement (White, 1982), and functions in this study as a control variable.

### *Results*

The CBEDS data revealed that 10.5 percent of mathematics teachers in regular high schools had emergency permits. Although a few emergency permit teachers had advanced degrees, 85.9 percent possessed a baccalaureate degree or less. By contrast, 41.3 percent of mathematics teachers with credentials had a masters degree or better.

Table 1 displays mean test scores, proportion of students participating in the assessment, AFDC, years of experience of mathematics teachers, and education level of mathematics teachers. Grade-level mean test scores and participation rates were weighted by the number of students tested. AFDC and the teacher statistics reflect the entire school and were weighted by total school enrollment. An increasing trend in test scores suggests a modest increase in achievement from grade 9 to 11. The declining number of students enrolled in higher grades is consistent with student attrition from dropping out. The decreasing trend in student participation is consistent with more selective testing in grade 11.

**Table 1**
**Means of Selected Variables**

| | *School* | *Grade 9* | *Grade 10* | *Grade 11* |
|---|---|---|---|---|
| Test Score | — | 690 | 697 | 703 |
| Participation | — | 86% | 85% | 81% |
| AFDC | 15.7% | — | — | — |
| Years Teaching | 14.4 | — | — | — |
| Education Level | 3.6 | — | — | — |
| Number Tested | — | 347,201 | 313,303 | 260,933 |
| Number Enrolled | — | 405,516 | 370,080 | 321,896 |
| Number of Schools | — | 785 | 794 | 789 |

Note: Dashes in a cell indicate that data are not available.

Table 2 displays selected correlations of school mean scaled scores with selected school mean variables weighted by the appropriate grade enrollment. The results are consistent across grades. All correlations are statistically significant, ($p<.001$). The strong relationship often found between poverty and achievement is replicated in this study. AFDC correlates more strongly with test scores than do the other study variables. Correlations with AFDC are largest for ninth grade test scores and smallest for eleventh grade. An investigation of this trend is beyond the scope of this study. However, it is possible that lower achieving students are less likely to be tested in higher grades, possibly the result of dropping out.

The positive relationship between student participation and test scores is perhaps unexpected and seems inconsistent with the hypothesis that lower participation rates are associated with widespread exclusion of lower achieving students. However, school participation rates are negatively related to poverty. Schools with more poverty tend to have lower participation rates and lower test scores. Schools with less poverty tend to have higher participation rates and higher scores. Of course, school characteristics other than poverty could be related to student participation.

**Table 2**
**Correlations for Selected Variables**

| Variable | 9th Grade Test Score | 10th Grade Test Score | 11th Grade Test Score |
|---|---|---|---|
| Percent AFDC | -0.64 | -0.61 | -0.59 |
| Percent Participation | 0.45 | 0.48 | 0.35 |
| Years Teaching | 0.24 | 0.26 | 0.27 |
| Education Level | -0.24 | -0.23 | -0.22 |
| Percent Emergencies | -0.39 | -0.36 | -0.36 |

Note: All correlations are statistically significant, ($p < .001$).

For example, participation rates might reflect administrative competence. Students at better run schools might have better opportunities to learn and might be more likely to do well on tests.

Teaching experience, measured by the average number of years in service, is positively related to test results. Schools with well-prepared teachers tend to have higher mathematics scores, whether preparation is measured as percent of mathematics teachers with emergency permits or as an education level index. To some extent, the effect of teaching experience is mediated by poverty. That is, schools with more poverty tend to have both less well-prepared teachers and lower test scores. One way to assess the influence variables independently is to include all of them in a multiple regression analysis.

Table 3 displays the results of three multiple regression analysis for grades 9, 10, and 11. Achievement test scores were the dependent variables and the analyses were weighted by the number of students tested. The three multiple regressions yield similar patterns of results. Student poverty, measured by AFDC, demonstrates the strongest relationship with test scores. Student participation, following the pattern of related simple correlations, is positively related to test scores, even after taking poverty into account. The percent of mathematics teachers on emergency permits predicted test scores about as well as student participation. Higher percents of emergency permits were associated with lower scores. Finally, the average number of years of teaching experience was positively related to scores. Schools with more experienced mathematics teachers tend to have higher mathematics achievement. The values of $R^2$, a measure of how well the independent variables predict test scores, appear to trend slightly down as the grade levels increase. This downward trend parallels a similar slight downward trend in the importance of AFDC as a predictor. One explanation for the trend could be increasing homogeneity of students at upper grade levels. As more disadvantaged students either drop out or find placement in alternative schools, those remaining in regular high schools become more similar socially and demographically. If this hypothesis is true, it could account for some of the increase in test scores in higher grades.

