Deficient Diplomas

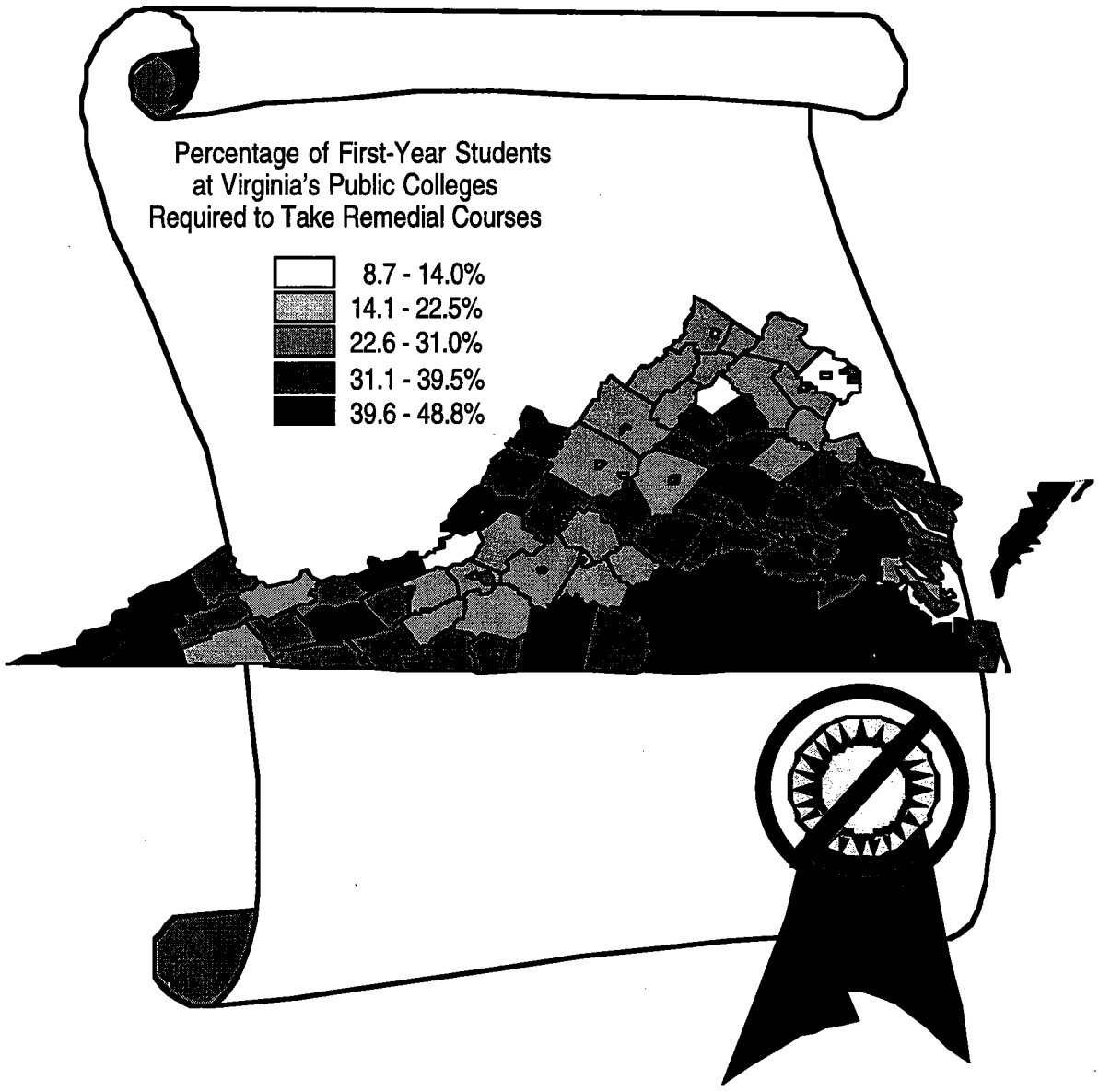
Is It Time for a Graduate Warranty Program?

A Report Prepared for the

Thomas Jefferson Institute for Public Policy

by

I. David Wheat, Jr.



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Thomas Jefferson Institute for Public Policy
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Foreword

Are today's high school graduates capable of handling the basics of reading, writing and mathematics? Does a high school diploma really mean they are prepared for the next step in life – whether that means attending college or entering the workforce? Sadly, the answer to these two questions is too often, "NO!"

That is why the Thomas Jefferson Institute for Public Policy commissioned this study, "Deficient Diplomas: Is it Time for a Graduate Warranty Program?"

Last November, the Thomas Jefferson Institute published its first major study on public education, "Understanding Virginia's Report Card: Why Test Scores Vary from One Community to Another." That study, written and researched by David Wheat, struck a responsive chord across our state. Local school boards held public meetings surrounding the ideas in the study. It was used as course material in college level seminars. Political leaders refer to this study when education policy is debated and discussed.

This new study, also written and researched by David Wheat, focuses on the problem of ill-prepared high school graduates who enter college needing remedial course work in reading, math and/or English. The author is a Harvard-trained policy analyst. He currently manages his own consulting firm, teaches political science at a community college, and spent nearly fifteen years as a teacher in Virginia's public schools. He was a member of the statewide team that developed the new Standards of Learning in history and social science.

Mr. Wheat researched why 25% of students aren't prepared for college although their high school diploma indicates they are so prepared. He delved into the reasons for this poor showing and developed additional variables to be considered when determining how well a high school is doing in actually preparing students for college level courses. And Mr. Wheat also reconfirms his findings from the study last year, "Understanding Virginia's Report Card." He shows what a local school division can do to improve the ability of its high school graduates to be truly prepared for college, and he outlines demographic factors that can't be changed.

Finally, this study, referring to the program currently being conducted by the Hanover County school system, suggests that a "Graduate Warranty Program" be established statewide so that local school divisions would be more accountable and less likely to have graduates going to college unprepared. Should a high school graduate with a "warranty" on his or her diploma need to take remedial courses upon entering college, the tuition would be paid by the local school division with matching grant assistance from the state for a limited time. Following that start-up phase, remedial course tuition payments for warranted students would be paid entirely from local funds.

To make this "Graduate Warranty Program" work best, the local school divisions must make this price for remedial course work public during the annual budget process. A special line item in the annual budget of each school division could be required showing the cost of remedial courses to the local school division.

Other options to consider, although not addressed in this particular study, included a "Graduate Guarantee Program" that would promise employers that students who graduate from high school are prepared for employment. Some minimum guarantee should be considered indicating that the high school diploma means the graduate can do simple math, read at a reasonable level of comprehension and speak good English. If a high school graduate fails to perform adequately on an exam for employment and needs remedial work to qualify for a job, then the local school system should have to pay for the remedial courses it had "guaranteed" were not needed. And our Governor and legislators should also consider adding the percentage of high school graduates who are not prepared for college to the new report card required by the state for every school.

This study continues the effort by the Thomas Jefferson Institute to bring relevant information and creative alternatives to the public debate. It reflects the ideas of the author and does not necessarily reflect the views of the Thomas Jefferson Institute or its Board of Directors.

The ideas in this study are worthy of consideration by those in policy-making positions and by parents who want their children to be better prepared after graduating from high school. Hopefully, other ideas will be generated as a result of this study and they will also be debated and discussed.

Michael W. Thompson
Chairman and President
September 1998

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Table of Contents

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Executive Summary

Background and Purpose of this Report

For many college admissions officers and private employers, high school diplomas no longer adequately signal achievement and competence. When too many diplomas are deficient--that is, they fail to convey the educational attainment of the recipients--new methods of certification are needed.

One indicator of deficient diplomas in Virginia is the finding by the State Council on Higher Education (SCHEV) that about one-fourth of the first-year college students from Virginia's public school system must take remedial courses due to their failure to demonstrate minimal competency in reading, English, or mathematics. According to SCHEV, the remediation costs amount to almost $40 million annually, of which $15 million is borne by college students and their parents in the form of tuition for unexpected mandatory courses that do not count toward degree requirements. That leaves $25 million to be paid by the rest of Virginia's taxpayers. A review of national statistics confirms that the Commonwealth is not alone in issuing deficient high school diplomas, and the national remediation rate appears to be even higher than Virginia's.

In some states, legislators have proposed that the cost of remedial instruction be paid by the K-12 school district that produced the unprepared high school graduates in the first place. One school division in Virginia--Hanover County--has voluntarily developed a Graduate Warranty Program, and the county pays for any remedial courses required of warranted students. A joint initiative by SCHEV and Virginia's Board of Education is being designed to encourage other school divisions to adopt similar plans.

Each annual release of SCHEV's remediation statistics provokes the kind of media attention that generates criticism and reaction at the local school division level. Believing that adequate preparation--for both college and the workforce--is critical for Virginia's high school graduates and that much of what passes for "debate" on this issue produces more heat than light, the Thomas Jefferson Institute for Public Policy commissioned the research for this report.

The report evaluates the controversial remediation statistics for the period 1991-96 in the context of other relevant data, and identifies reasons that some school divisions seem to do a better job of preparing their graduates for college. In addition, the report considers policy options that emerged from the analysis, including ways to upgrade high school students' preparation for college-level courses, methods to improve the monitoring of college students' performance, and designs for graduate warranty programs.

Indicators of Effectiveness

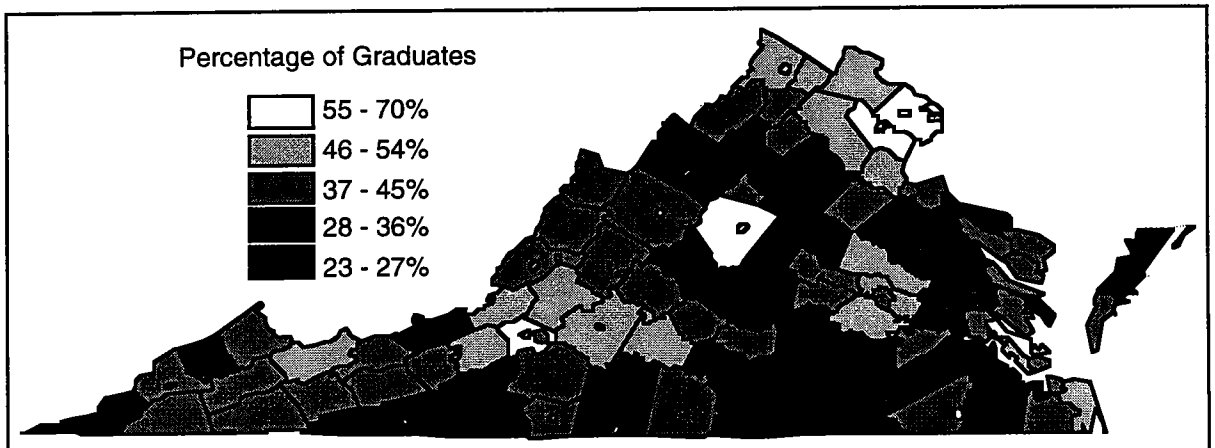
The statewide average percentage of former public school graduates requiring remediation in college has been consistently close to 25 percent for several years. However, students from some school divisions have been much more likely to require remediation than their college

classmates from other parts of the state, as the map on the cover of this report illustrates. The SCHEV data indicated a range from a low near 10 percent of first-year students needing remediation to a high near 50 percent. One goal of this study has been to identify factors that account for such differences among school divisions.

Valid accounting for differences in measures, however, requires valid measures in the first place. SCHEV reports only on students at Virginia's *public* colleges and universities and, thus, excludes those attending private colleges within the Commonwealth or out-of-state institutions. If one-third of Virginia's college-bound graduates are excluded from the monitoring system, as our estimates suggest, the SCHEV data alone cannot reveal how well schools are preparing students for college. The bias inherent in such an omission is that the SCHEV data may show two school divisions with similar remediation rates, while considerable differences in college preparatory effectiveness may exist if one of the divisions has a higher percentage of its graduates *enrolled* in college, albeit on private and/or out-of-state campuses. Criticism of the SCHEV data must be tempered, however, by the observation that the out-of-state and private college enrollment data needed to correct for such omissions are not within SCHEV's jurisdiction.

The closest approximation to college enrollment data for public school graduates is collected by Virginia's Department of Education (DOE) in the form of graduates' "plans" to attend college. However, the National Center for Education Statistics (NCES) has estimated the overall percentage of Virginia graduates attending public and private institutions, both in- and out-of-state, and has compared the remediation rates at public and private colleges. Therefore, using a combination of SCHEV, DOE, and NCES data, we calculated a more valid indicator of graduates' readiness for college.

For each school division, **the percentage of graduates "bound and prepared" for college** was defined as the *estimated* percentage of high school graduates who met two criteria: (a) *they went to college*, and (b) *they were not required to take remedial courses upon arrival*. The map below displays the geographic variation in the percentage of graduates "bound and prepared" for college, and Exhibit 4 (page 14) lists each school division's percentage.

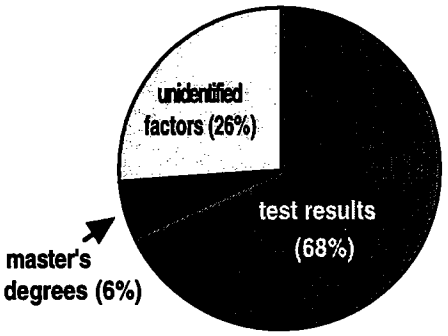


Percentage of Each Division's Graduating Class Bound and Prepared for College

Source: Estimated from SCHEV, DOE, and NCES data, 1991-96

College Bound and Prepared: Why School Divisions Vary

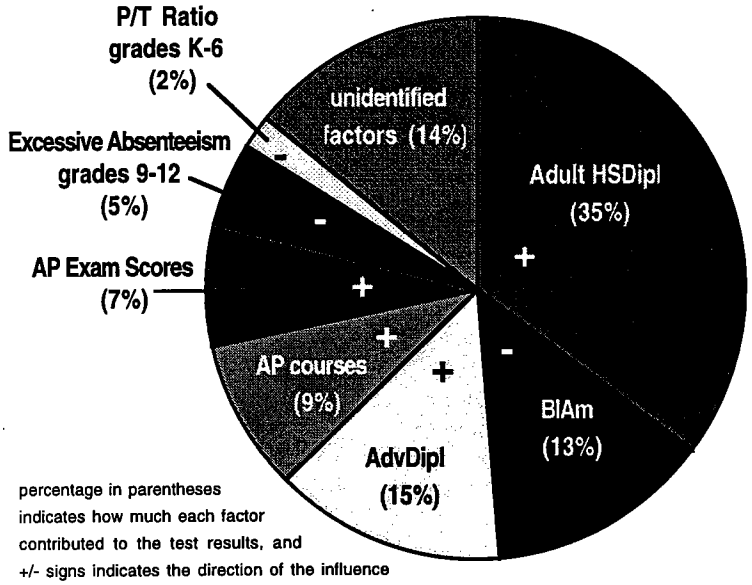
Two factors--students' test results and teacher education levels--were highly accurate predictors of being "bound and prepared for college." *Graduates were more likely to both (a) attend college, and (b) not need remediation, if they came from school divisions where more teachers had master's degrees and more juniors scored above the 75th percentile on national standardized tests.* Those two factors accounted for 74 percent of the variation from one school division to another, and, as the pie chart at right indicates, the test results contributed most (68 percent) of that overall statistical explanation.



