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DO DOLLARS MAKE A DIFFERENCE? THE RELATIONSHIP BETWEEN EXPENDITURES AND TEST SCORES IN PENNSYLVANIA'S PUBLIC SCHOOLS

by Jonathan Klick*

Abstract

For the past three decades it has been evident that the quality of public schools in the United States has been on the decline. Whether measured empirically against the systems of other countries or judged anecdotally by employers who believe today's high school graduates do not have the skills requisite for even entry-level work, it becomes clear there is something wrong with the current public school system. The education establishment claims the problem is a lack of funding, while many tax payer groups claim more money is not the answer. This study uses data from each of Pennsylvania's 501 school districts to look at the relationship between funding and achievement while controlling for the economic background of each school's student population, as well as other organizational characteristics.

Introduction

*"When other relevant factors are taken into account, economic resources are unrelated to student achievement."*¹

—The Brookings Institution

*"Is it possible that the defendants in these cases do not sense the irony of spending so much money to obtain the services of experts to convince the court that money isn't the real issue? These contradictions do not seem to trouble them at all. But do they really ask us to believe that the laws of economics, which control all other aspects of our lives in this society, somehow cease to function at the schoolhouse door?"*²

—Marilyn Morheuser³

In 1983, the National Commission on Excellence in Education released its report *A Nation at Risk*. In this report, the commission confirmed what other studies had been indicating for years. U.S. school children were lagging behind students in other industrialized countries in the basic fields of science and mathematics.⁴ Also, many people started to believe that contemporary school children were learning less in basic subjects than those of just a generation ago. This seemed to be supported by

declining scores on the Scholastic Aptitude Test (SAT) and other similar standardized tests.

This realization of declining educational achievement spurred the implementation of school improvement programs across the country. Most of these programs called for an increase in the amount of funding provided for schools. Implicitly, this holds that expenditures at least partially determine the quality of an education system as measured by quantified indicators of student knowledge of basic subjects.

Intuitively, this assumption makes sense. With more money schools can "buy" more education. Presumably, more funding will allow school districts to hire better teachers, purchase higher quality text books and employ any number of other tactics which should give schools the ability to do their job.

However, it appears as though intuition was wrong in this respect. Before *A Nation at Risk* was published the trend did not lend credence to the assumption that more money leads to better test scores. The period of declining test scores, from the early 1960s through the early 1980s, coincided with a period when expenditures on education were rising in real terms. Per-pupil expenditures rose 58 percent in real terms during the 1960s and 27 percent in the 1970s.⁵

During the decade after the report, expenditures rose 29 percent, but there was little appreciable

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improvement. In the 1990s, American 13-year-olds finished last in a test comparing their science and math skills with students in five foreign countries and four Canadian provinces⁶ and SAT scores had not begun any recovery to the early 1960s level.

Management expert Russ Ackoff has commented that such testing measures are misleading in that cross-generational comparisons are impossible. He has made the point that today's students learn things that would have been impossible for those of a generation ago to learn.⁷ While a comparison of specialized knowledge does seem unfair, there are still grounds to compare the skill levels each generation exhibited in rudimentary subjects such as reading and math. It is doubtful that there have been the cutting-edge knowledge explosions in vocabulary or arithmetic necessary to turn the comparison into one of apples and oranges. And one need not look to previous generations to witness a decline in these basic skill areas. The National Assessment of Educational Progress's final 1994 Reading Report Card found that there was a significant decline in the proportion of twelfth graders at or above a proficient reading level since 1992 and a significant decline in the proportion of twelfth graders at or above the basic level of reading.⁸

However, even if comparisons, cross-generational and international, are abandoned altogether, there are still practical evaluations of the quality of education that can be made. American Telephone has reported that, on average, 115 out of 117 applicants flunk its employment exam and Motorola has found that 80 percent of its applicants fail its exam which evaluates English skills at the seventh grade level and math skills at the fifth grade level.⁹

The situation in Pennsylvania's public schools is perhaps worse than that of the nation as a whole. Pennsylvania's students perform worse on the SAT than all but the students from six other states.¹⁰ David Hornbeck, the superintendent of the Philadelphia school district, the state's largest, has said, "Fewer than 20 percent of our kids can read or do math or do science at what we consider a proficient level."¹¹

In terms of practical measures of school achievement, there are also indications that Pennsylvania's public schools are deficient. School board members from throughout Chester County, whose districts have consistently scored among the highest in the state on Pennsylvania's educational assessment tests, have testified that employers often come to

them with the complaint that their schools are turning out students who do not even have the skills requisite for entry-level employment.¹²