**Table 3**
**Multiple Regression Analyses by Grade Level**

| | Grade 9 Weights | | Grade 10 Weights | | Grade 11 Weights | |
|---|---|---|---|---|---|---|
| | Raw | Beta | Raw | Beta | Raw | Beta |
| Intercept | 671.1 | 0 | 667.5 | 0 | 686.3 | 0 |
| AFDC | -0.6 | -10.7 | -0.5 | -9.3 | -0.6 | -9.0 |
| Participation | 30.7 | 3.7 | 39.4 | 4.5 | 24.6 | 2.9 |
| Years Teaching | 0.3 | 1.7 | 0.4 | 2.1 | 0.5 | 2.4 |
| Percent Emergencies | -27.8 | -4.1 | -19.8 | -3.1 | -24.4 | -3.2 |
| $R^2$ | 0.50 | | 0.47 | | 0.44 | |

### *Discussion*

The results of the first study are consistent with the hypothesis that there is a shortage of qualified mathematics teachers and that this shortage is associated with weak student achievement in mathematics. Student poverty strongly predicts mathematics achievement in this study, as in many others. After factoring out the effects of poverty, teacher experience and preparation continue to demonstrate a significant association with achievement.

Several California policies communicate the importance of learning mathematics. Long-standing high school graduation course requirements encourage students to commit a significant amount of time to mathematics instruction. Similar course requirements for college entrance reinforce the message. A state curriculum framework for mathematics appeared in 1985, and the state colleges and universities published a statement of desired competencies in 1982. More recently, the State Board has adopted mathematics curriculum standards describing what students are expected to know and be able to do at each grade level. Current and past statewide assessment programs include mathematics tests. California policymakers and educators have consistently proclaimed the importance of teaching and learning mathematics. To what extent has the setting of priorities and goals correlated with desired student outcomes?

High school student performance in mathematics does not meet expectations, for those who are college bound or for others. The NAEP mathematics results show relatively large percentages of students at "below basic" skill levels. Compared to the nation, California has lower percentages of students that are "at or above basic." The NAEP results are consistent with the 1998 findings from the STAR assessment program that suggest lagging performance of California high school students on the basis of national norms.

One explanation for the lower than expected results in mathematics relates to student demographics. Traditionally, student poverty correlates with low achievement. Possibly, disadvantaged students enjoy less support for academic pursuits from their families and peers, and are more focused on meeting needs related to safety and survival. California has a growing number of students whose primary language is not English. These students do not have the same degree of access to the curriculum or assessment as native English speakers. On the other hand, many believe that teaching and learning mathematics depends less on mastery of English than other subjects. Although language skills are important for assessments of writing or reading comprehension, they probably play a lesser role in understanding mathematical notation, solving equations, etc.

Despite the powerful effect of poverty, the experience and education of mathematics teachers predicts student achievement. Schools with more experienced and more highly educated mathematics teachers tended to have higher achieving students. Schools with higher percentages of teachers on emergency permits tended to have lower achieving students. Unfortunately, teacher credential information indicates a declining trend in the number of newly-prepared, fully-qualified, high school mathematics teachers, and increases in the number of those who are teaching out of their area or on emergency permits. One reason advanced for these trends is that college students with an interest in mathematics avoid teaching in favor of more lucrative career pathways found in science or engineering. There appears to be a shortage of mathematically able students to meet the overall demand in teaching and other professions. Given growing K-12 enrollments and growth in technical professions that compete with education, this shortage is likely to persist and grow more severe.

