DOCUMENT RESUME

ED 453 237 TM 032 588

AUTHOR Nuttall, Ronald; Hell, Regina Jean-Van
TITLE Poverty, Courses Taken and MCAS Test Scores in Mathematics and Science.
PUB DATE 2001-04-14
NOTE 40p.; Paper presented at the Annual Meeting of the American Educational Research Association (Seattle, WA, April 10-14, 2001).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Achievement Tests; Black Students; *Course Selection (Students); *High School Students; High Schools; *Mathematics Achievement; *Science Achievement; *Scores; Sex Differences; Socioeconomic Status; State Programs; Test Results; Testing Programs
IDENTIFIERS African Americans; *Massachusetts Comprehensive Assessment System

ABSTRACT

The aim of this study was to look at the Massachusetts Comprehensive Assessment System (MCAS) data for 10th graders from 1998 and investigate whether these differences were significant when using the mathematics and science achievement scores. In addition, the variables of socioeconomic status, gender, and types of courses taken in mathematics and science were used in the analyses. Three hypotheses were tested. One was that the differences between African Americans and Whites in mathematics and science scores are related to types of courses taken previously. It was also expected that males would have higher mathematics scores than females and that students with low income would be more likely to have low test scores in science and mathematics. The regression analyses demonstrated that previous courses taken in mathematics and science were strong predictors of MCAS achievement scores. The other predictors, race, socioeconomic status, and gender, explained very little of the variance in achievement scores in mathematics and science. These results have strong implications for public policy issues in Massachusetts. (Contains 4 figures and 34 references.) (Author/SLD)

Poverty, Courses Taken and MCAS Test Scores in Mathematics and Science

Ronald Nuttall Ph.D.

ronald.nuttall@bc.edu

And

Regina Jean-Van Hell Ph.D.

jeanvanh@earthlink.net

Boston College

Presented

American Educational Research Association

April 2001 Seattle, Washington.

Abstract

Black and white test scores differences is a topic that has been widely debated. The aim of this study was to look at the Massachusetts Comprehensive Assessment System (MCAS) data of 10th graders from 1998 and investigate if these differences were significant when using Mathematics and Science achievement scores. In addition, variables of socioeconomic status, gender and types of courses taken in mathematics and science were used in the analyses. Three Hypotheses were tested. One is that the differences between African-Americans and whites in math and science scores are related to types of courses taken previously. Second, it was expected that males would have higher math scores than females. And third, it was expected that students with low income would be more likely to have low test scores in science and mathematics. The regression analyses demonstrated that previous courses taken in math (R^2= .35) and science (R^2=.27) were strong predictors in achievement scores obtained in the MCAS. Other predictors, race, socioeconomic status and gender explained very little of the variance in achievement scores in math and science. These results have strong implications for public policy issues in Massachusetts.

Poverty and Achievement

In the sixties and seventies, discussions were centered on inner cities schools and the blame for the educational failure of urban youths was due to the economic backgrounds of these youths (Berube, 1984). In the sixties Jerome Bruner, a Harvard psychologist, view was that all children were educable. In the mid-sixties, the focus of the civil right group was to educate the urban poor and a reform movement for the public schools began. Among the critics that pressed for school reform was Jonathan Kozol whose point of view was that the public schools were to be blamed for student low achievement rather than the student's lack of sufficient economic background.

At the other end of the spectrum, James Coleman did his extensive study of Equality of Educational Opportunity in 1966. The Coleman Report concluded that the family background was the chief determinant of educational achievement and that schools and their resources were found to have little effect. Moreover, the concept of social background as an important factor for academic achievement was strongly supported by Edward Banfield, a Harvard political scientist, in his publication "The Unheavenly City" in 1970. In Banfield's publication he stated that most social problems depend of changing peoples psychology or culture of poverty; which he believed the government was incapable of doing.