74% of the Variation in School Divisions' Graduates Being Bound and Prepared Was Accounted For by 2 Factors:
(1) Standardized Test Results
(2) Master's Degree Teachers

With those findings in hand, the analysis moved to a second stage to determine what accounted for the differences in school divisions' test results. The factors examined included those within school officials' control (education policies and practices) and also the community and school demographic characteristics that had to be statistically isolated prior to making valid inter-division comparisons.

Overall, 86 percent of the variation in school division test results was accounted for by five education factors (listed below) and two demographic factors (the percentage of the community's adults with high school diplomas and the percentage of Black Americans in the community). The pie chart below makes it clear that, while the demographic factors accounted for almost half of the school division differences in test results, *nearly 40 percent of the variation was attributable to education policies and practices that are within the control of education policy makers and administrators.*



percentage in parentheses indicates how much each factor contributed to the test results, and +/- signs indicates the direction of the influence

86% of the Variation in School Divisions' 11th Grade Test Results Was Accounted For by 7 Factors

DEMOGRAPHIC FACTORS: 48%
--> % Adults with HS Diploma
--> % Black Americans
EDUCATION FACTORS: 38%
--> % Receiving Adv Studies Diploma
--> % Taking Adv Placement Courses
--> % Passing Adv Placement Exams
--> % Absent More than 10 days, 9-12
--> Pupil-Teacher Ratio, K-6

The common thread for three of the five education factors was advanced, usually rigorous, course work. When comparing school divisions with similar demographic features, juniors' test results were better in those divisions where more students enrolled in courses required for the

advanced studies diploma, where more students took college-level advanced placement (AP) courses, and where more students passed at least one national AP exam. Test scores were also higher--again, other things being equal--in school divisions where excessive absenteeism (missing more than 10 days) among high school students was lower, and where the pupil-teacher ratio in grades K-6 was lower.

Policy Options

It is clear that high school graduates' chances of being "bound and prepared for college" are lower in some school divisions than others, and policy considerations should focus on what is necessary to increase those chances.

Improving Test Results

Improving graduates' chances of going to college and being prepared for college-level work upon arrival is a realistic objective for school divisions in Virginia. Many of the factors that affect the chances for graduates to achieve that status are within the control of education policy makers.

In our earlier, much broader study of school division test scores at all grade levels (*Understanding Virginia's Report Card*, Thomas Jefferson Institute for Public Policy, November 1997), many of the policy recommendations were incentive-based; that is, school divisions would have financial incentives for vigorously pursuing measurable improvements in critical areas that would improve test results. The findings in this report, which relate just to 11th grade test results, reaffirm the importance of those earlier recommendations, which included:

- **Raising Academic Standards** through vigorous implementation of the new Standards of Learning (SOL), elimination of social promotion, and making promotion contingent on passing the SOL achievement tests;

- **Reducing Excessive Absenteeism** through financial incentive programs at both the division and individual school level;

- **Providing Incentives for Master's Degrees**, including tax credits and state matching salary supplements; and

- **Reducing Pupil-Teacher Ratios** in grades K-3 to 17:1 and in grades 4-6 to 19:1, by joint state and local funding for 1600 new teachers in the 65 school divisions with ratios above the statewide average.

If these earlier recommendations were implemented, along with concentrated efforts to increase student enrollment in challenging courses (such as advanced placement courses and those required for the advanced studies diploma), improvements in 11th grade test scores would occur, and more graduates would be prepared for college-level course work. Consideration should also be given to financial incentives for extraordinary academic achievements, such as a monetary award to high schools for *each* student passing an advanced placement exam.

Improving Information Needed for Policy Making and Evaluation

In that earlier study, we also recommended **improvements in data collection and reporting** to enhance strategic planning and program evaluation at both the state and local levels. The current study reiterates the weaknesses in DOE's data system, and also points to limitations inherent in the SCHEV student monitoring system.

Assessing the effectiveness of the public school system--an absolute prerequisite for major

changes in policies affecting that system--requires at least the following additions to the current database maintained by DOE and SCHEV:

- demographic data for individual public and private high schools,
- high school courses, grades, and SAT scores for public and private high school graduates enrolled in college (at public and private colleges, in- and out-of-state),
- college enrollment data for public and private high schools (at public and private colleges, in- and out-of-state), and
- remedial courses taken by all public and private high school graduates at all colleges (public and private, in- and out-of-state).

School Division Warranty Programs

What schools should do to improve the preparation of their students for college is clear. *How to get them to do it* is less obvious. Several of the earlier policy recommendations contain financial incentives. In addition, success or failure in the implementation of the Standards of Learning will have consequences in terms of school accreditation by spring, 2003. However, it is time for a new policy that provides an incentive structure arching over all the others.

Whether designed as a "carrot" or a "stick" program, a *mandatory* Graduate Warranty Program that builds on the best features of the Hanover County innovation and the initiative undertaken by SCHEV and the Board of Education deserves serious attention at the highest levels of Virginia state government. There are two essential components of such a program: (1) Graduates who met certain academic requirements would be certified by their school divisions as being "ready for college," and (2) the school divisions would promise to reimburse any certified graduates who had to take remedial courses during their first year in college. SCHEV and Board of Education officials are hoping that private donors will provide sufficient "matching fund" incentives to entice some school divisions to participate in the Graduate Guarantee Program, but that voluntary approach has yet to work. The Governor and General Assembly should give serious consideration to a *mandatory* Graduate Warranty Program.

A new state policy creating another state mandate for local schools, however, would necessitate at least temporary partial state funding through matching grants. Ultimately, however, to have the desired incentive effect--namely, to get school divisions to accept responsibility for the quality of their graduates and *reduce the need for remedial courses*--a Graduate Warranty Program would have to "bite" financially closest to home. If school administrators had to appear before local school boards and county supervisors to request funding for former graduates' remedial course tuition, they would have to be ready with answers to tough questions from taxpayers and their elected representatives. **After an initial start-up period of 3 to 5 years, therefore, localities should have to pay for warranty claims from local budgets alone.**

Creating a remedial course tuition insurance program should *not* be the intent of a graduate warranty program. If such a program merely compensated students and parents for the $15 million in annual remedial tuition *without affecting the education of students in the public schools*, it would just shift $15 million more to the $25 million deficient diploma burden already borne by Virginia taxpayers, and the Commonwealth's public school graduates would be no better prepared for college.

Instead, the goal should be the *reduction in the need for remedial courses* in college. Our strategy should be to develop an incentive structure within which local school officials would see opportunities foregone due to new or reprogrammed funds being diverted to warranty claims, and see the benefits of producing more graduates who are bound and prepared for college.

Deficient Diplomas

Is It Time for a Graduate Warranty Program?

Introduction to the Issue

Background

1998 college graduates who call Hanover County home have a unique position in Virginia education history. When their college applications were submitted four years ago, high school transcripts stamped "This Student is Warranted" were attached.

For its high school graduating class of 1994, Hanover County Public Schools had launched an innovative program designed to appeal to taxpayers who expect to get their money's worth from the public school system. Called the *Graduate Warranty Program*, it was a commitment to parents that graduates certified as "ready for college" were, in fact, prepared for college course work. If not, the Hanover County schools would reimburse the parents for any remedial course tuition.[1]

In April of this year, just prior to college commencements for the historic Hanover students, the State Council on Higher Education in Virginia (SCHEV) and Virginia's Board of Education announced a pilot project--the *Graduate Guarantee Program*--that is designed to encourage other school divisions to implement reimbursement plans.[2]

Schools willing to attach *warranties* to their graduates? That's a new one. Those that *do* provide warranties certainly counter the claim that educators avoid accountability for the quality of their products. Unfortunately, as of now, "those that do" in Virginia includes only Hanover County. The state's voluntary Graduate Guarantee Program program has yet to be implemented.

A driving force behind this new current in the school reform movement is the fact that, for many college admissions officers and private employers, high school diplomas no longer adequately signal achievement and competence. When too many diplomas are deficient--that is, they fail to convey the educational competence of their recipients--new methods of certification are needed.

One indicator of deficient diplomas in the Old Dominion is that about one-fourth of Virginia's public high school graduates bound for college are unprepared when they get there. Data collected by SCHEV from Virginia's public colleges and universities indicate that about 25 percent of the first-year students from the Commonwealth's public school system fail to demonstrate minimal competency in reading, English, or mathematics and must take remedial courses.[3]

SCHEV estimates that the remediation costs for the unexpected mandatory courses (that do not count toward degree requirements) amount to almost $40 million annually, of which $15 million is borne by college students and their parents directly--leaving to other Virginia taxpayers the $25 million balance.[4]

[1] Hanover also "warrants" its non-college-bound students by a guarantee to employers that "graduates will possess...skills necessary for success in the workplace." Evaluating the effectiveness of the Hanover County program was beyond the scope of this report, so favorable comments are directed at the principle inherent in the policy rather than the program in practice. See Part II of the Appendix for additional information.

[2] "Virginia Graduate Guarantee Update", State Council on Higher Education in Virginia, April 23, 1998.

[3] *Academic Performance Characteristics: In-State First-Time Freshmen at Virginia's State-Supported Institutions*. SCHEV. 1991-96.

[4] Estimates contained in the "Virginia Graduate Guarantee Update" cited above.

A review of national statistics reveals that the Commonwealth has not been alone in issuing high school diplomas to students with deficiencies in their educational achievement. In 1989, about 30 percent of America's college freshmen were taking remedial courses, according to data collected by the National Center for Education Statistics (NCES).[5] In 1995, a follow-up NCES study found the situation virtually unchanged, with 81 percent of public four-year universities across the country offering at least one remedial course and 29 percent of the first-year students taking at least one such course.[6]

When remedial course percentages on California and New York campuses climbed above 40 percent in the mid-1990s, officials began serious examination of the trends. California has begun a phased reduction in remedial courses, with the hope that a joint effort by the college and the K-12 systems can better prepare public school students for college course work.[7] And City University of New York announced in May 1998 that remedial courses would be eliminated entirely within three years.[8]

In Virginia, SCHEV took similar steps early in this decade, relegating to community colleges the responsibility for helping freshmen "catch up" when they lacked college-level skills.[9] Unprepared students are now supposed to be referred to the community colleges for skill upgrading before they take true college-level courses at the universities. SCHEV's latest published report indicates that 85 percent of the first-year students taking remedial courses are enrolled at community colleges, with all of the remainder at just three four-year institutions: Clinch Valley College, Norfolk State University, and Virginia Commonwealth University.[10] Nevertheless, anecdotal reports continue to circulate regarding thinly-veiled remedial courses on other major college campuses in Virginia.

In some states, legislators have proposed that the cost of remedial instruction be reimbursed by the K-12 school districts that produced the unprepared high school graduates in the first place.[11] In Virginia, Hanover County's program that reimburses certified graduates' families for unexpected remedial course costs is the lone example of its kind.

Purpose of this Report

Each release[12] of SCHEV's annual remediation statistics gets intense media attention and generates tough questions for local school division officials, provoking many to challenge the report's validity.[13]

Believing strongly in the importance of adequate preparation of Virginia's high school graduates--whether bound for college or the workforce--and being concerned that much of what passes for "debate" on this issue has not been productive, the Thomas Jefferson Institute for Public Policy commissioned the research for this report.

The report examines and evaluates the controversial Virginia data that have generated a wider interest in student warranty programs. In addition, the report explores policy options for designing such programs, as well as other methods to increase the chances that graduates will be prepared for college.

Simply stated, the report attempts to explain why graduates from some school divisions are more likely to require remedial courses, and identify ways--including graduate warranty programs--to improve all graduates' chances of being prepared for college-level courses.

[5] "Remedial Education at Higher Education Institutions in Fall 1995." NCES, October 1996.

[6] *Ibid.*

[7] "Cuts in College Remedial Courses Proposed," *Education Week*, November 1, 1995.

[8] "Closing Open Admissions," Washington *Post*, May 30, 1998, page A18.

[9] Cited in "1992 Virginia Plan" during joint meeting of SCHEV and Virginia Board of Education, February 1997.

[10] *Academic Performance Characteristics*, SCHEV, for the 1996-97 academic year.

[11] "More college students need remedial classes." The Cincinnati *Enquirer*, April 24, 1997.

[12] The timing of the releases has been irregular. The 1995-96 data were published in September 1997, while the 1996-97 findings were announced in February 1998.

[13] See "Schools Rap College Remedial Report", Fairfax *Journal*, October 1, 1997.

Data Limitations and Implications

There are weaknesses in both SCHEV's student performance monitoring system at the college level and in the Virginia Department of Education (DOE) high school data collection process that constrain the statistical ability to "explain" why remedial instruction is needed. These limitations prevent analysis at either the individual student or school level, and require that the focus be on data aggregated at the school division level.[14]

Therefore, the policy options contained in this report also include those aimed at improving the data collection system used to monitor the college performance of Virginia high school graduates.

SCHEV Data Limitations. Although SCHEV's monitoring system has been on an individual student basis (rather than a random sample basis) since 1992, the students' records do not include information about their high school preparation for college (e.g., whether they graduated with an advanced studies "Governor's Seal" diploma) or their year of high school graduation. Such data gaps preclude a study in which the individual students would be the primary units of analysis, and also prevent correlating individual students with cohorts of specific graduating classes of specific high schools. Indeed, some "first-year" college freshmen, in SCHEV terminology, may have graduated from high school several years prior to their initial college enrollment and, in some cases, from high schools that no longer exist.[15]

In addition, SCHEV's widely publicized "remediation percentages" that are the focus of this report can be taken at face value for only a very well-defined population; namely, the first-time freshmen at Virginia's *public* colleges and universities, which excludes all those first-time freshmen at Virginia's *private* colleges and those Virginians who enrolled at *out-of-state* institutions. Left unanswered are the questions about the *number* of Virginia graduates who attended those non-public, non-Virginia institutions, and what *fraction* of that number required remediation during their first year in college.