One way to mitigate the effects of this shortage would be to provide training in mathematics to teachers who lack subject matter preparation. One difficulty with such staff development is that the amount of training needed to develop the necessary skills is likely to be great, and that limited staff time and resources will result in long, sustained periods of training. The challenge, in some cases, will be to provide the equivalent of an undergraduate minor spanning multiple courses over a period of years, to a teacher who is already employed full-time. Some under-prepared teachers may not have taken the necessary courses in college because they lacked prerequisite skills from high school. This in-service challenge will be difficult to reconcile with the limited time and resources usually provided for staff development. Given the difficulties, it would be prudent to evaluate the effectiveness of such in-service programs, and to consider other ways of easing the shortage. Financial incentives might induce more people to take up teaching mathematics. There is abundant anecdotal evidence that higher starting salaries in other fields have drawn people with technical skills away from teaching. One drawback of financial incentives is the potential for inequality and divisiveness that they might create in the teaching profession. An additional issue is whether policy makers could make available sufficient additional funds for an incentive program large enough to meet the needs of schools.

An alternative long-term strategy to address a shortage would be to require higher levels of mathematical skills of all undergraduate students, possibly by increasing the rigor and number of required lower division mathematics courses, and by requiring more upper division mathematics courses. The general education breadth requirement at the California State University (1993) calls for “a minimum of twelve semester units or eighteen quarter units into the physical universe and its life forms, with some immediate participation in laboratory activity, and into mathematical concepts and quantitative reasoning and their applications” (California State University, 1993). This policy often translates into a requirement for one mathematics course. Strengthening the mathematics requirements could increase the numbers of students who major or minor in the subject, and could help to meet the demand for such expertise in teaching and other professions.

High school student ability in mathematics should be seen as one outcome of a larger system that includes both K-12 schools and higher education. It would be unfortunate if weakened undergraduate requirements perpetuate poor high school preparation. This pattern could be a symptom of a downward spiral in mathematics literacy in the population. As collegiate requirements weaken, resources for undergraduate mathematics programs diminish, the mathematics skills of teachers decrease, and the students are less well prepared. Expectations of faculty and administrators in high school and college drift lower, making it more difficult to provide the resources and leadership needed to create and implement high standards. In the short run a pattern of low expectations and low performance is the path of least resistance. In the long run the path of least resistance results in lowered student ability and decreased capacity to make improvements.

## Study 2: Teacher Characteristics and Dropout Rate

### *Method*

Data for 805 regular high schools were obtained from mandated annual surveys administered by the California Basic Educational Data System (CBEDS) administered by the California Department of Education. The average student enrollment was an indicator of school size. Federally derived descriptors of school location provided the basis for categorizing school location as Large City, Medium City, Urban Fringe, or Rural. The research literature links both of these measures with school dropout rates, and they are included primarily as controls for the teacher education and employment variables (Cibulka, 1986; Coley, 1995; Ekstrom, Geortz, Pollack, & Rock, 1986; Fetler, 1997b; Guthrie & Kirst, 1988; Hamilton, 1986; Hammack, 1986; McDill, Natriello, & Pallas, 1985; Pittman & Houghwout, 1987; Rumberger, 1987; Schwartz, 1995; Toles, Schulz, & Rice, 1986; Venezky, Kaestle, & Sum, 1987).

The school level measures of teacher characteristics included annual growth in the number of employed teachers, the percent of new first-time teachers, the percent of teachers with only a Bachelor's degree, the average number of years of education, and the average number of years of experience of the teaching staff. Schools with increasing or declining student enrollment adjust the number of teachers they employ in order to meet the actual need for instruction. High growth schools experience relatively high demand for teachers both through the need to replace teachers who might ordinarily leave or retire, and the need to augment their teaching staff to accommodate added students. The average net annual growth in the size of the teaching staff is an indicator of the stability of the faculty. The percent of new first-time teachers and the average years of experience are indicators of teacher experience. The percent of teachers with only a Bachelor's degree and the estimated number of years of education are indicators of teacher educational background.

The two measures of student characteristics are the percent of students covered by the federal Aid to Families with Dependent Children (AFDC) program, and the annual dropout rate. The annual dropout rate is a measure of student performance. The annual dropout rate estimates the percent of students who leave during the course of a year, and is smaller than a cumulative rate which estimates the percent of a cohort leaving over a period of years.