The pendulum has swung from one side to the other; social scientists have taken opposite positions based on the latest research that supports their views. A study that brought a contrary view to Coleman's Report was Michael Rutter's work of London schools. This study concluded that schools could make a difference regardless of a pupil's socioeconomic background because some

schools were more successful than others. Rutter's longitudinal study looked beyond students' academic achievement rather he was interested in student's behaviors, teachers' behaviors and school policy. The major conclusion of this study was that the difference in school outcomes is dependent on the underlying ethos of the school regardless of the students' socioeconomic background (Berube, 1984). Moreover, this study claimed successful schools have educationally sound strategies, high teacher expectations of student achievement and behavior, and provide a pleasant climate. Other research has supported Rutters findings among them are Wilbur Brookover, from Michigan State University, and James Comer's from Yale University (Berube, 1984). These studies, the Brookover and Comer's investigated effective inner city schools and found out that successful schools have common characteristics similar to those pointed out by Rutter. Critics of effective schools argue that none of the studies established a direct causal link between the variables that were associated with effective schools and the success of those schools. In addition, critics of effective schools argue that this research is far from conclusive.

The debate between these two positions, those who support low socioeconomic background influencing academic achievement, and those who believe that socioeconomic background is not a factor of academic success rather it is ineffective schools that are to blame for the academic failure of its students; has not ended. It is a heated debate that has serious consequences regarding educational public policy and economic implications for the future of this nation. In a recent publication from Garibaldi (1997) he discusses there has been an increase in resegregation of many of the nation's public schools and most schools attended by minorities are located in urban areas. Moreover, he refers to the July

1996 report from the U.S. Department of Education "Urban Schools: The Challenge of Location and Poverty" which examined the characteristics of urban, rural, and suburban public schools in the 1980's. In this study (Garibaldi, 1997), the level of poverty in each school was determined by the percentage of students who received free or reduced-priced lunches. This study found that factors of school location and the level of poverty of students in a school directly and indirectly affected school performance. Sixty nine percent of students who attended high poverty urban public schools were minorities (Garibaldi, 1997). Thus, most minority students attended urban schools in the 1980's and these urban schools also had the highest concentrations of students from families with low socioeconomic backgrounds. In the 1996 Department of Education study, the level of school poverty was an important variable when examining student's academic achievement. The data revealed that students who had the lowest levels of achievement on standardized tests were more often enrolled at high poverty schools, while students who performed at higher achievement levels typically attended schools with lower level of poverty (Garibaldi, 1997).

Research on school failure has used demographic variables, such as poverty, ethnicity, family configuration, parental education, and level of English proficiency to distinguish between students who have at-risk of low achievement and those who are not (Worrell, 1997). Worrell (1997) discussing the at-risk literature has identified many characteristics associated with school failure, including academic, behavioral, socio-emotional, familial demographic and school. However, in his study examining the efficacy of demographic variables to distinguish between at-risk students who dropped out and at risk students who graduated, he found that the two groups were very similar in profile from

each other. The only differences were on self-reported risks and on mobility in middle schools that was as strong a predictor for dropout status as grade point average.

Although demographic variables have been associated with underachievement of students, school location is also an important determinant in assessing the educational quality, especially for students who attend schools where there are high concentrations of poor and minority students (Garibaldi, 1997). According to the U.S. Department of Education (1992), the availability of gifted and talented programs at schools in different locations is another important factor determining the strength and quality of school curricula. Schools having higher concentrations of poor students and urban schools were less likely to offer gifted and talented programs as well as availability of advance courses (Garibaldi, 1997).

Garibaldi (1997) reviewed a study of the 1990 National Assessment of educational Progress (NAEP) administration focusing on percentages of students who had taken a course in geometry because the patterns for those students were similar to those for students who had taken science, foreign language and other advanced courses. Sixty-eight percent of the 1990 graduates of the nations' public schools were found to have taken a geometry course at the secondary level. At the suburban schools seventy-three percent of students had taken geometry, compared with fifty seven percent of the urban students, a sixty- percent of students who attended high-poverty schools had taken geometry, compared to nearly 74 percent of students in low-poverty schools. But when the study controlled for the level of poverty, no statistical difference was found among urban, rural, or suburban students who has enrolled in a geometry course.