DOE Data Limitations. The remedial course data--as well as relevant education policy data contained in the annual *Outcome Accountability Project* issued by DOE--can be traced to individual high schools in the Commonwealth. That would suggest an opportunity to conduct the analysis at that level of institutional detail.

However, there is a lack of school-specific demographic data in DOE records, and that made it impossible to statistically "control" at the individual high school level those factors that are beyond school officials' ability to influence, such as the students' economic status or their parents' education level. Thus, reliable analysis at the individual school level was precluded.

Therefore, since the lowest level of one-to-one correspondence between demographic data and education data is at the school division level, this study has had to focus at that level and *make inferences about what was happening to individual students in individual schools* by reference to data relationships at the school division level.

This is a serious limitation because even *within* school divisions, individual schools differ in performance, and it is not possible for aggregate division-level data to account for that variation.[16]

So when we refer later (pages 18-19) to "unidentified factors" in the search for explanations about variation at the *school division* level, keep in mind that many of those factors might be identified if a thorough demographic analysis of *individual high schools* could be conducted.

Even the division-level data are not without design flaws (in addition to inevitable measurement errors). For example, a key factor in this analysis is the percentage of high school graduates in each division who enroll in college. However, school divisions

[14] School districts in Virginia are called divisions.

[15] "Schools Rap College Remedial Report", Fairfax *Journal*, October 1, 1997.

[16] For example, in the latest SCHEV *Academic Performance* report (for 1996-97 school year), two Henrico County high schools--Hermitage and Tucker--were reported to have about the same number of graduates enroll in Virginia's college system, but twice as many of Hermitage's graduates had to take remedial courses.

are not required to track and report actual college enrollments by their former students. The reported data closest to the actual enrollment figures are contained in Table 5 of the Superintendent's Annual Report, where one finds the graduating seniors' stated "plans" to attend college. From 1991 to 1996, an average of 64 percent of Virginia's public school graduates said they had "plans" to attend college in the fall after graduation.[17]

Adjustments to Improve Accuracy. Data limitations discussed above, in addition to focusing the analysis for this report on the school division, have also raised two related questions: (a) How many Virginia graduates from each school division enroll at either private colleges within Virginia or out-of-state institutions? and (b) What percentage of those students are required to take at least one remedial course during their first year in college?

Since the expressed intent of 64 percent of the graduates probably overstated actual college enrollments, a downward adjustment was needed. But how much?

Fortunately, an adjustment in the direction of greater accuracy was possible due to data collected by the National Center for Education Statistics (NCES). Analysis of an NCES report for Fall, 1994, combined with statewide graduate data from the Superintendent's Annual Report for that year, produced the following estimates of paths taken by Spring, 1994 Virginia public high school graduates entering college for the first time:[18]

Pct. of Virginia Public H.S. Graduates enrolled in college (first time)	54%
Pct. of Virginia First-Time-Students	
at Virginia colleges:	78%
at out-of-state colleges	22%
Pct. of Virginia First-Time-Students	
at VA public colleges:	67%
at VA private colleges:	11%
at public colleges outside VA	9%
at private colleges outside VA	13%

[17] Superintendent's Annual Report, 1994, Table 5.

[18] "Residence and Migration of First-Time Freshmen", National Center for Education Statistics, 1996.

For purposes of this report, therefore, the estimate of the number of graduates from each school division was calculated by amending the students' "plans to attend" by the same 15.6 percent downward adjustment that was needed for a statewide correction from 64 to 54 percent.[19]

Also, in the 1995 NCES study of remedial courses on college campuses, the remediation rate at private colleges was found to be 56 percent of the public college rate.[20] Therefore, the remediation rate for each school division was adjusted downward by 56 percent for the students estimated to be enrolled at private colleges, both in and outside Virginia.

With those two adjustments, it was possible to estimate the percentage of each school division's graduates who *both* went to college *and* did not need remedial courses upon arrival. The result was a more valid indicator of graduates' readiness for college.[21]

An Overview of Methodology

A detailed account of the methodology employed in this study is contained in the Appendix. However, a brief overview here may suffice for most readers.

Six years' worth of data, consisting of more than 100 variables for 131 school divisions, was analyzed by cross-sectional regression techniques to identify statistical relationships that could "account for" or

[19] Application of the 1994 figure to the entire 1991-96 period was justified on the grounds that the 1994 figure fell in the middle of the period under study and that such percentages would not be expected to vary widely from year to year.

[20] "Remedial Education at Higher Education Institutions in Fall 1995." NCES, October 1996.

[21] These assumptions are still subject to valid criticism. *Any* reliance on *plans* to attend college introduces some inaccuracy, and students attending out-of-state colleges may have more or less need for remediation than their former high school classmates who enroll at Virginia's public institutions. Without better data, we can't be sure. However, to the extent that errors introduced by these assumptions were "random" for our purposes (i.e., not significantly correlated with factors that might "cause" school divisions to produce graduates needing remediation), the statistical methodology would not be compromised. And there was no compelling reason to expect such correlations in this instance.

"explain" the variation in college enrollments and remediation requirements from one school division to another.[22]

The statistical methods enabled us to determine whether factors such as advanced placement course enrollments or pupil-teacher ratios (referred to as *independent variables)* are related to the *dependent variable*. In this report, the dependent variable is the percentage of each school division's graduates who *both* went to college *and* did not need remedial courses upon arrival--what we shall call being "bound and prepared for college."

One product of this kind of analysis is a line on a graph (the *regression line*) that visually aids in understanding "how close" the regression model conforms to the pattern of the data. The closer the data points cluster up and down the regression line, the stronger the relationship between the independent variables and the dependent variable. For an example, see Exhibit 7 (page 18).

Another result of regression analysis is a percentage estimate of how much each factor "accounts for" overall differences from one school division to another. Pie charts, such as the one in Exhibit 8 (page 18) help visualize what portion of the total variation in college enrollments and remediation requirements is due to each factor, and, by implication, which factors *appear* to have the strongest cause-and-effect relationship.[23]

Technical Appendix

Readers wanting a simple "primer" on statistical regression methodology should read Part I of the Appendix. Elaboration on issues footnoted throughout the report can be found in Part II of the Appendix, where each section corresponds to the number of a footnote. For example, more information on the Hanover County program, mentioned in footnote 1 on page 6, can be found in Section 1 of Part II. Part III contains school division data used in the analysis.

[22] There are actually 138 school divisions in Virginia. However, following DOE's standard procedure in the Superintendent's Annual Reports, data for some current or previous school divisions have been merged with adjacent or surrounding divisions for various reasons. These data combinations were made: Clifton Forge into Alleghany County, Bedford City into Bedford County, Emporia City into Greensville County, Fairfax City into Fairfax County, Lexington City into Rockbridge County, James City County into Williamsburg City, and South Boston City into Halifax County.

[23] In this study, cause-and-effect is inferred because the conditions and circumstances examined in the graduates' school divisions prevailed during the time that most of them were in high school, rather than because particular graduates took AP courses, had good attendance, etc., since we don't have data on the latter. All of the first-year college students in 1994, 1995, and 1996 were in high school during the period covered by this study. The 1991, 1992, and 1993 first-year students were in high school during one, two, and three years of the period under study, respectively. If one assumes that most first-year college students not enrolling in the fall after high school graduation do so within 2 or 3 years, then most of them were also in high school during most of the 1991-96 period covered by the study. See Part I of the Appendix for more on interpreting the results of regression analysis, including the caveat about inferring "cause-and-effect" relationships.

Remediation Requirements: Trends & Variations

The State Council on Higher Education in Virginia (SCHEV) has published four reports that provide annual statistical snapshots of the remediation requirements of first-year students in Virginia's public colleges and universities, during the academic years beginning in 1993, 1994, 1995, and 1996.[24] In addition, for this study, SCHEV staff provided comparable data for the academic years beginning in 1989, 1991, and 1992. (No data were collected in the fall of 1990.). The trends in remediation requirements are shown in Exhibit 1.

Two features of the bar graph in Exhibit 1 are readily apparent. First, in each year, public high school graduates were more likely to take remedial courses than were graduates from private schools.

Such a difference is not surprising to anyone who assumes that students attending private schools are more likely to come from families having traits that correlate with educational success, including parents who place a very high value on education. Without demographic data for the private schools, however, it was not possible to account for such factors.

Thus, despite the better performance demonstrated by graduates from private high schools, there was insufficient information to attribute that difference to more effective private school preparation *per se*.

This inability to answer such an extremely important education policy question due to inherent data limitations underscores the need for better information about the schools--both public and private.

The second eye-catching feature in Exhibit 1--the apparent sharp increase in remediation requirements between the academic years that began in 1991 and 1992--is presumably due to a change in data collection procedures rather than any fundamental changes taking place in the schools. According to SCHEV staff, 1992 was the first year that data collection applied to all students rather than relied on a sampling procedure.[25] That explanation seems consistent with the sharp increases occurring in *both* public and private schools.

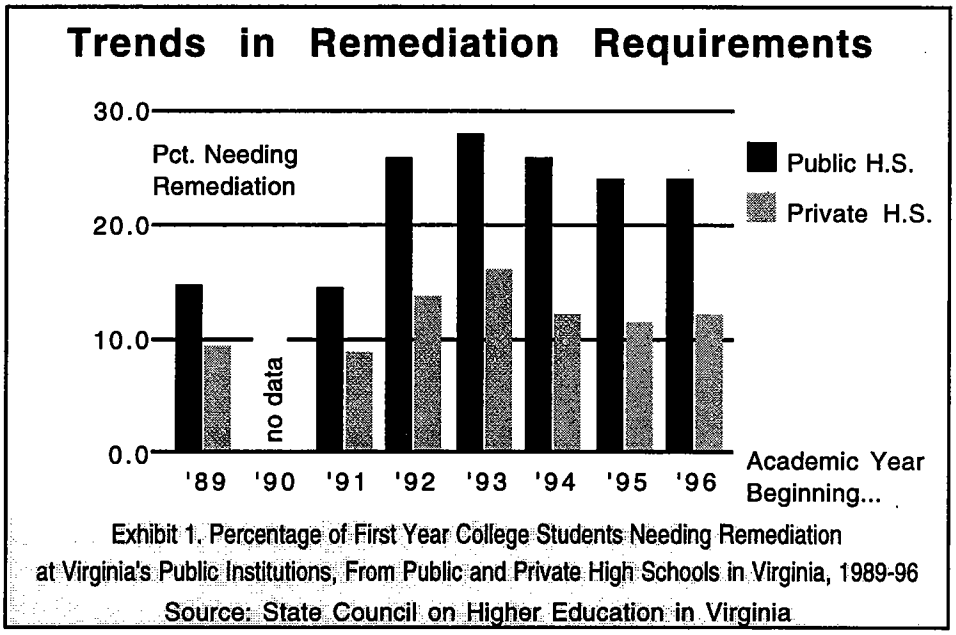


Exhibit 1. Percentage of First Year College Students Needing Remediation at Virginia's Public Institutions, From Public and Private High Schools in Virginia, 1989-96
Source: State Council on Higher Education in Virginia

Beyond these two glaring features in Exhibit 1, there is a pattern that is probably more relevant to the task at hand. Since the departure from the sampling method in 1992, the recorded remediation requirements have not varied much from year to year. They ranged from 24 to 28 percent for public school graduates, and from 11 to 16 percent for graduates of private high schools. Even if 1993 represents an actual high-water mark (rather than a random variation due to

[24] *Academic Performance Characteristics: In-State First-Time Freshmen at Virginia's State-Supported Institutions* (State Council on Higher Education in Virginia), 1993-96.

[25] Personal interview with SCHEV staff, July 8, 1998.

differences in student populations) with "improvements" since then, the trend line is essentially flat since that year.

Geographic Variation

While the *statewide average* percentage of former public school students requiring remediation in college has been hovering around 25 percent, students from some school divisions have been much more likely to require remediation than their college classmates from other parts of the state. The considerable variation in remediation requirement rates associated with school divisions across the Commonwealth during the period from 1991 to 1996 is displayed geographically in Exhibit 2 below.

On the next page, the table in Exhibit 3 lists the individual school divisions, ranked according to the remediation requirement rates for first-year college students from their respective schools over the same six-year period. *A primary goal of this study was to identify factors that account for such differences from one school division to another.*

Demographics. Readers should refrain from drawing conclusions about the comparative efficacy of school division education policies based just on the data in Exhibits 2 and 3.

Indeed, readers familiar with the demographic geography of Virginia will already have noted from the map in Exhibit 2 that the remediation requirement patterns conform roughly to statewide economic, social, and racial patterns. In the search for education policy factors that might account for some of the variation in remediation requirements among school divisions, it is necessary to statistically "control" such community demographic characteristics that are beyond the influence of state or local education officials.

Indicators of Effectiveness. In addition to properly accounting for demographic factors before making inter-divisional comparisons, an even more fundamental question needs attention: Is the *percentage of first-year students needing remediation* a valid indicator of whether students in a particular school division had been well prepared for college?

Implicit in a "yes" answer is the assumption that all school divisions send about the same percentage of their graduates to college in the first place. That was certainly untrue in Virginia during the 1991-96 period, when the estimated college-bound percentage ranged from 80 percent in Falls Church to 32 percent in Page County.[26]

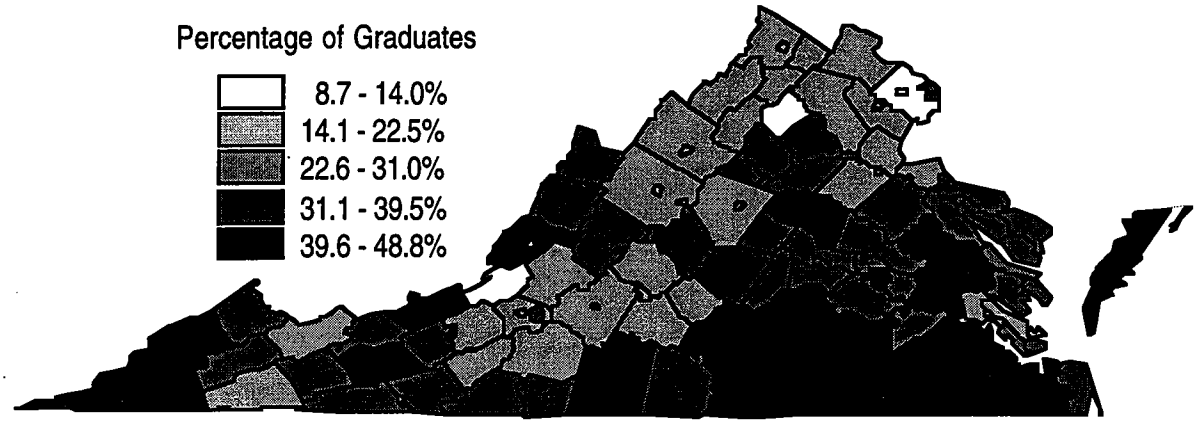


Exhibit 2. Geographic Distribution of First-Year College Students Requiring Remediation, From Public High Schools in Each School Division (1991-96)
Source: State Council on Higher Education in Virginia

[26] Estimated from Table 5, Superintendent's Annual Report, for 1991-96, with a 15.6 percent downward adjusted derived from NCES data on actual enrollments.