### *Results*

Table 4 displays statewide means, medians, and standard deviations. The distributions of three measures are skewed: the percent of faculty with only a Bachelor's, the percent AFDC, and the dropout rate. The positive values of the faculty growth measure are consistent with the overall growth in California's enrollments. Even so, about one-third of high schools reduced the size of their faculty over the four years covered by this study.

Table 5 shows that school average dropout rates are moderately correlated with all study variables, except the annual growth of the number of faculty. The usual correlations of school size and poverty with dropout rates are replicated in this study. The average number of years of teacher education and experience are negatively correlated with the dropout rate, so that schools with more highly educated and experienced teachers tend to have fewer dropouts. The percent of teachers with only a Bachelor's degree and the percent of new teachers are positively correlated with the dropout rate, suggesting that schools with minimally educated, novice teachers tend to have more dropouts. Consistent with expectation, years of teacher experience and education are positively associated with one another, and negatively associated with the percent of new teachers and percent of teachers with only a Bachelor's. That is, schools with more highly educated and experienced teachers tend to have fewer novice and minimally educated faculty.

The multiple regression analysis in Table 6 helps to assess the influence of each indicator on the dropout rate independently of the influence of other measures.

**Table 4**
**Means, Medians, and Standard Deviations of Student, School, and Teacher Measures**

| Measure | Median | Mean | Standard Deviation |
|---|---|---|---|
| Student Enrollment (ENR) | 2,112 | 1,983 | 853 |
| Faculty Growth (FGR) | 0.6 | 1.0 | 3.2 |
| Percent New Teachers (PNT) | 4.7% | 5.2% | 3.2% |
| Years of Education (YED) | 5.6 | 5.6 | 0.3 |
| Percent Bachelor's (PBA) | 6.6% | 11.4% | 11.5% |
| Years of Experience (YEX) | 16.1 | 16.3 | 2.9 |
| Percent AFDC (AFDC) | 11.4% | 15.3% | 12.3% |
| Dropout Rate (DOR) | 2.1 | 3.8 | 3.7 |

**Table 5**
**Correlations of Student, School, and Teacher Measures**

| | FGR | PNT | YED | PBA | YEX | AFDC | DOR |
|---|---|---|---|---|---|---|---|
| ENR | .16 | .02 | .04 | .21 | -.10 | .26 | .39 |
| FGR | | .26 | .08 | .13 | -.18 | -.09 | .10 |
| PNT | | | -.23 | .33 | -.43 | .09 | .26 |
| YED | | | | -.57 | .36 | -.14 | -.25 |
| PBA | | | | | -.21 | .19 | .44 |
| YEX | | | | | | -.21 | -.20 |
| AFDC | | | | | | | .51 |

Note: Correlations with an absolute value greater than .10 are statistically significant, ($p < .01$).

School enrollment, the percent of new teachers, the percent of teachers with only a Bachelor's, and AFDC were significantly associated with dropout rate. The standardized betas permit a comparison of the importance of these variables in predicting dropouts. AFDC appears to have the greatest impact, with a change of one standard deviation in AFDC related to a change of 3.2 standard deviations in the predicted dropout rate. Percent of teachers with only a Bachelor's degree and enrollment were nearly as important, followed by the percent of new teachers.

Table 7 displays a profile of two groups of schools identified as in either the top or bottom ten percent with regard to dropout rates. There were 80 schools in each group. The dropout rate of schools in the low group was about one-fortieth of those in the high group. The two groups differed markedly in terms of enrollment and AFDC, consistent with earlier results. The profiles show statistically significant differences between the two groups for the percent of teachers with only a Bachelor's and the percent of new teachers. The percent of teachers with only a Bachelor's was

**Table 6**
**Regression Analysis of Dropout Rate**

| Measure | Parameter Estimate | Standardized Beta |
|---|---|---|
| Intercept | -0.39 | 0 |
| Enrollment | 0.001* | 1.9 |
| Faculty Growth | 0.03 | 0.2 |
| Percent New Teachers | 0.20* | 1.1 |
| Years of Education | -0.60 | -0.4 |
| Percent B.A. | 0.09* | 2.0 |
| Years of Experience | 0.07 | 0.3 |
| AFDC | 0.13* | 3.2 |

*Significant ($p < .001$). $R^2 = 0.44$.