As Garibaldi discusses, this suggests that to raise the educational achievement of all students with advance placement and college preparatory courses such as algebra and geometry, biology, chemistry, three years of English and other core subjects must be offered even though students choose not to attend four-year colleges or universities.

To conclude, from the literature reviewed, demographic variables as well as school location and quality of education that include advanced courses, gifted and talented programs are factors that influence the achievement of students. The question is what can be done to improve the education of students that are affected by these variables. As Balfanz (2000) discusses urban educational policy and practice over the last thirty years have been focused to provide an answer to why students who attend urban public schools achieve so little. Many theorists have attempted to explain why so many poor and minorities fall 2 to 5 years behind national averages (Balfanz, 2000). The reform attempts have tried desegregation plans, federal compulsory education strategies and court ordered remedies to finance suits and exceptional systems have been used. Moreover, other proposed reforms have been school choice, privatization plans, site-based management, school restructuring and attempts to implement cultural relevant curricula and instruction. Yet, none of these reform plans have provided results.

Mathematics and science achievement of poor students

Mathematics and science achievement among poor students and racial/ethnic minorities has been traditionally fluctuating from declines, to relative stability followed by improved performance (Garibaldi, 1997). Trends reported by the National Assessment of Educational Progress (NAEP) mathematics scale scores for 1973 to 1996 have shown that 17-year-old White and Black students had declining scores between 1973 and 1978, both increased their performance between 1978 and 1996. Nevertheless, the scores of White students are at least 25 points higher than those of their Black counterparts (Garibaldi, 1997).

The trends in NAEP science scale scores from 1969 to 1996 showed between 1969 and 1982, that the average science test scores for 17-year-old Black and White students decreased; however, those scores steadily increased from 1982 through 1996. Although scores increased for both groups, the average score for white students has been maintained from 1969 to 1996 of 47 points higher than those of Black students (Garibaldi, 1997). Thus, mathematics and science achievement among Blacks has not reached the achievement levels of White students.

Cole and Griffin (1987) discuss in their research of improving science and mathematics for minorities and women, that schools with large populations of minority students are usually located in communities with small tax bases, or in large urban areas with declining fiscal resources. These fiscal limitations make it difficult for these schools to keep up with educational innovations, not only in terms of equipment and supplies, but also in terms of attracting new staff. Also these schools are not able to provide necessary training to keep existing staff

informed of the latest developments in educational research and technology (Cole & Griffin, 1987). Besides economic pressures, administrators and teachers in these districts, with large minority populations, are often under considerable pressure to reduce the dropout rates and to increase achievement test scores (Cole & Griffin, 1987). Consequently, the education of minority students is focused on emphasizing the basics.

Cole and Griffin (1987) argue that by increasing resources of these schools, opportunities could increase to participate in higher-level activities that are needed to excel in mathematics and science rather than just drilling the basics. Moreover, these authors argue that tracking and ability grouping is often associated with income and socioeconomic status. Students with low-income, one-parent households or with an unemployed worker are more likely to be assigned to low-ability groups. In many instances, Cole and Griffin (1987) discuss, children with low grades or test scores from middle-income families or higher income families can be tracked to higher-level courses because of parental intervention. Group placement has been shown to be stable over time. Once in a low group, it is hard to get out and be placed on a higher level. These authors looked at ability grouping and their effects and they found that a range of studies documented consistently that ability grouping has a detrimental effect. Differences of instruction occur across high and low tracked students and minor differences in first grade become major differences in later grades (Cole & Griffin, 1987). In a review of ability groups, Persel meta-analytic review found that "there is a slight trend toward improving the ability of high ability groups but that is off set by substantial losses by the average and low groups." (1977, in Cole & Griffin, 1987, p.28).

A more recent study by Fenwick (1996) discusses how our educational system still views and treat many minority, poor, and female students as undeserving of quality math and science instruction. Moreover, she comments tracking affects negatively minorities and poor children by not getting quality instruction, or the quality curriculum which has been documented extensively by Oaks and Kozol. Fenwick used the National Center for Educational Statistics Report of 1994 and her work with the Georgia Initiative in Mathematics and Science (GIMS) and found that students identified as in poverty in urban districts, the majorities are poor, and Black or Hispanics while in suburbia, and rural districts students are white. She asked the question, in her study, if poor students received the same kind of curricula offerings as students of other incomes.