Following the conventional wisdom, many educators have claimed that more funding is necessary to improve the quality of education in the state. In the School District of Philadelphia's plan for improving its schools, "Children Achieving," the ninth stated objective in the Executive Summary is to "Ensure adequate resources and use them effectively." In its explanation of this objective, the plan states "Adequate resources are a commonsense [sic] precondition to virtually all children achieving at high levels . . . additional resources are an absolute prerequisite for dramatically improving student outcomes."¹³ In 1994-95, Philadelphia spent \$6,261.17 per pupil,¹⁴ just short of the \$6,804 per pupil state average which is higher than the state averages of all but six states.¹⁵

Given the anecdotal and quantitative evidence that public schools are deficient in providing American students with fundamental information and in preparing them for the work force, it is reasonable that parents, politicians, and educators would want to remedy the system.

This desire is obvious enough; however, the means to improvement are not quite so obvious. Conflicting results have been obtained by numerous studies of the relationship between per-pupil expenditures and student achievement.

In a survey of studies analyzing the determinants of student performance, Eric Hanushek found that in only 34 percent of 377 studies on the subject, were expenditures found to be statistically significant. And, of those, 20 percent found that a negative relationship actually existed.¹⁶ Therefore, only 27 percent of these tests found expenditures to have a significantly positive effect on student achievement.

Similarly, in its 1993 Report Card on American Education, the group Empower America, which counts among its leadership former Secretary of Education William Bennett, noted that of the ten states that consistently rank among the top in various student achievement tests, only one rated in the top ten in terms of per pupil spending (Wisconsin at No. 8).¹⁷

This evidence is sufficient to call the assumption that money is the key to quality education into question. However, it is not sufficient to conclude that, because studies of a national scope propound

there is no relationship, there is no linkage between expenditures and achievement in a specific geographic area. To do so would be to commit a fallacy of decomposition.

It is the purpose of this study to analyze specifically the schools in the state of Pennsylvania to determine whether or not expenditures play a role in student achievement. Knowledge of this relationship is necessary in order to formulate effective plans to improve the quality of education in the state.

The Model

Beginning in 1992, the Pennsylvania Department of Education began administering the Pennsylvania System of School Assessment (PSSA) test. This test is taken by fifth, eighth and eleventh graders in February or March of every year, and it measures basic reading and math skills. The 1994–95 school year marked the first year every public school in the state participated in the testing.

Effectively, there are nine different analyses performed in this study. Scores on the reading section of the PSSA and scores on the math section of the PSSA are both studied as well as the summation of both. These analyses are carried out at the fifth, eighth and eleventh grade levels. These separate tests were done to examine any differences in the relationship that result from either grade level or subject matter.

PSSA scores were selected as the basis for the dependent variable in this study. This test is particularly well-suited to serve as a proxy for school achievement in that every student must participate in the testing. Unlike the SAT which is taken only by a self-selected group, the PSSA has the potential to measure achievement by all students, not just those who are college bound.

The PSSA is scored on a relative basis. That is, no absolute score is given in terms of percentage of questions answered correctly. Instead, results for schools are related on a basis of the percentage of a school's students whose score falls within each quartile of the distribution of scores throughout the state. This relative grading provides yet another advantage of using the PSSA as the proxy for school achievement. By using relative scores, an analysis can be made of what determines differences among schools in educational quality.

In order to yield a quantified "score" for each school for this study, a weighting system was developed whereby scores in the fourth quartile received three points, scores in the third quartile received two points, scores in the second quartile received one point and scores in the first quartile received no points. Mathematically, this scoring scheme can be related as follows:

$$\begin{aligned} \text{Score} = & (3 \times \text{percentage of students in } Q4) + \\ & (2 \times \text{percentage of students in } Q3) + \\ & (1 \times \text{percentage of students in } Q2) + \\ & (0 \times \text{percentage of students in } Q1). \end{aligned}$$

By way of clarification of the scoring system, the most possible points on either subject test a school could receive would be three, assuming 100 percent of its students scored in the fourth quartile. Likewise, the highest possible score for the total test would be six if 100 percent of a school's students scored in the fourth quartile in both reading and math. Likewise, if 100 percent of a school's students were to score in the first quartile on both tests, its score would be zero. A school with students whose scores were normally distributed would receive a scores of 1.5 on each subject test.

The explanatory variables investigated in this study are total expenditures per pupil, percent of student body coming from low income households, size of school district and occurrence of strikes within the district.