To illustrate hypothetically the bias of such an assumption, assume that School Division A and School Division B have about the same number of graduates.

Then assume that all of the graduates from School Division A attend college, and half need remediation. In School Division B, on the other hand, only two students go to college, yet one of those needs remediation.

In both cases, the "remediation rate" would be 50 percent, even though School Division A obviously *prepared* a much larger share of its graduates for college than did School Division B.

Even in cases less extreme than this example, the percentage of first-year students needing remediation would *not* be a valid indicator of the relative effectiveness of School Divisions A and B.

Using a "real" example from the list of school divisions in Virginia, we could compare Falls Church and Waynesboro. Those two divisions' "remediation rates" put them near the top of the list in Exhibit 3.

From 1991 to 1996 they sent about the same number to college each year, an average of 75 and 79, respectively.

Division	Remediation %	Division	Remediation %	Division	Remediation %
Craig	8.7	Washington	22.4	Mathews	29.5
Rappahannock	10.3	Nelson	22.6	Essex	29.6
Fairfax County	13.8	Gloucester	22.6	Pulaski	30.1
Waynesboro	14.0	Chesterfield	22.7	Carroll	30.5
Falls Church	15.1	West Point	23.0	Westmoreland	30.7
Roanoke County	15.7	Bath	23.0	Grayson	30.9
Lynchburg	15.7	Patrick	23.5	King William	31.4
Appomattox	15.9	Radford	23.6	Northampton	31.4
Bedford County	16.1	Henrico	23.7	Danville	31.8
Campbell	16.3	Buchanan	24.4	Amelia	31.8
Williamsburg	16.8	Russell	24.5	Louisa	32.9
Manassas City	17.0	Hanover	24.6	Lunenburg	32.9
Harrisonburg	17.2	Newport News	24.9	Isle of Wight	33.2
Franklin	17.2	Culpeper	24.9	Scott	33.2
Stafford	17.5	Buckingham	25.0	Giles	33.5
King George	17.5	Arlington	25.3	Chesapeake	33.5
Staunton	17.6	Northumberland	25.4	Southampton	33.8
Albemarle	17.6	Madison	25.6	Wythe	34.1
Botetourt	17.7	Caroline	25.7	Wise	34.6
Clarke	17.8	Richmond County	25.8	Alleghany	34.7
York	17.9	Highland	25.9	Mecklenburg	35.0
Floyd	18.2	Roanoke City	26.1	Dinwiddie	35.1
Frederick	18.4	Colonial Heights	26.2	Prince Edward	35.2
Prince William	18.5	Martinsville	26.3	Accomack	35.3
Franklin City	19.3	Norton	26.4	Charlotte	35.3
Salem	19.4	Charlottesville	26.7	New Kent	35.3
Shenandoah	19.7	Fluvanna	26.8	Pittsylvania	35.5
Poquoson	20.1	Orange	26.8	Nottoway	36.7
Loudoun	20.1	Halifax	26.9	Hopewell	37.5
Fauquier	20.5	Powhatan	27.1	Dickenson	37.5
Montgomery	20.6	Cumberland	27.1	Brunswick	38.1
Winchester	20.8	Bland	27.6	Manassas Park City	39.0
Rockingham	20.8	Greene	27.8	Norfolk	39.6
Amherst	21.2	Smyth	28.0	Suffolk	41.7
Tazewell	21.2	Colonial Beach	28.0	Surry	41.9
Fredericksburg	21.2	Rockbridge	28.2	Lee	42.2
Page	21.4	Virginia Beach	28.3	Richmond City	42.2
Covington	21.5	Alexandria	28.3	King and Queen	42.4
Augusta	22.1	Prince George	28.5	Petersburg	43.0
Galax	22.1	Goochland	28.8	Charles City County	43.7
Spotsylvania	22.2	Lancaster	29.0	Portsmouth	46.4
Warren	22.2	Henry	29.1	Sussex	48.2
Bristol	22.2	Hampton	29.2	Greensville	48.8
Buena Vista	22.3	Middlesex	29.4		

Exhibit 3. Percentage of First-Year College Students from Each School Division Required to Take at Least One Remedial Course at Virginia's Public Institutions, 1991-96

Source: State Council on Higher Education in Virginia

However, during that period, the average size of the Falls Church graduating class (95) was smaller than that of Waynesboro (156).

Therefore, the Falls Church *percentage* of graduates going to college (80 percent) was much higher than the 51 percent in Waynesboro. Yet their nearly identical "remediation rates" in Exhibit 3 do not account for that fact. Nor do they account for the different remediation rates at private colleges.

Instead of defining the dependent variable as the "SCHEV remediation rate" listed in Exhibit 3, we have defined it as the percentage of graduates who *both* went to college *and* did not require remediation upon arrival--that is, those "bound and prepared" for college.

Using that dual characteristic provides a more valid indicator of school division effectiveness than the remediation percentages published by SCHEV and listed in Exhibit 3.

Exhibit 4 at right reflects this revised effectiveness measure. It shows the percentage of graduates who *both* attended college *and* did not take remedial courses upon arrival.[27]

School Division	% of Grads	School Division	% of Grads	School Division	% of Grads
Falls Church	70	Rappahannock	45	Lunenburg	36
Fairfax County	63	Russell	45	Patrick	36
Roanoke County	58	Waynesboro	45	Grayson	36
York	58	Washington	45	Mathews	36
Radford	57	Gloucester	44	Mecklenburg	36
Franklin City	57	Roanoke City	44	Buckingham	36
Manassas City	56	Warren	44	New Kent	36
Albemarle	55	Norton	44	Pittsylvania	35
Arlington	55	Buchanan	44	Hopewell	35
Prince William	55	King George	44	Colonial Beach	35
Poquoson	54	Pulaski	43	Nelson	35
Salem	54	Appomattox	43	Orange	35
Lynchburg	54	Chesapeake	43	Rockingham	35
West Point	53	Martinsville	42	Giles	35
Loudoun	53	Middlesex	42	Culpeper	34
Winchester	52	Lancaster	41	Cumberland	34
Hanover	52	Williamsburg	41	Accomack	34
Stafford	52	Rockbridge	41	Floyd	34
Staunton	52	Bath	40	Portsmouth	34
Montgomery	51	Northampton	40	Petersburg	33
Fredericksburg	51	Shenandoah	40	Madison	33
Campbell	51	Smyth	40	Isle of Wight	33
Newport News	50	Bland	40	Charlotte	33
Chesterfield	50	Southampton	40	Carroll	33
Clarke	49	Northumberland	40	Lee	33
Henrico	49	Alleghany Highlands	40	King William	32
Tazewell	49	Covington	40	Westmoreland	32
Virginia Beach	48	Goochland	40	Essex	32
Bedford County	48	Amherst	39	Louisa	32
Colonial Heights	48	Prince George	39	Surry	31
Botetourt	47	Greene	38	Fluvanna	31
Fauquier	47	Powhatan	38	Manassas Park City	31
Danville	47	Spotsylvania	38	Brunswick	30
Frederick	47	Highland	38	Sussex	30
Charlottesville	47	Richmond City	38	Dickenson	30
Craig	47	Augusta	38	Amelia	29
Alexandria	46	Norfolk	37	Dinwiddie	28
Harrisonburg	46	Scott	37	Caroline	27
Galax	46	Wythe	37	King and Queen	26
Franklin	45	Prince Edward	37	Greensville	26
Buena Vista	45	Wise	37	Page	26
Richmond County	45	Henry	37	Charles City County	24
Bristol	45	Halifax	37	Suffolk	23
Hampton	45	Nottoway	36		

Exhibit 4. Estimated Percentage of Each Division's Graduating Class Bound and Prepared for College, (average,1991-96)

Source: SCHEV (1991-96), Virginia Superintendent's Annual Reports (1991-96), and National Center for Education Statistics (1994-96)

[27] See Part II of the Appendix for the procedures used to calculate the estimates contained in Exhibit 4.

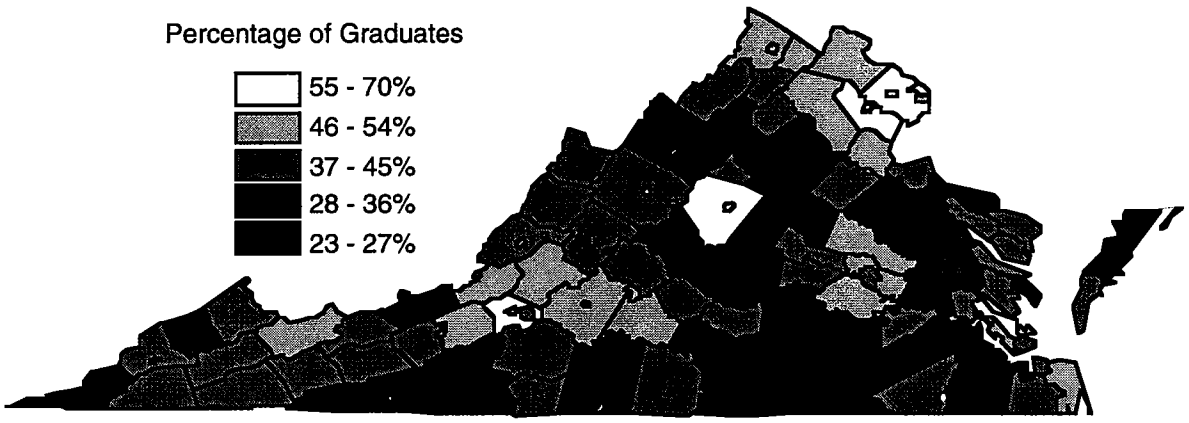


Exhibit 5. Estimated Percentage of Each Division's Graduating Class Bound and Prepared for College (average,1991-96)

Source: Estimated Using Data from SCHEV, DOE, and NCES

To complete the illustrative example, note that the adjustment caused Waynesboro to shift downward from the 4th position in Exhibit 3 to the 47th slot in Exhibit 4, while Falls Church moved upward from 5th to 1st.

To reiterate, the data in Exhibit 4 should be interpreted as follows: Using Falls Church as an example, an average of nearly 70 percent of the graduates between 1991 and 1996 planned to go to college *and* could do so without having to take remedial courses during their freshman year.

Simply stated, 7 of every 10 Falls Church graduates were *bound and prepared* for college. On the other hand, such a description would have applied to only about 2 of every 10 graduates from Suffolk, the school division at the bottom of the list.

The map in Exhibit 5 provides a geographic display of the data contained in the table of Exhibit 4.

Inter-Division Comparisons

In this study, the search for factors having an impact on college enrollments and remediation rates is focused on those *within the control* of school officials.

There are, however, other factors *beyond the control* of school officials that also influence students' chances for adequate preparation, such as the socio-economic characteristics of the community and the student population, the effects of which had to be statistically "isolated" before valid assessments of education policies and *valid comparisons of school divisions* could be made.[28]

On the next page, Exhibit 6 provides an approximation of the relative effectiveness of the 131 school divisions in preparing their students for college. The data in Exhibit 6 were generated by a regression model designed to estimate the percentage of graduates "college bound and prepared" that could be "expected" based on demographic factors alone. After extensive testing of different combinations of various demographic factors, only two displayed a statistically significant relationship with the dependent variable: the locality's percentage of adults with high school diplomas and the locality's percentage of Black Americans.[29]

The data in Exhibit 6, then, should be interpreted as follows. The school divisions with large positive numbers had many more graduates "college bound and prepared" than would have been expected, given the demographics of those divisions. The divisions with large negative numbers had

[28] For detailed discussion of the rationale for statistically isolating the demographic factors before evaluating the efficacy of education policies and practices, see *Understanding Virginia's Report Card* (Thomas Jefferson Institute for Public Policy, November 1997), pp.10-13.

[29] See regression model statistics in Appendix, Part II.

fewer than expected, and those with numbers closer to zero had about what was expected based on demographics alone.

Since some variation is due to chance and to measurement error, small differences between two divisions should not be taken as evidence that one is doing a better job of preparing students for college.[30]

Exhibit 4 (page 14) shows that 57 and 31 percent of the graduates from Franklin City and Manassas Park were college-bound and prepared, respectively. Exhibit 6, at right, says that the demographics in Franklin and Manassas Park would have predicted a reversal of their rankings.[31]

For Franklin, a percentage closer to 35 would have been "expected" given that city's demographics. The difference between the actual and expected percentage was a *positive* 22 points. So, Franklin City exceeded expectations

The actual percentage for Manassas Park was 14 points *lower* than the expected value of 45. Manassas Park, then, failed to meet expectations.

