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ABSTRACT

Data from the National Educational Longitudinal Study of 1988 (NELS:88), which allow students to be linked to particular teachers, are used to estimate the impact of teacher degrees on student performance in the subject areas of mathematics, science, English, and history. The NELS:88 was a nationally representative survey of about 24,000 eighth graders in 1988, about 18,000 of whom were surveyed again in 1990. It was found that several teacher characteristics do appear to make a difference in student performance. Teachers certified in mathematics and those with Bachelors' or Masters' degrees in mathematics and science were associated with higher student performance scores. Mathematics and science degrees were not found to influence student outcomes in English and history, suggesting that it is the subject-specific training rather than teacher ability that results in improved performance. This finding suggests that student achievement in technical subjects can be improved by requiring in-subject teaching. (Contains 4 tables and 16 references.) (SLD)

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Evaluating the Effect of Teacher Degree Level on Educational Performance

by

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Abstract

In this paper, we use data drawn from the *National Educational Longitudinal Study of 1988*, which allows students to be linked to particular teachers, to estimate the impact of teacher degrees on student performance in four subject areas. We find that several teacher characteristics do appear to matter--that is, they are statistically significant and influence student achievement in the expected direction. In particular, teachers in math and science subjects with subject-specific degrees are associated with higher student test scores in those subjects.

I. Introduction

The recently completed report on teaching in America released by the National Commission on Teaching and America's Future offers a general indictment of the teaching profession. The commission cites a number of statistics that purport to show that many newly hired teachers are unqualified for the job. In particular, the commission reports that one fourth of high school teachers lack college training in their primary classroom subject and that teacher recruiting and hiring practices nationwide are 'distressingly ad hoc' (*Washington Post*, 9/13/96). Underlying the concern about out-of-field teaching is the assumption that teachers with degrees in the subject that they teach are more effective. Although this may seem a common sense proposition, previous work on the relationship between educational outcomes and teacher characteristics is far from conclusive.

There have been literally hundreds of studies, by economists, sociologists and others, on the impact that schools and teachers have on students. Most have modeled standardized test scores across students, schools, or school districts, as a function of individual and family background characteristics and schooling variables such as expenditures per pupil and class size. The majority of these conclude that individual and family background traits explain the vast majority of variation in student test scores. The effects of educational inputs such as per pupil spending, teacher experience, and teacher degree level have been shown to be relatively unimportant predictors of outcomes, and the impact of any particular input to be inconsistent across studies (Hanushek, 1986).

These results are puzzling, particularly with regard to teachers. Teaching is the largest profession in the United States, employing over three million adults (NCES, 1994, p. 71). An elaborate system of teacher education and certification is geared toward the preparation of those entering teaching, and there are significant professional development opportunities for those remaining in the profession. More than 40% of teachers have at least a Masters degree and more than 25% have at least twenty years full-time teaching experience (NCES, 1994, p. 77). Over 60% of all schooling expenditures at the K-12 level are devoted to instructional costs which consist overwhelmingly of teacher salaries and benefits. Further, teacher salary incentives reward years of experience and degree levels, traits that do not appear to have a relationship to student achievement. What can explain the inconsistent findings of the educational productivity literature with respect to educational resources, particularly teachers? In this paper we shed some light on the relationship between student achievement and teacher degree levels. We begin, in the next section, by reviewing the educational productivity literature.

II. Background: Previous Literature on Educational Productivity

"Educational productivity" studies typically regress student outcomes, such as performance on a standardized test, on a host of factors such as individual and family background variables, and measures of school inputs such as class size, teacher experience and education, and expenditures per pupil.[1] A number of studies using this methodology have yielded inconclusive findings. Eric Hanushek notes that these studies as a whole show that "differences in [school] quality do not seem to reflect variations in expenditures, class sizes, or other commonly measured attributes of schools and teachers" (Hanushek, 1986, p. 1142). He concludes that there is "no strong evidence that teacher-student ratios, teacher education, or teacher experience have an expected positive effect on student achievement" and that "there appears to be no strong or systematic relationship between school expenditures and student performance" (Hanushek, 1986, p. 1162).