Fenwick found the data did not show any substandard school. This was not surprising. However, school districts set curriculum and standards that are the same for all students. But she found poor students were more likely to be taught by inexperienced teachers or by teachers without certification or not certified to teach the subject they are teaching. Also, Fenwick (1996) found urban poor students are twice as likely to have a science teacher who is either without certification at all or not certified in science.

This pattern is consistent across three other subject matters, like math, English and social science. Another important finding from her study was that in urban and suburban schools where poor students attend, these students are taught by teachers who have negative attitudes toward students and are less likely to encourage students to do their best or to do homework. Thus, poor students are 67 percent of the time taught by teachers who do not encourage

them to do their best or to do homework. Moreover, Fenwick found that 71 percent of teachers in urban settings, teaching poor students, report negative attitudes about their students. Finally, Fenwick found poverty status of a student dictates the quality of instruction and the quality of teacher the student will encounter without taking into consideration the students' abilities and potentialities.

An extensive study done by Samuel S. Peng (1995) for the National Center for Education Statistics using the National Education Longitudinal Study 88 (NELS: 88) investigated why Blacks, Hispanics and American Indians have lower achievement test scores in science and mathematics than other students. The researcher used data on a number of home, school and student variables from the NELS 1988 eighth grade cohort. This study found at early ages all students have the same positive attitudes toward science and mathematics learning, in school and have similar aspirations for science and mathematics related careers, however, as students get older, more racial/ethnic students become unprepared to enter in these fields because they fall behind in math and science learning.

Another major finding was that a larger percentage of racial/ethnic students come from families in poverty which have less educational resources at home (books, computers), and their parents are more likely to have parents with low levels of education and more likely to be unemployed and less likely to provide adequate mentoring or role modeling for math and science learning. The third major finding of his study is that racial/ethnic students are more likely to attend disadvantaged schools, where the overall academic and supporting environments are less conducive to learning; and do not persist or demonstrate

effort or become active participants of the schools. Finally, these students are in low-track achievement groups (Peng, 1995). In sum, this extensive study summarizes the research reviewed previously and reconfirms that racial/ethnic students are more likely to come from poor income families and they attend schools with limited resources, weak curriculums, where teachers have low expectations. Consequently students under-perform in achievement test scores in mathematics and science and are less likely to pursue a career in these areas.

Research on Mathematics and Science Courses Taken in High School

Research on school achievement has shown that courses taken in reading, writing and mathematics enhance the performance of students (Jones et al., 1986). However, other studies suggest that the influence of schooling is not as important as other variables, for example socioeconomic status. In sum, a number of studies done in the 1980's demonstrated (Jones et al., 1986) a relation between mathematics skills and the number of mathematics courses taken in high school. A study of Schmidt, (1983) which analyzed data from the National Longitudinal Study (NLS) found a strong relationship between students' scores and the NLS mathematics test and the number of hours of mathematics instruction. The relationship was substantiated after adjusting for selected student background characteristics such as white versus other and SES. Similar findings have been reported with analyzing the data from 1977-1978 National Assessment of Education Progress (NAEP) in mathematics (Welch, in Jones, et al 1986).

The study of Jones et al. (1986) analyzed data from the 1980 high school cohort from High School and Beyond (HSB). The purpose was to find out the

influence of high school and mathematical and science courses on students' math and science knowledge and skills as assessed in their senior year. In addition, other variables were tested such as home environmental factors, general intelligence, high school skills displayed as sophomores, students information about courses taken, school transcripts and reports.

The results of Jones et al (1983) study revealed that in mathematics differences among high school seniors in the number of advanced courses taken in high school accounted for 53 percent of the variance of scores on the HSB's mathematics test given in the senior year. Second, less test variance was accounted for (48% of the total) when information about courses taken was obtained from high school transcripts rather than from the students' reports. Jones et al (1983) question the reliability of the transcripts in mathematics and the coding used of the high school transcripts into the data used by the HSB.