School Division	% of Grads	School Division	% of Grads	School Division	% of Grads
Franklin City	22	Craig	2	Lee	-3
Falls Church	14	Henry	2	Powhatan	-3
Danville	13	Lancaster	2	Shenandoah	-3
Lynchburg	12	Petersburg	2	Chesterfield	-4
Buchanan	11	Poquoson	2	Greene	-4
Richmond	10	Prince William	2	Highland	-4
Tazewell	10	Amherst	1	Portsmouth	-4
Campbell	9	Botetourt	1	Westmoreland	-4
Radford	9	Charlotte	1	Wythe	-4
Fairfax County	8	Charlottesville	1	Alexandria	-5
Galax	8	Frederick	1	Alleghany Highlands	-5
Roanoke County	8	Henrico	1	Amelia	-5
Russell	8	Mecklenburg	1	Cumberland	-5
West Point	8	Middlesex	1	Dickenson	-5
Winchester	8	Northumberland	1	Greensville	-5
Buena Vista	7	Prince Edward	1	Hopewell	-5
Northampton	7	Rappahannock	1	Norfolk	-5
Norton	7	Richmond City	1	Virginia Beach	-5
Staunton	7	Stafford	1	Charles City County	-6
Franklin	6	Warren	1	Colonial Beach	-6
Fredericksburg	6	Sussex	1	Essex	-6
Salem	6	Scott	0	Louisa	-6
Southampton	6	Pittsylvania	0	Augusta	-7
Albemarle	5	Hampton	0	Culpeper	-7
Appomattox	5	Wise	0	Dinwiddie	-7
Lunenburg	5	Grayson	0	Floyd	-7
Manassas City	5	Waynesboro	0	Isle of Wight	-7
Martinsville	5	Goochland	0	Madison	-7
Nottoway	5	Loudoun	0	Orange	-7
York	5	King George	-1	Prince George	-7
Bedford County	4	Patrick	-1	Caroline	-8
Bristol	4	Surry	-1	Giles	-8
Halifax	4	Accomack	-2	King and Queen	-8
Hanover	4	Bland	-2	King William	-8
Montgomery	4	Colonial Heights	-2	Mathews	-8
Newport News	4	Covington	-2	Rockingham	-8
Washington	4	Fauquier	-2	New Kent	-9
Buckingham	3	Gloucester	-2	Williamsburg	-9
Pulaski	3	Harrisonburg	-2	Spotsylvania	-10
Roanoke City	3	Nelson	-2	Fluvanna	-11
Smyth	3	Rockbridge	-2	Page	-13
Arlington	2	Bath	-3	Suffolk	-13
Brunswick	2	Carroll	-3	Manassas Park City	-14
Clarke	2	Chesapeake	-3		

Exhibit 6. Percentage of Each Division's Graduating Class Bound & Prepared for College That is Greater (+) or Less (-) than Would be Expected Based on Statistically Significant Demographic Factors Alone (educational level and racial mix of community), 1991-96

[30] See Part II of the Appendix.

[31] The percentage of adults with high school diplomas was 62% and 71% and the percentage of Black Americans was 54% and 7%, respectively, in Franklin City and Manassas Park. See division demographic data in Appendix, Part III.

Education Policy Analysis and Findings

One goal of this report has been to identify school division policies and practices that have an impact on high school graduates' college enrollment rates and their preparation for college-level courses.

Our operational definition of a school division's effectiveness in preparing students for college has been the percentage of the division's graduates who satisfied two criteria: (a) they were college-bound, *and* (b) they did not need remedial courses upon arrival. We have described that category of graduates as being "bound and prepared for college."

Summary of Findings

Two factors--students' test results[32] and teacher education levels--were found to be highly accurate predictors of being "bound and prepared for college."

Graduates were more likely to *both* (a) attend college and (b) not need remediation if they came from school divisions with higher percentages of

- **juniors scoring above the 75th percentile on national standardized tests, and**
- **teachers with master's degrees.**

This common sense finding says that high school graduates were more likely go to college and be prepared on arrival if they attended schools where students and teachers were smarter. Granted, test scores and master's degrees are not *prima facie* evidence of intellectual attainment. Examples abound of good test takers and worthless sheepskins. Nevertheless, the findings in this study remind us to distinguish the rule from the exceptions. Generally speaking, students and teachers who have more knowledge and ability will score higher on tests and be more likely to earn master's degrees, respectively. In other words, in general, test results and education credentials *do matter.*

[32] Tests of Achievement and Proficiency (TAP), given to 11th graders as part of Virginia's statewide assessment program during most of the 1990s but recently replaced.

School officials could easily influence the number of faculty members with master's degrees--through recruitment policies and salary supplements. However, we had to determine what those officials could do to raise test scores. Thus, a second stage of the analysis was required.

After the effects of demographic factors had been isolated (described on pages 15-16), test results were better in those school divisions with higher participation and performance in advanced courses, better attendance, and smaller elementary classes.

Specifically, the percentage of juniors scoring above the 75th percentile on the national standardized tests was *higher* in school divisions where:

(1) a *higher* percentage of the adults had high school diplomas,

(2) the percentage of Black Americans was *lower*,

(3) a *higher* percentage of students took the challenging academic courses required for the advanced studies diploma,

(4) a *higher* percentage of students took college-level advanced placement (AP) courses,

(5) a *higher* percentage of students "passed" a national AP exam,[33]

(6) the excessive absentee rate (more than 10 days) in grades 9-12 was *lower*, and

(7) the pupil/teacher ratio in grades K-6 was *lower*.

School officials must take as "givens" the two demographic factors. The other five factors, however, are within school officials' control and hold the prospect for raising juniors' scores on standardized tests--or, more to the point, raising the knowledge and

[33] In this context, "passing" an AP exam means scoring at least a "3" on a 5 point scale.

ability level of juniors--to a point where they can look forward to being "bound and prepared" for college.

Regression Details

The remainder of this section details the results of the regression analysis that has just been summarized. The discussion may appear somewhat redundant, given the summary just completed, but it does include the basis for confidence in the findings.[34]

College-Bound and Prepared

In the first stage of analysis, dozens of factors were tested by regression analysis procedures in an effort to statistically "account for" the wide variation in college attendance and remediation requirements across school divisions in Virginia. Both socio-economic and education policy factors were examined.

Ultimately, however, the regression model that accounted for the largest percentage of the variation in the dependent variable contained just two independent variables: the percentage of teachers with master's degrees, and the percentage of students scoring above the 75th percentile on the 11th grade national standardized tests. Those two factors combined to account for 74 percent of the variation in the percentage of graduates bound for college and prepared on arrival. Once those two factors were tested in the model together, no other factor was able to make a statistically significant addition to the model's explanatory power.[35]

The graph in Exhibit 7 illustrates how well the regression model accounts for the variation from one school division to another. The vertical axis of the graph represents the actual percentage of graduates *both* bound for college and not needing remediation, for each school division, based on the data contained in the table of Exhibit 4 (page 14). The horizontal axis in the graph marks the percentages "predicted" by the regression model. The closer the points cluster up and down the diagonal regression line, the better the fit between the model and the data, which means more confidence in the findings.

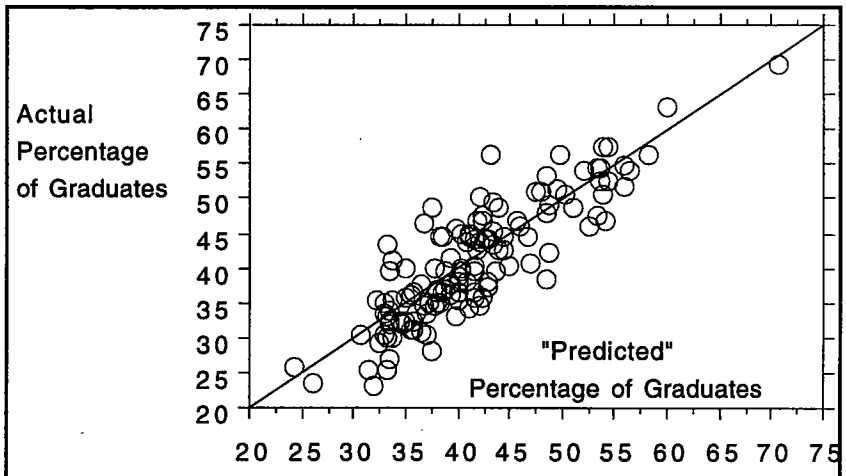


Exhibit 7. Comparison of Actual Percentage of Graduates "Bound and Prepared" for College with the Percentage of Graduates "Predicted" by the Regression Model

The pie chart in Exhibit 8 displays the relative contribution of both factors to our understanding of the variation in the dependent variable. Students' test performance accounted for 68 percent of the differences in being "college bound and prepared," while master's degree teachers accounted for 6 percent.

The approximate quarter slice of the

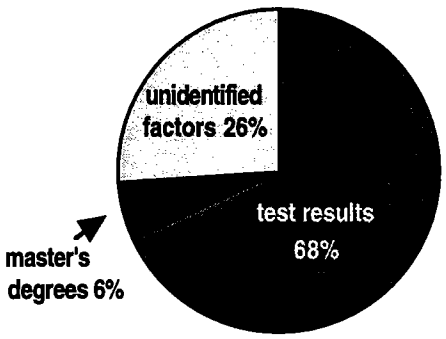


Exhibit 8. 74% of the Variation in School Divisions' Graduates Being "College Bound and Prepared" Was Accounted for by Standardized Test Results & Master's Degree Teachers

[34] Readers unfamiliar with regression analysis may wish to read Part I of the Appendix.

[35] See regression model statistics in Appendix, Part II.

pie chart labeled "unidentified" is a reminder that the two identified factors do not tell the whole story. It is almost a certainty that more could have been learned if individual *schools* or individual *students*--rather than school *divisions*--had been the units of analysis.

Accounting for Test Results

The more important of the two factors--the test results--was found to be a conduit for the combined impact of the seven additional factors summarized on page 17.

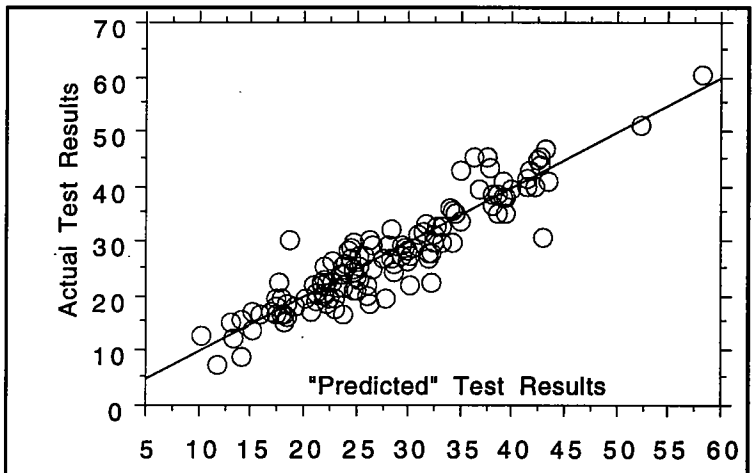


Exhibit 9. Comparison of Actual 11th Grade Test Results With Test Results "Predicted" by the Regression Model

Before comparing the independent contribution of each of those factors to our understanding of 11th grade test results, examine the overall "fit" of the second-stage regression model in Exhibit 9 above. The seven factors combined to account for 86 percent of the variation in test results from one school division to another.[36]

The pie chart at right (Exhibit 10) helps distinguish the relative contribution of the seven independent factors in the regression model. The percentages in parentheses indicate how much each factor contributed to the variation in test results, and the plus or minus signs indicate the direction of that influence.

Exhibit 10 reveals that the demographic factors (adult education levels and racial mix) accounted for nearly half (48 percent) of the variation in test scores, while 38 percent of the variation was explained by education policy factors.

The common thread for three of the five education factors was advanced course work. For school divisions with similar demographic features, juniors' test results were *better* in those divisions where *more* students enrolled in courses required for the advanced studies diploma, where *more* students took college-level advanced placement (AP) courses, and where *more* students passed a national AP exam (i.e., scored at least a "3").

Test scores were also *higher*--again, other things being equal--in school divisions where excessive absenteeism (missing more than 10 days) in grades 9-12 was *lower*, and where the pupil-teacher ratio in grades K-6 was *lower*.

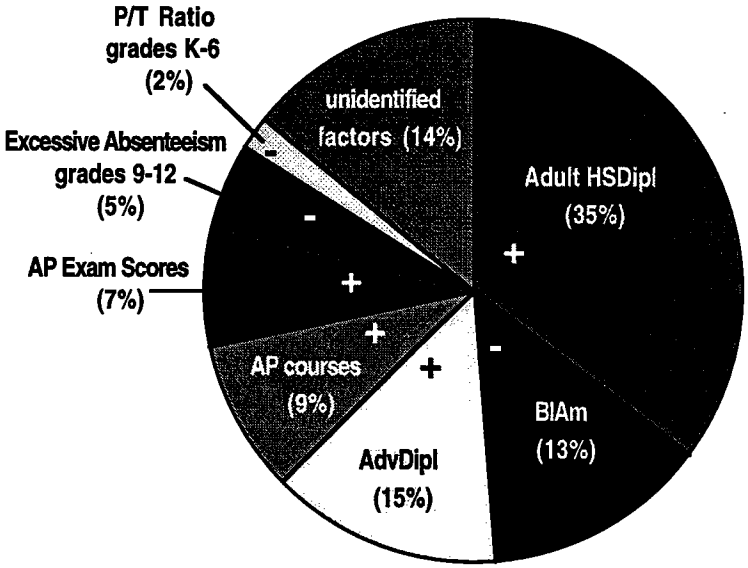


Exhibit 10. 86% of the Variation in School Divisions' 11th Grade Test Results Was Accounted For by 7 Factors

[36] See regression model statistics in Appendix, Part II .

Policy Options

Virginia public high school graduates' chances of being "college bound and prepared" are lower in some school divisions than others, and policy options should highlight ways to increase those odds.

Improving Test Scores

Improving graduates' chances of going to college and being prepared for college-level work upon arrival is a realistic objective for school divisions in Virginia. Many of the factors that affect the chances for graduates to achieve that status are within the control of education policy makers.

Our earlier, much broader study of school division test scores (*Understanding Virginia's Report Card*, Thomas Jefferson Institute for Public Policy, November 1997), suggested ways to improve test results at all grade levels. The findings in this report, while relating just to 11th grade test results, reaffirm the importance of those earlier recommendations, which included:

- **Raising Academic Standards** by vigorous implementation of the new Standards of Learning, elimination of social promotion, and making promotion contingent on passing the SOL achievement tests;
- **Reducing Excessive Absenteeism** through financial incentive programs for both divisions and individual schools;
- **Master's Degree Incentives**, including tax credits and state matching salary supplements; and
- **Reducing Pupil-Teacher Ratios** in grades K-3 to 17:1 and in grades 4-6 to 19:1 by joint state and local funding for 1600 new teachers in the 65 school divisions with above-average ratios.

If those earlier recommendations were implemented, along with concentrated efforts to increase student enrollment in challenging courses (such as advanced placement courses and those required for the advanced studies diploma), improvements in 11th grade test scores would occur, and more graduates would be prepared for college-level course work.

Consideration should also be given to financial incentives for extraordinary academic achievements, such as a monetary award to high schools for *each* student passing an advanced placement exam.[37]

Improving Information Needed for Policy Making and Evaluation

In that earlier study, we also recommended **improvements in data collection and reporting** to enhance strategic planning and program evaluation at both the state and local levels. The current study reiterates the weaknesses in DOE's data system, and also points to limitations inherent in the SCHEV student monitoring system.