These findings raise the question of whether it makes sense, from an efficiency standpoint, for schools to spend large sums of money hiring teachers with advanced degrees. However, it may be premature to reach strong conclusions about the impact of teacher training on student outcomes based on the previous research. For example, a recent "meta-analysis" by Hedges, et. al. (1994), using the same set of studies reviewed by Hanushek, found that the pattern of estimated coefficients reveals a positive relationship between observable teacher characteristics and student outcomes.[2]

Another problem with many of the studies reviewed by Hanushek is that variables representing school and teacher "quality" are typically very crude. For instance, degree level alone does not distinguish between colleges of differing quality, nor when the degree was granted, nor

[1] It is quite likely that there are unobservable characteristics factors that are typically omitted from educational production functions, and may lead to bias in the estimated effects of observable characteristics. For further discussion of this, see Goldhaber and Brewer (1997).

[2] One may also reject many of the studies reviewed by Hanushek on the basis of poor data. For instance, many early studies were unable to control for prior achievement using a "pre-test" score to net out individual ability, as is now generally accepted to be important (Boardman and Murnane, 1979; Hanushek, 1979; Hedges et al., 1994).

does it convey any information about college major, certification requirements fulfilled, or subsequent professional development.

Production function studies which have used more refined measures of teacher inputs have found more consistent results. Monk and King (1994) report that teacher subject matter preparation in mathematics and science does have some positive impact on student achievement in those subjects. Measures of the selectivity of teachers' colleges have also been shown to be positively related to student achievement (Ehrenberg and Brewer, 1994). The latter result most likely reflects the fact that the selectivity measure captures teacher ability.[3] Additionally, teacher motivation, enthusiasm, and skill at presenting class material are likely to influence students' achievement, but are difficult traits to accurately measure and are thus omitted from standard regression analyses (Goldhaber and Brewer, 1997).

Data deficiencies in previous studies may also have led to significant measurement error problems. Many studies that include teacher and class characteristics use variables that have been aggregated to the school-level. There is considerable variation in teacher and class characteristics within schools; hence these aggregate level variables are measured with error and may not accurately reflect the true student-teacher relationships. This can lead to dramatically different estimates of the effects of school resources on achievement.[4] Here we focus primarily on teachers, emphasizing how subtle differences in model specification can influence the results and interpretation of the relationship between teacher qualifications and student outcomes.

III. Econometric Methodology and Data

Following the conventional educational production function methodology, we model the achievement of student i at school j, Y_{ij} as a function of a vector of individual and family background variables (including some measure of prior ability or achievement), X_{ij}, and a vector of schooling resources, S_j, which do not vary across students, and a random error term:

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[3] Also, the few studies which have had measures of teacher (verbal) ability, for example in the form of a teacher test score, have found a much more robust positive relationship to student achievement (Coleman et al., 1966; Ehrenberg and Brewer, 1995; Ferguson, 1991) than those using other teacher characteristics.

[4] Akerhielm (1995) finds this result in the case of class size.

$$Y_{ij} = \beta X_{ij} + \gamma S_j + \epsilon_{ij} \tag{1}$$

S_j may consist of school, teacher, or class specific variables. β is the return to individual and family background characteristics and γ is the return to schooling resources. The dependent variable, Y_{ij}, is individual student achievement (in the 10^{th} grade) on separate standardized tests in each of the four subject areas: math, science, English, and history. The assumption of the model is that the included individual and family background variables and included schooling resources are uncorrelated with the error term.[5]

We start by including only school-level variables in S_J, then sequentially include general teacher characteristic variables, class-level variables, and finally specific teacher degree variables. If (1) is correctly specified, Ordinary Least Squares (OLS) estimation will yield consistent estimates of β and γ and the overall importance of schooling factors S_j can be ascertained by performing an F-test of the hypothesis that the coefficients of the schooling variables are jointly equal to zero. The addition of subject-specific teacher degree information to the model allows us to determine whether these variables affect student outcomes, and how the omission of these variables can influence the general interpretation of teachers' impact on students.