The results of the Jones' study regarding science courses demonstrated that there was a weaker relationship between test scores and courses taken in contrast to the strong relationship found in the mathematics. However, the results showed that courses taken based on students' reports or on transcripts accounted for 20% of the variance in test scores (compared to 53% for mathematics). Furthermore, when adjustment was made for SES, verbal score and science score two years earlier, less than 2% of the test score variance was accounted for by science courses taken in high school.

Jones et al. (1986) discuss the possibility of reasons for the differences in results in science and mathematics are due to the differences in length of the tests in mathematics and science plus the differences in instruction in science when compared to mathematics across the nation. In sum, research has found that

mathematics courses in high school have a relationship with test scores but the relationship between science courses and test scores in science is less strong.

Tracking

Tracking and ability grouping are common practices that have been widely discussed, criticized and debated. These two practices group students of similar achievement levels for instruction but they differ. Ability grouping is more widely used in elementary schools for grouping students of same reading level (Loveless, 1998). On the other hand, tracking is used in the middle and high schools to group students in courses offered which reflect differences in students' prior learning.

Tracking has been widely criticized because researchers have shown that it fails to benefit any students, that it channels poor and minority students into low tracks and dooms them into inferior education (Loveless, 1998). As loveless (1998) writes, research has indicated that when students are grouped into separate classes and given an identical curriculum, there is no appreciable effect on achievement. But, when the curriculum is adjusted to correspond to ability level, it appears that student achievement is boosted, especially in high ability students receiving an accelerated curriculum.

Heterogeneous grouping has not been widely adopted in middle and high schools, therefore, conclusions about whether it is better or not has been investigated. In the past, tracking was rigid however; today schools assign students to tracks based on their prior performance on particular subjects and proficiency. Moreover, most schools assign students based on their choices once

prerequisites have been met and transcript studies have demonstrated that students can move independently up or down in each subject's hierarchy of courses depending on their performance (Loveless, 1998).

It has been well established by research that low tracks often emphasize good behavior and menial tasks, while high tracks offer preparation to college. These differences in learning environments particularly undermine the academic achievement of the poor and minority students (Loveless, 1998). As Loveless (1998) discusses, Catholic high schools have provided low track students with quality education and have been able to boost low track students into higher levels.

Gender Differences in Mathematics and Science.

In 1992 the American Association of University Women published a book "How Schools Shortchange Girls." In this book one of the recommendations was that "girls must be educated and encouraged to understand that mathematics and sciences are important and relevant to their lives" (AAUW, 1992, p.86). In fact, in 1992 the researchers found that stereotypes of mathematics and sciences were seen as inappropriate for girls and women and classroom bias was apparent in these areas.

In a more recent publication from the American Association of University Women Education Foundation (1998), the researchers report girls' participation is improving in some academic areas where it previously lagged, particularly in math and science. However, the number of courses taken in a discipline does not tell the whole story; class by class comparisons show that girls are still less well represented in some higher levels courses in math, science and computer science

(AAUW, 1998). However, data from 1994 showed that girls are more likely than boys to end their high school math careers with algebra II. As the report discussed, the Council of Chief State School Officers and the 1994 High School Transcript Study found that males and females take comparable number of high school mathematics courses (AAUW, 1998). Moreover, the data demonstrated that both groups, males and females, averaged nearly 3.5 credits in math courses.

The picture of courses taken in science by high school girls is different. A greater percentage of female high school graduates took science courses in 1994 than in 1990 (AAUW, 1998). Girls are more likely than boys to take both biology and chemistry. Nevertheless, physics remains to be a male domain. Thus, in physics the gender gap still exists (AAUW, 1998)

Massachusetts Comprehensive Assessment System (MCAS)

The statewide assessment program serves two main purposes: 1) as a tool for measuring the performance of individual students and schools against established state standards; 2) to improve classroom instruction by providing useful feedback about quality of instruction and modeling effective assessment approaches that can be used in the classroom. MCAS was implemented in response to the Education Reform Law of 1993. The fundamental goal of the Education Reform in Massachusetts is to improve student's academic performance. The Massachusetts Curriculum Frameworks and the MCAS together create a statewide system designed to support students, parents, teachers, and schools by uniformly promoting high academic standards for all public school students in the Commonwealth. In May 1998, students in grades 4, 8 and 10 participated in the first annual administration of the MCAS tests in

English Language Arts, Mathematics and Science and Technology. The results from this initial administration of MCAS served as a baseline against which students and schools can measure their progress in achieving newly established state standards.