Total expenditures (Exp) per pupil is measured by dividing total expenditures made by a district by the average daily attendance within that district. This data has been summed for the years 1989–1995. The rationale for this summation is provided by the assumption that education is cumulative; therefore, if expenditures do have an impact on education, it is more useful to look at expenditures over the educational career of a student rather than at expenditures made just in the year the test was taken. Presumably, the relationship between expenditures and achievement will be positive. While there is a danger in that it is impossible to account for migration between school districts during this time period, it is not beyond reason to assume the net effect of this movement is negligible.

Percentage of students from low income households (Poor) was chosen as an indication of the social capital available to students.¹⁸ Presumably,

poverty will limit the amount of leisure time a parent has to spend with a child in such activities as reading together or doing homework. Also, these data are likely to give an indication of the ability of a household to provide educational resources to a student such as books or computers. Intuitively, the relationship between this variable and achievement will be negative.

The size of a school district is measured by its average daily attendance (ADM). This variable was chosen to examine the effects of economies and diseconomies of scale on the education process. Intuitively, it seems as though there are certain efficiencies that can be gained in larger districts which can eliminate the duplication of administrative tasks, thus freeing more resources for educational purposes. However, on the other end of the spectrum, a district that is too large may not be able to manage its schools effectively and thus will become bureaucratized and wasteful.¹⁹ It is reasonable to assume that district size will exhibit a quadratic relationship to achievement with a positive relationship turning into a negative relationship after some optimal size is reached.

Lastly, occurrence of strike (Strike) was included due to the presence of the claim by the department of education that some districts may not have been able to cover all of the topics tested by the PSSA due to teacher strikes in the districts. This is a fair enough consideration and it warrants inclusion in the study. Strikes were measured as a dummy variable with one representing the occurrence of a strike in the district and zero denoting the absence of any strikes in the district during the year. Obviously, as noted by the department's concern, a strike is likely to have a negative effect on achievement.

Functional Form of the Model

Although various functional forms were studied in each separate analysis, there are some a priori assumptions that can be made about the functional relationships of the variables to achievement. Because the measurement of achievement in this case is a limited one, one that has both an upper and lower bound, it is reasonable to assume that the relationship between expenditures and scores is asymptotic to the maximum score of three (six in the case of total score). Acknowledging this, the ini-

tial assumption was that expenditures should exhibit a reciprocal relationship, thus $(1/\text{expenditures})$ is likely to be a more useful measurement in this process. With this transformation, it is necessary to note that the expected relationship between $(1/\text{expenditures})$ will be negative.

The relationship between percent low income and achievement has been assumed to be a linear one. There is no logical reason to suspect that, at a certain level, the absence of poverty in a school would become harmful. Similarly, there are no grounds for supposing that the existence of poverty after a certain level would become beneficial.

As discussed previously, district size is likely to be quadratically related to achievement. Small districts should experience increasing returns to scale as they grow, and very large districts are likely to experience decreasing returns to scale as they grow.

Comment on Overall Findings²⁰

Regarding expenditures, of the 63 different functional forms of the model that contained some expression of expenditures (those forms which contained only expenditures and ADM have been ignored because of their low explanatory power), 22 of the forms showed expenditures to be statistically insignificant at a 0.05 significance level. Of the 41 forms which showed expenditures to have a significant impact upon performance, 16 showed that impact to be negative. That is, when more money is spent per pupil, test scores actually drop. For those forms which rendered a significantly positive coefficient with the expenditures term, that coefficient, in every case, was so small (generally on the order of about 0.000005) that an increase of \$100,000 per pupil would be necessary to raise the school's score by 0.5 points. Obviously, this is an impractical scenario.

Of the 90 functional forms of the model that contained "poor" as an explanatory variable, poor's coefficient (generally about -3.0 for total scores) was significantly negative 90 times. As for the effect of a strike on student performance, in no case did strike's coefficient turn out to be statistically significant. Finally, no consistently significant relationship was found between ADM and achievement.

Also, it is interesting to note that the explanatory power of the regressions decreased significantly

from the fifth grade scores to the eighth grade scores and again to the eleventh grade scores. The coefficients of determination for the fifth grade scores neared or surpassed 70 percent, while those for the eighth grade scores dropped under 60 percent and those for the eleventh grade scores fell between the 30 and 35 percent range.