The data used here are derived from the first two waves of the *National Educational Longitudinal Study of 1988* (NELS). NELS is a nationally representative survey of about 24,000 8^{th} grade students conducted in the spring of 1988. About 18,000 of these students were resurveyed in the 10^{th} grade (spring 1990). At the time of each survey students took one or more subject based tests in four subject areas: math, science, English, and history. The tests were carefully designed to avoid "floor" and "ceiling" testing effects and were put on a common scale using Item Response Theory.[6]

The NELS dataset is particularly well suited for our analysis since it is nationally representative, contains a comprehensive set of educational variables, and unlike most other data,

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[5] For a discussion of the implications of violating this assumption see Goldhaber and Brewer (1997).

[6] For more information on this methodology, see Rock and Pollock (1991).

links students to specific classes and teachers. This is an important characteristic of the survey since it eliminates problems that may arise from using data aggregated to the school-level. Further, this linkage allows us to investigate in detail the effect of subject-specific teacher degree levels on student achievement since the characteristics of each 10th grade teacher (race/ethnicity, degree level, experience, certification, etc.) who taught students taking the 10th grade subject tests are known. The teacher and class data in NELS are organized by school subject, such that separate information is available about the teachers in each of the four subject areas sampled. As a result, the sample here is also classified by subject area and all regressions are estimated separately on students who have complete information in math, science, English, and history. We confine our attention to public school students to avoid potential problems arising from the non-random assignment of students to private schools (Goldhaber, 1996). The sample consists of 5,113 students in math, 4,357 students in science, 6,196 students in English, and 2,943 students in history.

Virtually all teachers in public schools have at least an undergraduate degree. However, as illustrated in Table 1, which shows descriptive statistics broken down by subject area, far fewer teachers have degrees specific to the subject in which they teach. Consistent with the findings of the National Commission on Teaching and America's Future, in our sample only 68 to 76 percent (depending on class subject) of teachers have at least a BA in their subject area. A lower proportion of math and science teachers have BA degrees in their subject area than English and history teachers. And although about half of all teachers have at least an MA degree, less than a quarter have advanced degrees in their subject area. Finally, it is interesting to note that there is considerable variation by subject in the proportion of teachers who are female, with a much higher proportion of female teachers in English.[7]

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[7] For a discussion of the impact of teacher race, gender, and Ethnicity on student achievement, see Ehrenberg, Goldhaber, and Brewer (1995).

Table 1. Sample Means for Select Variables (standard deviation)

	Math	Science	English	History
8th grade test score	36.58 (11.66)	18.83 (4.75)	26.98 (8.43)	29.65 (4.56)
10th grade test score	43.96 (13.63)	21.78 (7.47)	30.52 (10.16)	32.25 (7.33)
Teacher's BA degree in subject	.68 (.47)	.69 (.46)	.73 (.45)	.76 (.43)
Teacher has MA (or more) degree	.50 (.50)	.55 (.50)	.51 (.50)	.52 (.41)
Teacher's MA degree in subject	.17 (.37)	.23 (.42)	.17 (.38)	.22 (.41)
Teacher is certified in subject	.97 (.18)	.94 (.24)	.95 (.22)	.94 (.23)
Teacher years of experience	15.52 (9.01)	15.37 (9.34)	15.42 (8.43)	15.65 (8.57)
Teacher is female	.46 (.50)	.39 (.49)	.71 (.45)	.32 (.47)
Teacher is black	.04 (.19)	.04 (.20)	.05 (.23)	.05 (.22)
Teacher is Hispanic	.02 (.14)	.02 (.14)	.02 (.14)	.01 (.10)
Teacher is Asian	.01 (.11)	.01 (.09)	.003 (.06)	.01 (.08)
Class size	23.35 (6.94)	23.58 (7.00)	23.51 (6.10)	24.89 (6.94)