Assessing the effectiveness of the public school system--an absolute prerequisite for major changes in policies affecting that system--requires *at least* these additions to the current database maintained by DOE and SCHEV:

- demographic data for individual public and private high schools,
- high school courses, grades, and SAT scores for public and private high school graduates enrolled in college (at public and private colleges, in- and out-of-state),
- college enrollment data for public and private high schools (at public and private colleges, in- and out-of-state), and
- remedial courses taken by all public and private high school graduates at all colleges (public and private, in- and out-of-state).

School Division Warranty Programs

What schools should do to improve the preparation of their students for college is

[37] Florida provides $600 awards to school districts for each student passing an AP exam. T. Toch, *In the Name of Excellence* (Oxford University Press, 1991), p. 100.

clear. *How to get them to do it* is less obvious. Several of the policy recommendations for improving test results are incentive-based; that is, school divisions would have financial incentives for vigorously pursuing measurable improvements in critical areas that would improve test results. In addition, success or failure in the implementation of the Standards of Learning will have consequences in terms of school accreditation by Spring, 2003. However, it is time for a new policy that provides an incentive structure arching over all the others.

Whether designed as a "carrot" or a "stick" program, a *mandatory* Graduate Warranty Program that builds on the best features of the Hanover County innovation and the initiative undertaken by SCHEV and the Board of Education deserves serious attention at the highest levels of Virginia state government.

There are two essential components of such a program: (1) Graduates who met certain academic requirements would be certified by their school divisions as being "ready for college," and (2) the school divisions would promise to reimburse any certified graduates who had to take remedial courses during their first year in college.

Certification should require warranted students to meet certain conditions, such as:

- completing course requirements for the advanced studies diploma,
- maintaining a cumulative GPA of at least 2.5 on a 4.0 scale,
- enrolling at college within one year after graduation from high school,
- selecting a degree program consistent with the high school courses taken.

SCHEV and Board of Education officials have been hoping that private donors will provide sufficient "matching fund" incentives to entice some school divisions to participate in the Graduate Guarantee Program, but that voluntary approach has yet to work. The Governor and General Assembly should give serious consideration to a *mandatory* Graduate Warranty Program.

A new state policy creating another state mandate for local schools, however, would necessitate at least temporary partial state funding through matching grants. Ultimately, however, to have the desired incentive effect--namely, to get school divisions to accept responsibility for the quality of their graduates and *reduce the need for remedial courses*--a Graduate Warranty Program would have to "bite" financially closest to home. If school administrators had to appear before local school boards and county supervisors to request funding for former graduates' remedial course tuition, they would have to be ready with answers to tough questions from taxpayers and their elected representatives. **After an initial start-up period of 3 to 5 years, therefore, localities should have to pay for warranty claims from local budgets alone.**

Creating a remedial course tuition insurance program should *not* be the intent of a graduate warranty program. If such a program merely compensated students and parents for the $15 million in annual remedial tuition *without affecting the education of students in the public schools*, it would just shift $15 million more to the $25 million deficient diploma burden already borne by Virginia taxpayers, and the Commonwealth's public school graduates would be no better prepared for college.

Instead, the goal should be the *reduction in the need for remedial courses* in college. Our strategy should be to develop an incentive structure within which local school officials would see opportunities foregone due to new or reprogrammed funds being diverted to warranty claims, and see the benefits of producing more graduates who are bound and prepared for college.

Appendix, Part I: Primer on Regression Methodology

The primary statistical procedure used in the analysis is known as regression analysis, in which a data item such as a test score is treated as a *dependent variable*. It is called "dependent" because its magnitude is presumed to *depend* on other causal factors, which are called the independent variables. It is called a "variable" because its magnitude *varies* from one case to another. In this study, for instance, we want to know *why there is variation in 11th grade test scores* among school divisions. Using regression techniques, we can examine how different magnitudes in the independent variables (e.g., pupil-teacher ratios or absentee rates) are correlated with different magnitudes in the dependent variable (e.g., test scores).

The concept of variation is central to an understanding of the results of the analysis. We will speak of independent variables that "account for the variation" or "explain the variation" in the dependent variable, and we will do so in percentage terms. The variation in the dependent variable that we want to account for is the variation from its average, or mean value. For instance, suppose that when the average score on a specific test for each school division is averaged over all the divisions in a state, the resulting mean is 75. We would say, then, the *average* school division had an *average* test score of 75. Further, assume there was considerable variation in average scores from one school division to another, so that some school divisions had average scores around 55 while others approached 95. Picking a division at random and not knowing anything else about the division (even its name), our best guess of the division's performance would be the mean value for all of the divisions, namely 75. But we would be way off in almost every case because there is such high variation around that mean. Regression analysis can produce a better estimate of a particular school division's performance than the statewide mean for all divisions.

A simple analogy will illustrate. Imagine that you're told that five boys have an average height of 60 inches, but that the smallest is 48 inches tall while the tallest measures 72 inches. If you're blindfolded and required to predict the height of one of the boys picked at random, your best guess would be the mean value, namely 60 inches.

However, suppose you were told that the five boys varied in age from 10 years to 18 years old. Then, when a boy is picked at random and you're told that he's 18, you would be likely to guess that he's the six-footer in the group because you know that, for boys between the ages of 10 and 18, height is very "dependent" on age. Notice, however, that you *might* be wrong. The correlation between age and height, even for that age range, is not perfect. There are some short 18-year olds. But the variation in height among 18-year olds is much less than the variation in height among boys 10 to 18. In this example, the independent variable "age" accounts for much of the variation in the dependent variable "height."

How much of the variation is accounted for can be estimated in percentage terms by the complex calculations that are part of the regression analysis. Here, a simplified graphical illustration of the age/height example should provide general readers with sufficient understanding of the regression process to enable comprehension of the findings in this study. Note the graph in Exhibit T1.

In Exhibit T1, the average height of the five boys is represented by the horizontal line that intersects the the vertical axis at 60 inches. The point on graph above each boy's name (arranged alphabetically on the horizontal axis) corresponds to that boy's height.

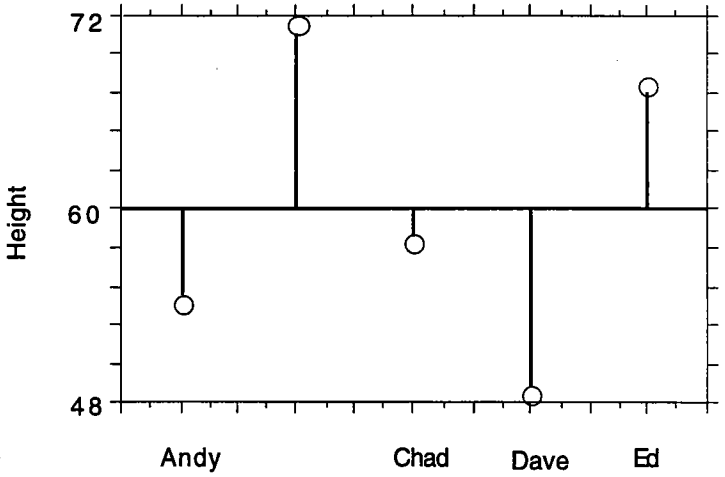


Exhibit T1. Distribution of Height Measurements for Five Boys

The average height is 60 inches, and the distance from each boy's height to the 60-inch line is his variation from the mean.

The distance from each point to the line that represents the average height is the variation of that boy's height from the mean. The total variation from the mean in this example is the sum of the variations for each of the boys. If, instead of arranging the boys alphabetically on the horizontal axis, we arrange them by age, a very different picture takes shape, as in Exhibit T2, where a vertical line has been added to show the mean age.

In Exhibit T2, a pattern is clear. The lines representing average height and age intersect and divide the graph into four areas. The upper-right area is for taller and older boys, while the lower-left is for shorter, younger boys.

Note that, for the five cases in this example, all the measurements fall into either the upper-right or lower-left areas of the chart. We have no exceptional cases of boys who are above the average age (14) but below the average height (60 inches), which would have been observed in the lower-right area. Likewise, no observations are found in the upper-left area, which is reserved for boys who are very tall for their age.

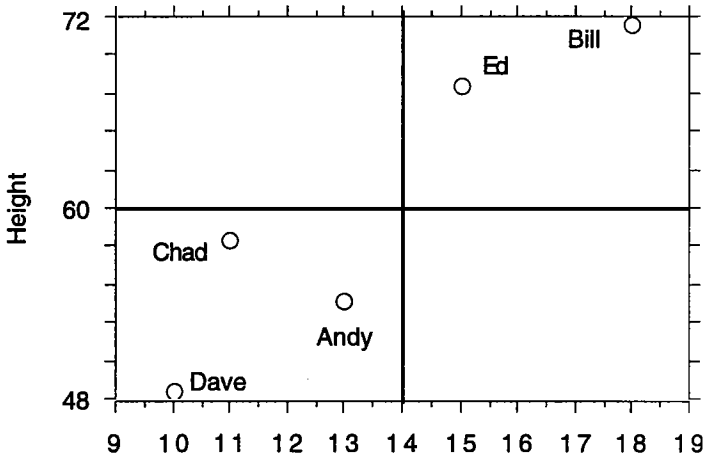


Exhibit T2. Distribution of Height Measurements by Age

The average height is 60 inches, and the average age is 14.

When data conform to the pattern that is seen in Exhibit T2, there is said to be a strong correlation between the independent variable (traditionally labeled along the horizontal axis) and the dependent variable (labeled along the vertical axis). More formal statistical methods, such as regression analysis, can determine *how strong* the correlation is, and Exhibit T3 illustrates the idea.

In Exhibit T3, the horizontal line is still the average height for the boys in the example, 60 inches. The line that slants upward to the right, however, is something new in this graph: the *regression line.* It has been estimated statistically from the actual heights and ages of the five boys. Think of the regression line as a "prediction" of a boy's height, given his age. The closer the measurements are to the regression line, the stronger the correlation between the independent variable (age) and dependent variable (height) and the more accurate a prediction of height based on age. Bill's predicted height is almost exactly the same as his average height. Ed, on the other hand, is taller than the height predicted by the regression line.

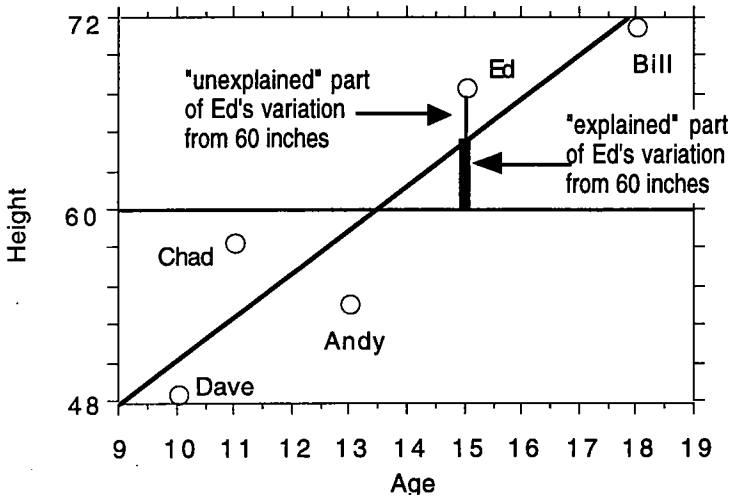


Exhibit T3. Regression "Explains" Some Variation From the Mean

Ed's age is 14, and that "accounts for" the fact that he is taller than the average age of these five boys. It does not account for the fact that he is taller than the average 14-year-old.

This graphical relationship can also be represented in the form of an equation. In this study, such an equation will be useful in predicting test score results in school divisions based on the independent variables.

Exhibit T3 also illustrates the concept of "accounting for" the variation around the mean of the dependent variable. The total distance from Ed's point on the graph to the horizontal line representing the mean height is his variation from the mean. Note that

his total distance from the mean can be separated into two components: the distance from the mean to the regression line and the distance from the regression line to his point on the graph. In regression terminology, we say that the distance from the mean to the regression line is the amount of the variation from the mean that is "accounted for" or "explained" by the independent variable. The distance from the regression line to his point on the graph represents the variation that remains "unexplained" because other causal factors have yet to be identified.

If we were told that both of Ed's parents were over six feet tall, that might help us understand why Ed was tall for his age. The "height of parents" could be another independent variable that, along with age, would probably account for almost all the variation from 60 inches in this illustration. Using several independent variables instead of just one is called "multiple" rather than "simple" regression analysis.

When all the points on the graph are analyzed in this fashion, it is possible to calculate the sum of the *explained* variations and compare that number with the sum of the *total* variations. (Actually, statisticians "square" the distances before summing to take care of minus signs.) A simple ratio between the *explained* and *total* distances from the mean gives a measure of the percentage of the variation in height that has been statistically "accounted for" or "explained" by age. If all the points were located precisely on the regression line, such a ratio would equal 1, and we could say that 100% of the variation has been explained. If, after comparing two variables and finding that the calculated regression line is flat and almost coincides with the horizontal line representing the mean, then the ratio would be close to zero, and we would conclude that none of the variation had been explained.

In this document, graphs and pie charts have been used to illustrate relationships between test score data and several independent variables. They help us visualize what portion of the total variation in test scores is "accounted for" or "explained" by the independent variables, and, by implication, appear to have some cause-and-effect relationship with the test scores.