One explanation for this observation may be what Chester Finn from Vanderbilt University calls the "9/91" problem. Finn notes that by the time a child reaches the age 18, only nine percent of his time has been spent in schools, while the other 91 percent often subverts what schools attempt to do.²¹ This phenomenon can be applied to this situation because, presumably, the time children of fifth grade age or younger spend away from schools is spent primarily with their families which serve an educative purpose as well. However, as children age, separation from families becomes more distinct, and outside social influences play more of a role in the individuals' development. Almost by definition, these outside influences will be more difficult to specify and nearly impossible to quantify. From this reasoning, it is obvious that the true relationships involving older individuals' achievement will involve more of these unspicifiable influences than those of younger students. Therefore, the explanatory powers of a quantified relationship will decrease as age increases.

Policy Implications

The most clear-cut finding of this study is that dollars definitely do make a difference. But that difference is not necessarily made in the schools; instead it is made in the home. Poverty, without fail, proved to be a significant determinant of whether or not a student will succeed in school. The data could not possibly make this point more clearly. Those schools heavily populated by low income students are unable, on average, to educate those students in basic math or reading skills.

The reasons for this linkage are not clear. Perhaps these students initially come to school with deficiencies due to a lack of significant parental attention in the pre-school years, or maybe these students do not have the proper support system needed to reinforce the skills taught in the schools. This could be the case for many reasons. Perhaps low income parents do not have the free time to

spend with their children. Another possibility might be that poorer children do not have sufficient resources at home to reinforce their school lessons. One other possibility is that there may be a negative correlation between income and education of parents. This point is in fact made in some economic literature.²² This speculation would hold that affluent parents are better educated and are, therefore, better able to serve as a resource for their children as teachers in their own right. Perhaps this resource is not readily available to children from low income families.

However, regardless of the reason, family income does make a difference in student achievement. Such a conclusive statement cannot be made for school expenditures. Given this situation, it may be sensible for communities to divert funds from the schools and instead spend them in the community. Improving youth centers by employing educators and purchasing improved educational material could create a significant resource for those students who cannot look to their homes for help. Another option might be to develop a mentor program whereby poor youth can be put in contact with a role model who is available to help students achieve.

These options need to be researched because there is no proof that money spent on these programs will be any more effective than the money spent in the schools. But, in light of this study, at least in Pennsylvania, an alternative to educational spending, which has only a negligible effect, must be investigated.

The conclusion that educational dollars do not make a difference has been used by many affluent districts to fight the claims of poorer districts that the funding system for education (i.e. moneys coming from localized tax bases) creates separate and unequal school systems for the rich and poor. By explaining away this claim in saying that money does not matter but to continue to spend thousands of dollars more than poorer districts, the affluent communities contradict themselves. If money does not make a difference, are there not more productive uses for that tax revenue than just throwing it at the schools?

If the conclusion could be reached through research that there is a different money-achievement relationship to be found at affluent schools that does not exist at poorer schools, there would be grounds for the continued high spending in wealthy

districts. In the absence of any such findings, it seems reasonable to claim that if the marginal benefit of spending in schools is effectively zero, then school expenditures can be reduced everywhere without affecting achievement. Thus, a more efficient system is created.

These data do, however, cause one to wonder why, as Ms. Morheuser questioned, do the laws of economics cease to function at the schoolhouse door. There are two possible explanations for this. The first possibility would hold that schools are operating in a position of zero marginal or negative marginal benefits of expenditures. Effectively, the schools are spending too much money.

A more plausible explanation would be that schools are not using the money they have effectively. This possibility has been raised by Stanford economist Thomas Sowell. Sowell has cited studies of the Milwaukee and New York City school systems which have shown that less than half of the money spent per high school student in New York or per elementary school student in Milwaukee actually reached the school.²³ His explanation for this is the growing bureaucratization of the public school establishment. Because of this, funds get eaten up in non-instructional administrative costs.

Or perhaps the schools are using their funds effectively, but their objectives are not the education of students in primary subjects such as reading and math. During the period of declining test scores, there has been a proliferation of non-academic instruction involving courses in sex education, environmental awareness, and other social causes that did not exist before the 1960s. This possibility is reasonable if that is what society values. Perhaps, as Ackoff claimed, today's students are learning more in a plurality of subjects. If this is the case, then maybe schools are using their funding effectively.

Conclusion

Pennsylvania's public schools are in the midst of reforms that claim to be geared toward improving deficiencies in basic subjects such as reading and math. These deficiencies are glaring in the light of standardized test scores and in the context of the complaints of employers that Pennsylvania's high school graduates are not prepared for employment in even entry-level positions. One of the main

thrusts of most of these reforms involves dedicating more funding to education. This study should give pause to those reformers. Maybe after some structural changes are initiated in the schools, this added money will be productive, but as things stand now, it is likely that any extra money will not have an appreciable effect on helping students achieve.

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