IV. Results

General Educational Production Function Models[8]

Table 2 shows the ordinary least squares estimates of the 10th grade educational achievement in each of four subject areas. Included in the model are four sets of explanatory variables: individual and family background variables, school-level variables, teacher variables, and class variables. The individual and family background variables include sex, race/ethnicity, parental education, family structure, family income, and 8th grade test score. School variables include urbanicity, regional dummies, school size, the percentage of students at the school who are white, the percentage of students at the school who are from single parent families, and the percentage of teachers at the school with at least a Masters degree. Teacher variables include sex, race/ethnicity, years of

[8] We refer to models without subject-specific teacher characteristics as "general" models.

experience at the secondary level, whether the teacher is certified, and the teacher's degree level. Class-level variables include class size and percentage of minority students in the class.

Although we do not show the coefficients of individual and family background variables, they are included in each model. For each subject area these variables alone account for the majority of the variation that we are able to explain with our full model. Most of the estimated coefficients of these variables are statistically significant in the expected direction. For instance, years of parental education is significant and positively related to test scores in all four subjects.

We estimate the models sequentially, first including only individual and family background variables, then adding school, teacher, and class variables respectively. There are interesting differences between subjects in terms of what is explained by each set of variables. Separate F-tests for the school, teacher, and class variables, of the hypotheses that the coefficients at each level are jointly equal to zero, are rejected at the 5% level for math and science subjects. However, in English and history, the null hypotheses of joint significance is only rejected in two cases: for the class-level variables in English, and the school-level variables in history. It is also worth noting that we explain a much larger portion of the overall variation in math and English test scores, than we do in science and history.

A closer examination of the results reveals that few of the school, teacher, or class coefficients are statistically significant in the expected direction. For instance, we find the counterintuitive result that class size is positively associated with student achievement in three of the four subject areas (with history being the exception).[9] We also find the percentage of teachers with at least a Masters degree is stastically insignificant in all four subject areas (this is true in both the model estimated with only school-level variables and the models shown in Table 2 which include school, teacher, and class variables). Although this finding may simply indicate that there is little relationship between school-level variables and individual student achievement, it is certainly consistent of previous findings which have helped to shape the impression that teachers' qualifications don't matter.

Other results from these general models tell a similar story. Years of teaching experience is

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[9] Although this result is counterintuitive, it is not atypical of production function results (see Akerhielm (1995) who found a similar result which she attributed to the non-random assignment of students to classes).

not statistically significant in any subject area, nor is it statistically significant whether the teacher has a Masters degree.[10] This implies that teachers with Masters degrees are no more (or less) effective than those without an advanced degree, clearly a counterintuitive finding. The results for teacher certification are similar in that we find the coefficient on teacher certification to be statistically insignificant (except in English, where teacher certification is significant and negative). In the next section we discuss the impact of adding subject-specific teacher characteristics to the model.

Table 2. OLS Estimate of 10th Grade Achievement[a]
(absolute value of t-statistic)

	Math	Science	English	History
School Variables				
Urban	-0.058 (0.2)	0.365 (1.3)	0.420 (1.7)	1.929 (4.7)
Rural	-0.288 (1.2)	0.132 (0.6)	-0.145 (0.7)	0.421 (1.4)
Northeast	0.690 (2.2)	0.586 (2.0)	0.468 (1.6)	0.986 (2.7)
North central	0.053 (0.2)	0.674 (2.7)	0.151 (0.7)	-0.213 (0.7)
West	-0.039 (0.1)	0.494 (1.8)	0.161 (0.6)	0.225 (0.6)
School size (x 1000)	0.141 (0.7)	0.593 (3.5)	0.148 (1.0)	0.648 (2.5)
% white in school	-0.029 (5.1)	-0.018 (3.0)	-0.023 (4.7)	-0.001 (0.1)
% teachers with MA or more in school (x 1000)	-0.021 (0.0)	2.627 (0.5)	-3.838 (0.8)	4.510 (0.8)

[10] Although the race, ethnicity, and gender of teachers appears to impact student scores in math and science, we do not explore the issue here. For a more detailed analysis of this issue, see Ehrenberg, Goldhaber and Brewer (1995).