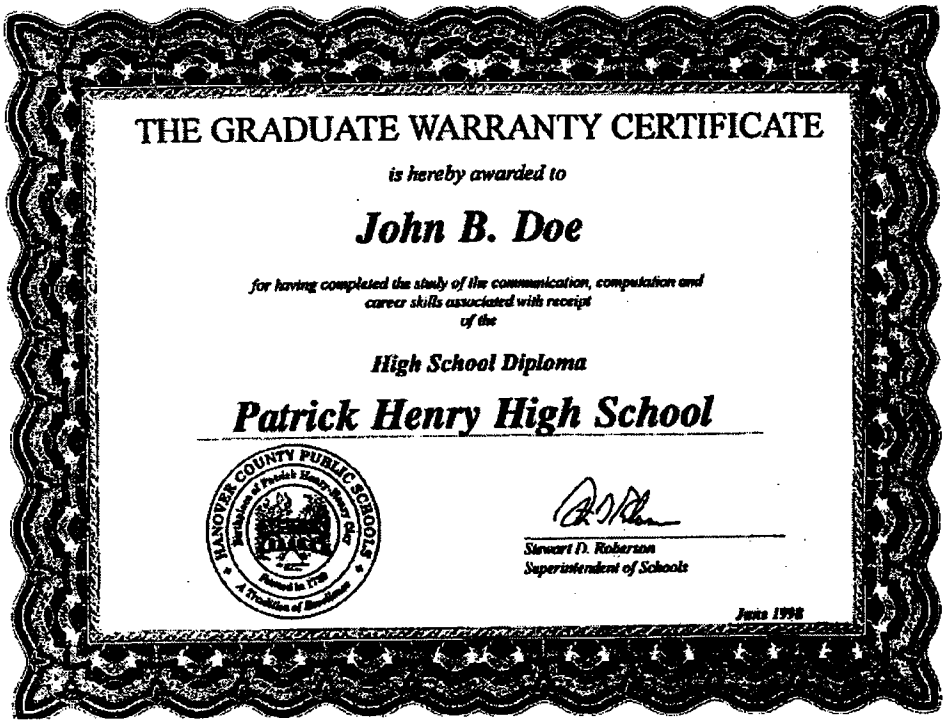
We say "appear" because regression cannot *prove* cause-and-effect; it can merely suggest such a relationship by the way variations in the dependent variable occur when the independent variables take on different values. It is up to the analyst and the readers of the analysis to decide whether it is reasonable to infer a cause-and-effect relationship. Strictly speaking, a boy's age does not *cause* him to be taller. Birthday parties are not followed by growth spurts. Rather, the natural human growth process is regular enough in its pattern that, within a certain range of birthdays, one's age correlates with particular stages of that growth process. Age is more a barometer of the change that is taking place than it is the true cause of that change.

Appendix, Part II: Elaboration on Selected Footnotes

In this part of the Appendix, each section corresponds to the number of a footnote in the main report. Not all of the footnotes were technical or made reference to the Appendix, but the numbering sequence remains the same. For example, the first section is #1 and refers to footnote #1 on page 6.

Section 1 (page 6): Hanover County Public Schools eagerly provided additional information, including program guidelines, certification criteria, and procedural forms used in the administration of the program. Of particular interest is the following policy statement by the school division:

> On February 13, 1990, the Hanover County School Board adopted Policy 7-28.2 which established a Graduate Warranty Program for graduates of the public school division who are employed by businesses, industries, and other organizations. This policy guarantees to the business community that graduates of the Hanover County Public Schools will possess communication, computation, and career skills necessary for success in the workplace. On November 10, 1992, the School Board extended the Graduate Warranty Program to include students accepted in postsecondary education at two and four-year colleges, universities, and community colleges. Beginning with the graduating class of 1994, students' final high school transcripts indicated that they were covered by the extended Graduate Warranty Program If a dean of admissions,, or other appropriate college official, determines that a student who has graduated from the Hanover County Public Schools within the past two years must be placed in a course of remediation before qualifying to enroll in a required academic class, the designated college official will notify Hanover's Director of Alternative Education to activate the extended Graduate Warranty Program. The designated college official and the Director of Alternative Education will decide if the school division or the postsecondary institution will provide remediation for the student in the determined area of weakness. If it is agreed that the college will provide the remediation, then reimbursement for the services will be made to the college by the school division for those services. The college official would then meet with the student to secure his/her consent to participate in the program. At that time, the college official and the student would complete an agreement form stipulating the core academic area to be remediated and other terms. Retraining courses offered by the school division will consist of eight to ten week sessions in the evenings and on Saturdays. At the conclusion of the course, the student's performance will be shared with the college. Retraining courses provided by the college and funded by the school division would follow a schedule established by the institution, and the student's progress would be shared with the school division.



THE GRADUATE WARRANTY CERTIFICATE

is hereby awarded to

John B. Doe

for having completed the study of the communication, computation and career skills associated with receipt of the

High School Diploma

Patrick Henry High School

HANOVER COUNTY PUBLIC SCHOOLS

Stewart D. Roberson
Superintendent of Schools

June 1998

Also of interest is the warranty certificate provided to college-bound graduates, reproduced at left. The certificate issued to graduates headed for the workforce is similar, being addressed to "the employer" of John Doe "as a guarantee of the commitment of the Hanover County School Board to provide, if necessary to promote the graduate's success in the workplace within a period of two years after graduation, retraining in the communication, computation and career skills associated with the receipt of the High School Diploma."

Section 27 (page 14): In general, the calculations were a series of multiplications and additions for the four different "college paths" that graduates could follow (public or private institutions both inside and outside of Virginia), weighted by the remediation rate for each path. It was assumed that, for each school division, the remediation rate for first-year students at *public* institutions (in or outside of VA) was the same; namely, the rate published by SCHEV. Likewise, it was assumed that, for that same school division, the remediation rate at all private institutions (in or outside of VA) was the same; namely, 56% of the public institution rate (based on NCES data). Finally, for that same school division, it was assumed that the ratio of graduates attending private institutions to those attending out-of-state public institutions was the same as the statewide ratio (24/33, or about 72%). Then, given the estimate of the percentage attending public institutions within VA (from DOE, SCHEV, and NCES) data, it was possible to estimate the percentage following the "other" three paths (100% minus the percentage attending VA public institutions), and the "other" paths were weighted 72% private and 28% public. To illustrate with Falls Church data from DOE and SCHEV, adjusted by NCES data:

The Falls Church percentage:

attending college anywhere: (54/64) x 94.7% = 80%
attending VA public institutions: 56%, with non-remediation rate of 84.9%
attending "others: 44%
attending private institutions: 72% of 44% = 32% with non-remediation rate of 91.5%
attending public institutions outside VA: 44%-32% = 12%, with an 84.9% non-remediation rate

attending college w/o remediation = 80% x [(56% x 84.9%)+(32% x 91.5%)+(12% x 84.9%)]
= 80% x (.87012) = 69.6 % (rounded to 70% in Exhibit 4)

Section 29 (page 15): The statistics for the regression model using only demographic factors as independent variables are reproduced below. The standard coefficients show the impact of the racial factor was negative (-.278) but not as large as the positive impact of the community's educational attainment (.601). The p-values indicate that there is very little likelihood (less than 1 in 10,000) that such results would have occurred by chance.

Regression Summary
PrC&NR vs. 2 Independents
Row exclusion: College Data Set 91-96 copy

Count	131
Num. Missing	7
R	.713
R Squared	.508
Adjusted R Squared	.500
RMS Residual	6.134

Regression Coefficients
PrC&NR vs. 2 Independents
Row exclusion: College Data Set 91-96 copy

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	11.862	3.627	11.862	3.270	.0014
adjAfrAm%	-.144	.033	-.278	-4.383	<.0001
WtAvgHSdipl	.487	.051	.601	9.479	<.0001

Section 30 (page 16): The data entries in Exhibit 6 were calculated by subtracting the percentages predicted by the demographic regression model from the actual percentage of "college-bound and prepared" graduates for each school division. The greater the positive differences, the more the divisions' actual percentages exceeded the expectations based on demographics alone. The greater the negative differences, the more the divisions' actual percentages fell short of what demographics alone would have predicted. In *Understanding Virginia's Report Card*, a similar analysis resulted in the labels "overachiever" and "underachiever" being attached to those school divisions near the top and bottom of a similar list for test results at all grade levels. Just "how near" the top or bottom would justify those labels for a specific school division is always a matter of conjecture. The standard deviation of the data in Exhibit 6 is about 6 percentage points, so it's reasonable to conclude that some divisions with entries between plus or minus 6, *might* reflect variation from the mean--and from each other--that is due to random fluctuations and measurement error rather than real differences in effectiveness. And, while less likely, the same *could* be true of any particular division between one and two standard deviations from the mean. Moving further out (either higher or lower on the list), the odds become smaller that a division's position is due to chance. It should still be emphasized, however, that small differences between two school divisions anywhere on the list in Exhibit 6 does not mean there is a significant difference in effectiveness between the two.

Section 35 (page 18): The statistics for the regression model in which "college bound and prepared" was the dependent variable are reproduced at right.

Regression Summary
PrC&NR vs. 2 Independents
Row exclusion: College Data Set 91-96 copy

Count	131
Num. Missing	7
R	.862
R Squared	.744
Adjusted R Squared	.740
RMS Residual	4.427

The "adjusted R squared" in the column at right is the percentage of the variation accounted for by the independent variables in the model.

In the bottom table, "MDeg" is the code word for the independent variable "average percentage of teachers in the school division with master's (or higher) degrees from 1991 to 1996."

ANOVA Table
PrC&NR vs. 2 Independents
Row exclusion: College Data Set 91-96 copy

	DF	Sum of Squares	Mean Square	F-Value	P-Value
Regression	2	7277.052	3638.526	185.628	<.0001
Residual	128	2508.946	19.601		
Total	130	9785.999			

Similarly, "avg%11th75%+91-96" stands for the independent variable "average percentage of 11th graders scoring above the 75th percentile on the national standardized tests from 1991 to 1996."

Regression Coefficients
PrC&NR vs. 2 Independents
Row exclusion: College Data Set 91-96 copy

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	13.791	1.759	13.791	7.839	<.0001
MDeg	.259	.049	.240	5.245	<.0001
avg%11th75%+91-96	.711	.042	.779	17.002	<.0001

Note that the standard coefficient for the test results variable (.779) is more than three times greater than the coefficient for the master's degree variable (.240). The relative influence of the two factors is determined by squaring the coefficients, making the test results factor over 10 times more significant than the master's degree factor (.607 vs. .058). The 68% and 6% contribution estimates contained in the pie chart of Exhibit 7 on page 18 were derived by multiplying the total variation explained (74%) by [(.607)/(.607+.058)] and by [(.058)/(.607+.058)] for test results and master's degrees, respectively.

The "p-value" in the far right column in the bottom table indicates that, for both independent variables, the observed relationships would have occurred "by chance" less than once in 10,000 times.

Section 36 (page 19): The statistics for the regression model in which "11th grade test results" was the dependent variable are reproduced below. The interpretation of the various entries in the table is similar to that described above in section 35. From top to bottom, the independent variable code words stand for % of adults with high school diplomas, % of graduates with advanced studies diploma, % of students taking AP courses,% of students passing at least one AP course, % of 9-12 graders missing no more than 10 days of school, % of local population composed of Black Americans, and the pupil-teacher ratio in grades K-6, all of which were averages from 1991 to 1996.

Regression Summary
avg%11th75%+91-96 vs. 7 Independents
Row exclusion: College Data Set 91-96

Count	125
Num. Missing	13
R	.929
R Squared	.863
Adjusted R Squared	.855
RMS Residual	3.621

	Coefficient	Std. Error	Std. Coeff.	t-Value	P-Value
Intercept	-6.872	5.258	-6.872	-1.307	.1938
HSdipl	.319	.048	.365	6.680	<.0001
Avg%AdvDeg91-96	.244	.054	.233	4.531	<.0001
Avg%AP91-96	.208	.046	.185	4.570	<.0001
Avg3+AP91-96	.076	.020	.162	3.850	.0002
Avg%9-12Abs<=1091-96	.159	.044	.141	3.581	.0005
AfrAm%	-.126	.021	-.225	-5.905	<.0001
K6p/t	-.504	.220	-.083	-2.290	.0238

Appendix, Part III: School Division Data

The research for this report involved the analysis of dozens of variables, and the last three pages of this Appendix contain school division data used in the regression models. In most cases, the data value is the average value for the school division over the six-year period from 1991 to 1996. The few exceptions generally reflect a lack of a complete data series during that period, in which case averages were taken for those years in which data were available.

Prior to the use of the data in an earlier study, a four-page data sheet containing six years' worth of data for nearly 100 items was mailed to all school divisions. Each division superintendent was asked to have someone verify the accuracy and the data and respond if corrections were needed. Several school divisions responded with letters, faxes, and phone calls, and those corrections were made in the database used for this study. Nevertheless, it is certainly possible that some errors remain, and one of the purposes of this part of the Appendix is to enable readers from each school division to identify data errors so that the regression models can be given "mid-course" corrections if necessary.

Here are the meanings of the abbreviated data names used in the tables in this part of the appendix, the pages where they can be found, and the source of the data.[1]

abbreviation (page)	meaning (source)
Rem (29)	pct. of first-year students at VA public institutions taking remedial courses (SCHEV)
BPC (29)	pct. of graduates "bound and prepared for college" (*SAR*, *SCHEV*, *NCES*)
11>75 (29)	pct. of 11th graders scoring above 75th percentile on TAP (*OAP*)
MDeg (29)	pct. of teachers with master's degrees (*SAR*)
HSD (30)	pct. of adults in the county or city with high school diplomas (*USC*)
BlAm (30)	pct. of Black Americans in the county or city population (*USC*)
Att (30)	pct. of students in grades 9-12 absent no more than 10 days (*OAP*)
P/T (30)	pupil-teacher ratio in grades K-6 (*SAR*)
AdvD (31)	pct. of graduates with the advanced studies diploma (*OAP*)
AP (31)	pct. of students taking at least one advanced placement course (*OAP*)
AP3 (31)	pct. of students "passing" (scoring a 3 or better) on a national AP exam (*OAP*)

The purpose of these tables is to enable the reader to get a "feel" for the numbers associated with specific school divisions of interest and to do so easily. For that reason, the data entries are rounded. During the actual regression analysis, unrounded data were used to take advantage of greater precision.

[1] *OAP*: DOE's Outcome Accountability Project, 1991-96; *SAR*: DOE's Superintendent's Annual Report, 1991-96; *SCHEV*: SCHEV's Academic Performance Characteristics, 1991-96; *NCES*: National Center for Education Statistics, 1994-96; *USC*: U.S. Census for 1990, with updated estimates for 1996.