Massachusetts Curriculum Frameworks

The Massachusetts Education Reform Act of 1993 called for statewide Curriculum Frameworks and learning standards for all public school students. Prior to 1993 the only subjects specifically required by state law to be taught were history and physical education.

The Curriculum Frameworks are broad academic guidelines for teachers to use along with their local curricula. In combination, the frameworks and the MCAS, the required new statewide exam, would indicate student, school and district achievement in math science/technology, English, history/social studies and foreign languages.

The Mathematics Curriculum Frameworks started in March 1995 and passed through a chronology of development. The Board of Education received public comments on the drafts with the first draft having about 10,000 educators' comments. In sum, teachers, educators, administrators, businesses, students and higher education faculty scrutinized the Curriculum Frameworks for each subject. Thus, the state produced a mathematics Curriculum Frameworks "of high quality results driven and focus on world class standards"(doe.mass.edu,). The Curriculum Frameworks are considered "as a work in progress.... which will continue to be refined and strengthened" (doe.mass.edu). The purpose of the Curriculum frameworks is to be used by local communities to develop more

specific curriculum. However, the Department of Education will base the new student assessment (MCAS) on the frameworks. Information of the Curriculum Frameworks is available through the Internet by the Massachusetts Department of Education to the public.

The Mathematics Curriculum Framework was completed in January 1996. It is an extensive document that includes the guiding principles of the mathematics education, a guide for reflection and the content in Mathematics to be taught from PreK to 12th grade, with examples for class teaching as well as references for educators. . The mathematics curriculum contains the following strands; 1) number Sense, 2) Patterns, Relations and functions, 3) Geometry and measurement, 4) Statistics and Probability. The document provides a plan for implementation of a new curriculum for guiding teachers and administrators and student assessment. Moreover, the document includes instructional resources and materials, criteria for evaluating instructional materials, programs and references. In sum, it is an extensive and comprehensive document that covers many areas of instruction and evaluation.

The Science/Technology Curriculum Framework developed by the Massachusetts Department of education was created along the same criteria as the Mathematics Curriculum Framework. In the science and technology the content has the following four Strands recommended for PreK to 12 grade; 1) Inquiry, 2) Domains of Science with physical sciences, life sciences and earth sciences; 3) Technology; 4) Science technology and human affairs. This Science/Technology Curriculum is comprehensive and includes also guidelines for teachers and administrators to develop their own curriculum.

Brief history of the federal education policies that target students in poverty

Students who live in poverty are more likely than others to experience educational difficulties and are at risk for school failure. The federal government's role in education was minor until 1954, when Brown vs. Board of Education, Topeka, and other later judicial desegregation decisions had implications for educational policies (Mitchell, 2000). Historically, local governments had managed education and states were responsible to oversee policy objectives. It was not until 1965 that the federal government got involved to provide equal educational opportunities for disadvantaged students and poor minorities with the "Elementary and Secondary Education Act" (ESEA). Since then, the federal role in education has expanded. ESEA was created to focus attention on the educational needs of poor and minority students. Consequently, federal aid to education increased between 1960 and 1970 and the aim was to equalize opportunity (Mitchell, 2000). Thus, the federal government provided the resources and regulations and the designs and implementation was left to the states and local governments. ESEA and Title I programs had maintained and ensured that local educational agencies address the needs of disadvantaged students.