% students from single parent families (x 1000)	-9.863 (1.5)	0.136 (0.0)	-5.541 (1.0)	0.900 (0.1)
Teacher Variables				
Female	0.666 (3.4)	-0.058 (0.3)	0.217 (1.2)	0.275 (1.1)
Black	-0.886 (1.7)	-0.649 (1.4)	-0.523 (1.4)	1.061 (1.8)
Hispanic	1.649 (2.3)	-2.641 (3.9)	0.396 (0.6)	1.148 (1.0)
Asian	0.812 (0.9)	-2.993 (2.9)	-0.320 (0.2)	-1.365 (0.9)
Years of experience at secondary level	0.018 (1.5)	0.007 (0.7)	-0.007 (0.6)	0.025 (1.6)
Certified	-0.511 (0.9)	0.140 (0.3)	-1.267 (1.9)	0.170 (0.2)
MA or more degree	0.247 (1.2)	0.030 (0.2)	-0.070 (0.4)	-0.038 (0.1)
Class Variables				
Class size	0.038 (2.6)	-0.029 (2.1)	0.023 (1.6)	-0.013 (0.7)
Percent minority in class	-0.039 (6.3)	-0.013 (2.1)	-0.027 (4.9)	-0.011 (1.3)
Sample Size	5113	4357	6196	2943
Adjusted R^2	0.766	0.377	0.605	0.275

[a] Models also include individual and family background variables.

Subject-specific Teacher Models

Traditional education production functions do not include subject-specific teacher degree and certification information. The results in the previous section would lead one to the conclusion that teacher degree and certification have no impact on student achievement, which is in line with much of the previous literature. However, at least in our sample, the use of teacher subject-specific information is critical in interpreting the effects of these teacher characteristics on student achievement.

Table 3 shows the results when we add subject-specific teacher characteristics to our model (whether the teacher is certified in their subject area, and whether the teacher has BA or MA degrees in their subject area). These variables allow us to distinguish between teachers who are teaching specific classes and have a major in that subject (BA or MA), teaching specific classes and are certified in that subject, and those who are teaching but do not have subject-specific training. Columns (1), (3), (5), and (7) of the table are the estimated teacher coefficients when only general teacher variables are included in the model (reproduced from columns 1-4 of Table 1), while columns (2), (4), (6), and (8) show the results when we include the more refined subject-specific teacher characteristics.

In math and science, teacher subject-specific training has a significant impact on student test scores in those subjects (see columns (2) and (4)). A teacher with a BA in math, or an MA in math, has a statistically significant *positive* impact on students' achievement relative to teachers with no advanced degrees or degrees in non-math subjects.[11] We also see that teachers with BA degrees in science have a positive impact relative to those who teach science but have either no degree or a BA in another subject. These results are confirmed by performing F-tests of the hypotheses that the coefficients of the subject-specific variables are jointly equal to zero. The F-tests are rejected for math and science (at the 1 percent level). By contrast, we find no evidence that subject-specific degrees or certification have an effect on student achievement in English or history, where the

[11] We find similar results with teacher certification as illustrated by comparing the certification results in columns (1) and (2).

subject-specific variables were statistically insignificant.[12]

[12] In these subjects we could not reject the null hypothesis that the coefficients of the subject-specific variables are jointly equal to zero.