Division	Rem	BPC	11>75	MDeg	Division	Rem	BPC	11>75	MDeg	Division	Rem	BPC	11>75	MDeg
Accomack	35	34	17	27	Franklin	17	45	29	34	Nottoway	37	36	17	37
Albemarle	18	55	43	42	Franklin City	19	57	27	38	Orange	27	35	25	20
Alexandria	28	46	31	38	Frederick	18	47	32	21	Page	21	26	20	19
Alleghany	35	40	27	40	Fredericksburg	21	51	46	28	Patrick	23	36	26	35
Amelia	32	29	19	20	Galax	22	46	24	33	Petersburg	43	33	16	31
Amherst	21	39	24	35	Giles	33	35	20	36	Pittsylvania	35	35	18	44
Appomattox	16	43	27	33	Gloucester	23	44	30	28	Poquoson	20	54	46	38
Arlington	25	55	41	39	Goochland	29	40	24	34	Portsmouth	46	34	19	33
Augusta	22	38	30	29	Grayson	31	36	21	24	Powhatan	27	38	32	22
Bath	23	40	33	29	Greene	28	38	29	25	Prince Edward	35	37	20	31
Bedford City	.	.	.	.	Greensville	49	26	12	33	Prince George	29	39	36	36
Bedford County	16	48	28	32	Halifax	27	37	20	39	Prince William	19	55	40	42
Bland	28	40	26	20	Hampton	29	45	25	35	Pulaski	30	43	28	42
Botetourt	18	47	32	36	Hanover	25	52	39	31	Radford	24	57	46	45
Bristol	22	45	30	35	Harrisonburg	17	46	40	38	Rappahannock	10	45	27	20
Brunswick	38	30	13	29	Henrico	24	49	40	34	Richmond County	26	45	31	18
Buchanan	24	44	14	34	Henry	29	37	22	40	Richmond City	42	38	18	38
Buckingham	25	36	16	32	Highland	26	38	28	20	Roanoke County	16	58	41	43
Buena Vista	22	45	21	46	Hopewell	37	35	23	30	Roanoke City	26	44	26	40
Campbell	16	51	28	33	Isle of Wight	33	33	22	25	Rockbridge	28	41	30	26
Caroline	26	27	18	25	James City	.	.	.	.	Rockingham	21	35	29	29
Carroll	30	33	17	33	King and Queen	42	26	8	19	Russell	25	45	20	38
Charles City	44	24	8	25	King George	18	44	34	21	Salem	19	54	42	32
Charlotte	35	33	19	29	King William	31	32	21	21	Scott	33	37	24	30
Charlottesville	27	47	39	48	Lancaster	29	41	20	21	Shenandoah	20	40	28	26
Chesapeake	34	43	28	38	Lee	42	33	17	29	Smyth	28	40	20	36
Chesterfield	23	50	40	24	Lexington	.	.	.	28	South Boston	.	.	.	.
Clarke	18	49	33	25	Loudoun	20	53	44	31	Southampton	34	40	17	29
Clifton Forge	.	.	.	.	Louisa	33	32	22	24	Spotsylvania	22	38	30	18
Colonial Beach	28	35	22	13	Lunenburg	33	36	23	34	Stafford	18	52	38	24
Colonial Heights	26	48	44	31	Lynchburg	16	54	32	46	Staunton	18	52	36	33
Covington	22	40	23	33	Madison	26	33	27	26	Suffolk	42	23	17	23
Craig	9	47	20	33	Manassas	17	56	38	33	Surry	42	31	16	41
Culpeper	25	34	27	31	Manassas Park	39	31	21	16	Sussex	48	30	9	50
Cumberland	27	34	20	19	Martinsville	26	42	31	50	Tazewell	21	49	23	28
Danville	32	47	25	38	Mathews	30	36	26	38	Virginia Beach	28	48	36	36
Dickenson	38	30	17	29	Mecklenburg	35	36	16	27	Warren	22	44	27	30
Dinwiddie	35	28	22	29	Middlesex	29	42	30	14	Washington	22	45	25	39
Emporia	.	.	.	.	Montgomery	21	51	35	43	Waynesboro	14	45	34	34
Essex	30	32	22	21	Nelson	23	35	24	25	West Point	23	53	47	26
Fairfax County	14	63	52	35	New Kent	35	36	29	21	Westmoreland	31	32	19	22
Fairfax City	.	.	.	.	Newport News	25	50	30	32	Williamsburg	17	41	37	26
Falls Church	15	70	61	52	Norfolk	40	37	23	30	Winchester	21	52	44	42
Fauquier	20	47	36	22	Northampton	31	40	17	34	Wise	35	37	23	44
Floyd	18	34	24	24	Northumberlan	25	40	26	34	Wythe	34	37	19	40
Fluvanna	27	31	22	27	Norton	26	44	28	32	York	18	58	45	30

Division	HSD	BlAm	Att	P/T	Division	HSD	BlAm	Att	P/T	Division	HSD	BlAm	Att	P/T
Accomack	60	34	52	21	Franklin	60	11	55	18	Nottoway	53	42	72	19
Albemarle	82	10	73	18	Franklin City	62	54	74	20	Orange	66	14	56	16
Alexandria	87	22	74	16	Frederick	70	2	61	18	Page	55	2	54	18
Alleghany	68	3	72	17	Fredericksburg	74	22	58	17	Patrick	54	7	56	19
Amelia	56	32	64	20	Galax	56	6	69	20	Petersburg	63	73	44	22
Amherst	59	20	57	20	Giles	64	2	80	21	Pittsylvania	56	27	54	19
Appomattox	61	23	60	21	Gloucester	74	11	82	19	Poquoson	84	1	70	19
Arlington	88	10	61	17	Goochland	67	29	56	17	Portsmouth	67	48	52	22
Augusta	69	4	59	19	Grayson	51	3	64	19	Powhatan	66	22	69	20
Bath	67	6	68	14	Greene	64	6	54	19	Prince Edward	61	36	56	21
Bedford City	60	23	.	.	Greensville	52	57	53	20	Prince George	78	29	83	21
Bedford County	69	8	72	18	Halifax	52	39	51	19	Prince William	88	12	58	22
Bland	63	4	72	18	Hampton	80	40	64	21	Pulaski	60	6	63	21
Botetourt	73	5	68	22	Hanover	77	10	71	20	Radford	76	6	76	18
Bristol	61	6	62	17	Harrisonburg	77	7	61	18	Rappahannock	67	7	51	18
Brunswick	51	59	59	20	Henrico	82	21	69	19	Richmond County	57	31	65	20
Buchanan	42	1	50	17	Henry	54	24	62	20	Richmond City	68	56	42	21
Buckingham	54	41	54	21	Highland	62	0	67	17	Roanoke County	79	3	73	18
Buena Vista	56	5	68	17	Hopewell	67	27	56	18	Roanoke City	68	25	48	18
Campbell	66	15	62	19	Isle of Wight	66	31	62	20	Rockbridge	62	3	66	18
Caroline	59	37	52	20	James City	83	18	.	.	Rockingham	65	2	74	18
Carroll	50	0	59	19	King and Queen	58	42	50	15	Russell	51	1	52	18
Charles City	56	62	63	19	King George	73	20	50	18	Salem	76	5	68	18
Charlotte	52	37	55	19	King William	68	30	66	19	Scott	51	1	62	19
Charlottesville	76	22	53	16	Lancaster	65	30	57	19	Shenandoah	65	1	67	20
Chesapeake	77	28	66	21	Lee	48	0	63	20	Smyth	53	2	64	19
Chesterfield	87	7	70	21	Lexington	73	12	.	15	South Boston	60	37	.	19
Clarke	75	9	64	19	Loudoun	87	7	66	19	Southampton	58	45	65	18
Clifton Forge	69	15	.	.	Louisa	60	25	65	18	Spotsylvania	77	11	56	20
Colonial Beach	65	13	66	17	Lunenburg	52	38	55	21	Stafford	81	7	62	19
Colonial Heights	78	1	72	17	Lynchburg	70	27	59	21	Staunton	71	13	57	18
Covington	65	14	71	14	Madison	63	14	66	19	Suffolk	64	44	51	20
Craig	68	0	66	19	Manassas	84	10	67	19	Surry	58	55	54	19
Culpeper	67	17	55	19	Manassas Park	70	7	56	20	Sussex	54	58	49	21
Cumberland	61	21	49	18	Martinsville	63	38	62	17	Tazewell	57	3	56	22
Danville	57	38	56	18	Mathews	70	14	65	20	Virginia Beach	88	14	63	20
Dickenson	47	0	51	18	Mecklenburg	58	39	56	18	Warren	65	5	50	20
Dinwiddie	59	36	65	18	Middlesex	67	24	65	18	Washington	60	1	57	21
Emporia	58	46	.	.	Montgomery	74	4	70	19	Waynesboro	71	10	60	16
Essex	65	38	62	20	Nelson	57	18	60	18	West Point	74	19	78	16
Fairfax County	91	8	75	19	New Kent	73	20	69	20	Westmoreland	59	33	55	20
Fairfax City	87	5	.	.	Newport News	80	34	52	19	Williamsburg	84	16	62	19
Falls Church	91	3	75	17	Norfolk	73	40	44	20	Winchester	69	10	72	15
Fauquier	79	11	63	18	Northampton	57	46	57	19	Wise	52	2	67	20
Floyd	60	2	70	18	Northumberlan	64	29	70	21	Wythe	62	4	56	20
Fluvanna	68	23	58	18	Norton	54	7	64	19	York	88	16	80	20

Division	AdvD	AP	AP3	Division	AdvD	AP	AP3	Division	AdvD	AP	AP3
Accomack	26	10	21	Franklin	39	12	28	Nottoway	31	18	0
Albemarle	50	19	64	Franklin City	49	30	12	Orange	33	16	52
Alexandria	38	31	62	Frederick	41	14	32	Page	24	13	20
Alleghany	29	16	8	Fredericksburg	47	26	63	Patrick	30	22	11
Amelia	34	7	25	Galax	38	30	.	Petersburg	39	6	33
Amherst	40	24	23	Giles	31	11	5	Pittsylvania	38	28	14
Appomattox	45	8	.	Gloucester	40	11	38	Poquoson	49	28	44
Arlington	52	33	37	Goochland	30	16	25	Portsmouth	32	12	31
Augusta	41	19	48	Grayson	35	14	0	Powhatan	39	12	51
Bath	38	24	15	Greene	33	10	28	Prince Edward	35	22	15
Bedford City	.	.	.	Greensville	25	22	17	Prince George	36	6	94
Bedford County	44	16	24	Halifax	24	25	46	Prince William	51	29	38
Bland	27	17	0	Hampton	35	16	15	Pulaski	35	21	14
Botetourt	30	23	38	Hanover	52	24	40	Radford	45	23	30
Bristol	39	18	22	Harrisonburg	55	19	82	Rappahannock	43	27	38
Brunswick	23	11	7	Henrico	48	20	38	Richmond County	32	9	14
Buchanan	22	11	17	Henry	34	20	25	Richmond City	49	15	20
Buckingham	29	18	0	Highland	42	15	15	Roanoke County	48	22	29
Buena Vista	31	30	.	Hopewell	30	16	16	Roanoke City	29	22	27
Campbell	46	16	24	Isle of Wight	33	15	44	Rockbridge	30	17	19
Caroline	27	9	44	James City	.	.	.	Rockingham	33	14	28
Carroll	39	16	28	King and Queen	37	19	.	Russell	22	10	23
Charles City	28	6	0	King George	46	23	37	Salem	47	30	63
Charlotte	36	44	0	King William	35	12	21	Scott	35	22	10
Charlottesville	51	21	75	Lancaster	36	17	11	Shenandoah	38	18	34
Chesapeake	45	14	48	Lee	30	12	0	Smyth	30	9	37
Chesterfield	58	15	53	Lexington	.	.	.	South Boston	.	.	.
Clarke	43	17	26	Loudoun	47	21	73	Southampton	31	5	30
Clifton Forge	.	.	.	Louisa	38	5	40	Spotsylvania	44	11	60
Colonial Beach	21	8	28	Lunenburg	33	13	44	Stafford	50	18	61
Colonial Heights	50	18	11	Lynchburg	48	24	61	Staunton	55	22	23
Covington	38	14	50	Madison	42	16	52	Suffolk	33	8	21
Craig	25	21	19	Manassas	53	15	42	Surry	44	10	22
Culpeper	24	13	30	Manassas Park	30	6	0	Sussex	47	8	4
Cumberland	38	20	0	Martinsville	37	13	64	Tazewell	32	16	17
Danville	44	14	56	Mathews	35	12	47	Virginia Beach	47	18	62
Dickenson	26	12	7	Mecklenburg	34	13	6	Warren	31	17	27
Dinwiddie	30	5	47	Middlesex	30	21	0	Washington	35	17	24
Emporia	.	.	.	Montgomery	40	31	55	Waynesboro	43	20	56
Essex	35	27	34	Nelson	33	16	50	West Point	58	42	10
Fairfax County	65	43	44	New Kent	43	17	20	Westmoreland	39	11	.
Fairfax City	.	.	.	Newport News	39	16	40	Williamsburg	46	26	38
Falls Church	59	56	86	Norfolk	30	18	30	Winchester	40	27	23
Fauquier	41	15	36	Northampton	30	10	8	Wise	28	18	12
Floyd	36	8	.	Northumberlan	34	10	39	Wythe	34	29	9
Fluvanna	42	28	24	Norton	28	34	19	York	51	26	29

About the Author

I. David Wheat, Jr. is a strategic planning consultant retained by the Thomas Jefferson Institute for Public Policy to examine timely education policy issues. Previous reports include *Understanding Virginia's Report Card: Why Standardized Test Scores Vary from One Community to Another* (November 1997), *2000 New Teachers: Where Are They Needed Most?* (February 1998), *Car Tax Cuts: How Should Localities be Reimbursed?* (February 1998), *Raising Student Attendance: Some Low Cost Strategies* (March 1998), and *Local Perspective in a State Office: The Legislator's Dilemma* (March 1998).*

He is president of Wheat Resources Inc., a consulting firm established in 1981 that specializes in helping both private and public sector clients organize and analyze data they use in making strategic decisions. He received his Master's Degree in Public Policy from Harvard University's Kennedy School of Government in 1972, and then served three years as a White House staff assistant specializing in economic and energy issues. Later, at the University of Houston, he served as Director of Federal Relations and taught a graduate course on public policy implementation.

His education policy consulting work is enhanced by several years of nationally recognized classroom instruction experience in Virginia public schools, as well as by service on the Governor's Commission on Champion Schools, where he participated in the upgrading of the history and social science Standards of Learning for Virginia's students. He also teaches political science at Virginia Western Community College.

*Copies are available from the Jefferson Institute for Public Policy (voice: 703-440-9447; fax: 703-455-1531) or from the author (voice: 540-966-5939; fax: 540-966-5167). In addition, downloadable versions are available at the **www.wheatresources.com** web site.

"... a wise and frugal government, which shall restrain men from injuring one another, shall leave them otherwise free to regulate their own pursuits of industry and improvement, and shall not take from the mouth of labor the bread it has earned. This is the sum of good government, and this is necessary to close the circle of our felicities."

Thomas Jefferson

1801

Thomas Jefferson Institute for Public Policy
9035 Golden Sunset Lane
Springfield, Virginia 22153