**Table 7**
**Profile of Schools with High and Low Dropout Rates**

| Measure | Low Ten Percent | High Ten Percent |
|---|---|---|
| Dropout Rate* | 0.3 | 12.6 |
| Enrollment* | 1579 | 2733 |
| Teacher Annual Growth | 2.1 | 2.0 |
| Percent New Teachers* | 4.6 | 7.0 |
| Years of Education* | 5.7 | 5.4 |
| Percent B.A.* | 8.5 | 24.4 |
| Years of Experience | 17.1 | 15.5 |
| AFDC* | 6.1 | 26.9 |

*Differences between means are significant, ($p < .001$).

about three times larger in the high dropout group compared to the low dropout group.

### Discussion

This study replicates traditional findings that higher dropout rates are more likely in larger schools and in poor or urban areas. The relationship between poverty and student performance has long been documented (White, 1982). The correlates of poverty, perhaps including childhood neglect, lack of family or peer support for education, neighborhood crime, etc. work to decrease the chances of a diploma. People who are struggling to meet more basic, short term needs of food, shelter, and physical safety probably attend less to academic development, however much it is in their long term interest. Despite cases of exceptionally effective schools and teachers, or determined parents and students, a substantial performance gap persists between schools with disadvantaged and those with more affluent students.

One facet of research on effective schools is to identify factors that help students overcome disadvantages. This study confirms prior findings that teacher experience and education are two such factors. Teacher education and experience appear to influence dropout rates. The smaller the proportion of inexperienced teachers who are new to a school, the lower the dropout rate. The smaller the percent of teachers with only a Bachelor's degree, the lower the dropout rate. A comparison of teacher education and experience in the regression analysis, suggests that education has a stronger influence on the dropout rate. This influence appears to hold independently of poverty, school size, and urban location.

Overall years of teaching and years of education are less strongly associated with the dropout rate than the percent of new teachers or the percent with only a Bachelor's degree. One possible reason for the difference may exist in the assignments that schools typically give new teachers. More experienced teachers with seniority usually receive more desirable classroom assignments with well behaved, higher achieving students. Novice teachers lacking seniority receive less desirable, more difficult classrooms with lower achieving, at-risk students. Novice teachers are more likely to have minimum levels of education, particularly if the school district has lowered its hiring standards to maintain staffing levels. Arguably, at-risk students are most in need of intensive, skilled instruction, counseling, and support. Less well-educated novice teachers are the least capable members of faculty able to provide the needed services and support. Ironically, as novice teachers gain experience and education, they gain seniority that enables them to opt out of difficult assignments. While this pattern of assigning classrooms likely exists in many schools, the effects are probably more severe in hard to staff schools with a high proportion of disadvantaged, at-risk students. Such unpopular schools probably have difficulty in retaining more experienced and educated staff. With lower levels of education and experience at a school there is less capability to support and train new teachers.

## Conclusion

The quality of teacher preparation, the quantity of available teachers, and student outcomes are interrelated. A quick response to perceptions of a teacher shortage might be to lower teacher preparation standards in order to increase the supply of teachers. It would be unfortunate if the need for more teachers eroded standards for teacher preparation. This scenario leads towards lower student performance, less job satisfaction, higher teacher attrition, increased public discontent, and further erosion of standards. Easier teacher preparation programs and emergency permit hiring are expedient solutions to short term employment needs. However, such expediency will bring about greater long-term problems.

A different policy is preferable. Teachers who are more thoroughly prepared to meet the specific needs of schools will persist longer in their jobs. If this is true, higher retention rates of qualified teachers will result in the establishment of a more stable, satisfied, and highly competent workforce, slowing the revolving employment door at school district offices, and reducing the need for emergency permit hiring. An additional, perhaps more important benefit is that better prepared teachers should be more effective in their jobs and assist more students to higher levels of attainment. A policy of higher standards and more support may be difficult to achieve in the near term. Public schools will have to be weaned from expedient employment practices, and preparation programs will need to become more rigorous and attentive to local needs. In the longer term this policy will benefit students and the teaching profession.

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