Table 3. Comparison of Selected Coefficients from Educational Production Functions[a]
(absolute value of t-statistic)

	Math		Science		English		History	
Teacher Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Years of experience at secondary level	0.018 (1.5)	0.013 (1.1)	0.007 (0.7)	0.007 (0.6)	-0.007 (0.6)	-0.007 (0.7)	0.025 (1.6)	0.025 (1.7)
Certified	-0.511 (0.9)	-2.343 (2.3)	0.140 (0.3)	-0.827 (1.2)	-1.267 (1.9)	-0.645 (0.7)	0.170 (0.2)	0.142 (0.1)
Certified in subject	-	2.172 (2.2)	-	1.130 (1.2)	-	-0.685 (0.9)	-	0.035 (0.0)
BA or more in subject	-	0.769 (3.6)	-	0.683 (3.3)	-	0.130 (0.3)	-	-0.243 (0.8)
MA or more degree	0.247 (1.2)	0.052 (0.2)	0.030 (0.2)	0.023 (0.1)	-0.070 (0.4)	-0.085 (0.4)	-0.038 (0.1)	-0.056 (0.2)
MA or more in subject	-	0.595 (2.1)	-	0.002 (0.0)	-	0.078 (0.3)	-	0.101 (0.3)
Sample Size	5113	5113	4357	4357	6196	6196	2943	2943
Adjusted R^2	0.766	0.767	0.377	0.378	0.605	0.605	0.275	0.274

[a] Models also include individual and family background variables.

It is possible that the positive findings for teacher degree in math and science do not reflect the training that teachers have in those subjects but simply that math and science degrees serve as proxies for teacher ability. To test this hypothesis we re-estimated all models, including whether a teacher has a math or science degree in the English and history regressions. If math and science degrees serve as proxies for teacher quality we would expect the coefficients on these variables to be significant and positive in all of the subject areas, including English and history. This is not the case. Neither the math nor the science degree level variables are statistically significant in the English and history regressions. This result clearly suggests that, in math and science, teacher subject-specific knowledge is an important factor in determining 10th grade achievement.

We can infer the magnitude of the effect of teacher training on student achievement by examining the estimated coefficients in the models that include subject-specific information. For example, the total effect of a teacher having a Masters degree in any subject in the model with only general teacher variables is simply the coefficient on the MA variable. However, in the models with subject-specific information we are able to calculate more refined measures of the impact of teacher degrees. Here, the effect of a teacher having an MA in math is the sum of the coefficients of MA and MA major in math. Table 4 shows the estimated effects of model specification on predicted 10th grade achievement scores in math and science (we do not show English and history because none of the subject-specific variables were statistically significant).[13]

We see the impact of model specification in math and science by comparing columns (1) and (2) for math, and columns (3) and (4) for science. The science results do not differ much when subject-specific variables are used; however, there are important differences in the math findings. In the model with general teacher variables we predict students (with average characteristics) who have a teacher who is certified in math and has both a BA and an MA in math to have a 10th grade math score of 44.06. However, these same students are predicted to have a 10th grade math score of 44.69 when the subject-specific specification of the model is used. The difference between these predicted scores, .63, is about 5% of the 10th grade math test standard deviation, a small difference.

[13] All other variables are measured at their mean value.

Table 4. Effect of Model Specification on Predicted Test Scores[a]

	Math		Science	
	Model with general teacher variables	Model with subject-specific variables	Model with general teacher variables	Model with subject-specific variables
Certification in subject	43.94	43.95	21.79	21.81
BA in subject	43.96	44.21	21.78	21.99
MA in subject	44.08	44.57	21.79	21.78
BA, MA, and certification in subject	44.06	44.69	21.80	22.02

[a] All other variables are measured at their mean value.

V. Conclusion

Most traditional educational production function studies have used somewhat crude teacher characteristics. For example, in many cases only school-level teacher variables (e.g. percentage of teachers in a school with a Masters degree) are included in statistical models of student achievement. In this paper we assess the impact of educational resources in explaining student achievement using more refined measures of teacher skill. We are able to do this using data drawn from the *National Longitudinal Study of 1988* which includes subject-specific teacher degree information and allows us to link students particular teachers and classes. This link enables us to avoid problems with aggregation that may have plagued earlier studies.

We find that subtle differences in model specification can result in very different interpretations of whether teachers affect student outcomes. Although school-level variables do not, in general, seem to have much affect on student achievement, some teacher characteristics do. Teachers who are certified in mathematics, and those with Bachelors or Masters degrees in math and science, are associated with higher test scores. Because math and science degrees were not found to influence student outcomes in English and history, we believe that these results suggest that it is the subject-specific training rather than teacher ability that leads to these findings. This is important because it suggests that student achievement in technical subjects can be improved by requiring in subject teaching.

References

Akerhielm, Karen (1995), "Does Class Size Matter?" *Economics of Education Review.* 14(3): 229-241.

Boardman, Anthony E., and Richard J. Murnane (1979), "Using Panel Data to Improve Estimates of the Determinants of Educational Achievement," *Sociology of Education.* 52: 113-121.

Coleman, James, et. al. (1966), *Equality of Educational Opportunity.* Washington, D.C.: U.S. Department of Health Education and Welfare.

Ehrenberg, Ronald G., and Dominic J. Brewer (1994), "Do School and Teacher Characteristics Matter? Evidence from *High School and Beyond*," *Economics of Education Review*, 13(1): 1-17.

Ehrenberg, Ronald G., and Dominic J. Brewer (1995), "Did Teachers' Verbal Ability and Race Matter in the 1960s? *Coleman* Revisited," *Economics of Education Review*, 14(1): 1-23.

Ehrenberg, Ronald G., Dan D. Goldhaber and Dominic J. Brewer (1995), "Do Teachers' Race, Gender, and Ethnicity Matter? Evidence from NELS88," *Industrial and Labor Relations Review*, 48(3):547-561.

Ferguson, Ronald (1991), "Paying for Public Education: New Evidence on How and Why Money Matters." *Harvard Journal on Legislation*, 28:465-498.

Goldhaber, Dan D. (1996), "Public and Private High Schools: Is School Choice and Answer to the Productivity Problem?," *Economics of Education Review*, 15 (3).

Goldhaber, Dan D, and Dominic J. Brewer (1997), "Why Don't Schools and Teachers Seem to Matter? Assessing the Impact of Unobservables on Educational Productivity," *Journal of Human Resources*. Forthcoming, 32(3).

Hanushek, Eric A. (1979), "Conceptual and Empirical issues in the Estimation of Education Production Functions," *Journal of Human Resources*, 14 (3): 351-388.

Hanushek, Eric A. (1986), "The Economics of Schooling: Production and Efficiency in the Public Schools," *Journal of Economic Literature*, XXIV (3): 1141-78.

Hedges, Larry, Richard Laine and Rob Greenwald (1994), "A Meta Analysis of the Effects if Differential School Inputs on Student Outcomes," *Educational Researcher*, 23(3):5-14.

James L. Wattenbarger (eds.), *Where Does the Money Go? Resource Allocation in Elementary and Secondary Schools*, Thousand Oaks, CA: Corwin Press.

Monk, David H., and Jennifer King (1994), "Multi-level Teacher Resource Effects on Pupil Performance in Secondary Mathematics and Science: The Role of Teacher Subject Matter Preparation,: in Ronald G. Ehrenberg (ed.), *Contemporary Policy Issues: Choices and Consequences in Education*, Ithaca, NY: ILR Press.

National Center for Education Statistics (NCES) (1994), *Digest of Educational Statistics*, Washington, D.C.: U.S. Department of Education, NCES 94-115.

Rock, D. A., and J. M. Pollock (1991), *Psychometric Report for NELS:88 Base Year Test Battery*, Washington, D.C.: National Center for Education Statistics.

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