In 1983 with the publication of " A Nation at Risk," a report sponsored by the National Commission on Excellence in Education, the federal government began to pressure states to make voluntary reforms which included more rigorous course work, longer school days and increased teacher accountability (Mitchell, 2000; Murphy, 2001). Moreover, this report began a shift in the federal

focus from disadvantaged students to all students and moved education to the forefront of the national agenda. After ten years of state reform, President Clinton signed into law the Goals 2000: Educate America Act (Goals 2000) and ESEA was re-instituted (Mitchell, 2000). Under these new laws, for the first time, the federal government established a new framework for educational reform. The aim of this new legislation was voluntary and provided for local autonomy and had eight national goals. Also the states were encouraged to adopt standards of what students should know based on national models and to meet these standards.

After Goals 2000, the Clinton administration decided they had to establish a framework for federal support of elementary and secondary education (Mitchell, 2000). However, the administration viewed the reauthorization of ESEA as an opportunity to place many of the programs aimed to support poor and language minority children under the Goals 2000 umbrella and to restructure how federal money was distributed. However, there were several changes included such as change in curriculum and assessment, professional development, technical assistance and movement away from categorical programs which seek to improve the quality of education received by low-income and linguistically diverse students.

The standards based movement outlined in Goals 2000 and supported by ESEA has been criticized. Cookson (1995) argues standards based reform is not a proven theory and those high standards may not result in high performance for all students, regardless of their economic status. Other critics argue that the standards movement ignores intra and inter state disparities in financial resources, which place students in poor neighborhoods at a disadvantage (Sizer,

1995). Cookson (1995) argues the federal government is moving away from its original attempt to provide a safety net for economically disadvantaged and other under served students. In sum, the intent of the federal government in elementary and secondary education is to promote academic achievement for all students (Mitchell, 2000) and promoting equal educational opportunities is not a primary goal. How this change of focus will affect poor and minority students is not clear (Mitchell, 2000). Also Mitchell (2000) discusses the other goal of the federal government has changed from primary financial support to a major influence in the way schools operate and is a strong advocate for state-run systemic, standards-based reforms.

With the new provisions in Title I, all schools receiving funding are required to use the standards and assessments in measuring progress of students in Title I (Mitchell, 2000). As Mitchell discusses, this change could be beneficial for disadvantaged students because they will have access to a challenging curriculum and teachers and administrators will be accountable for their achievement. However, the down side of this could be that testing could hurt these students if they are not given enough support to meet those higher standards. Other, critics have predicted that testing will cause higher dropout rates (Murphy, 2001). As Mitchell summarizes, this new approach of the federal government will depend on how states and local government agencies deal with the challenging standards, assessments and accountability systems but also on how they focus on effective and appropriate professional development and the involvement of students' families and communities in the schooling process. As Mitchell (2000, p. 33) wrote "only through a comprehensive program approach can the needs of the poor and minority students be met."

Methodology

The data set used in this study was the May 1998 MCAS test from 10th graders in mathematics, and science. The mathematics MCAS test contains 39 items in mathematics and the science test has 38 items. In addition, the MCAS has a student questionnaire that includes items where students report the courses taken in mathematics and science as well as an item that describes the race of the student. The MCAS has information of the proportion of students that participate in free lunch. This data were used as a measure of socioeconomic status.

In order to find out which courses students had taken previously, the frequencies of the MCAS Student Questionnaire were analyzed. Analyses of variances were conducted in order to find out between group differences and within group differences with the following variables gender, free lunch and race. Then regression analyzes were conducted to investigate which of the independent variables: race, gender, and socioeconomic level as measured by free lunch and courses taken previously are best predictors of achievement test scores of math and science in the MCAS (dependent variables.)

Analyses

The data obtained from the MCAS was used to answer the following questions:

1) Are there differences between low socioeconomic and middle class socioeconomic student's achievement scores in math and science when types of courses take previously are taken into consideration?
2) Are there gender differences in math and science achievement scores?
3) Does race has an effect on achievement scores in math and science?

The frequencies of the Students' Questionnaires revealed that the total sample of 10th graders is 47,822. In tenth grade the percentage of students that had taken Algebra I or Integrated Math was 73.2%, those who had taken Geometry or Integrated Math II were 28% and those who had taken Algebra II or Integrated Math III were 11.3%. Only 1.5% had taken Trigonometry, Pre-calculus or Calculus. In science the picture is different, those who had taken integrated Science, Life Physical and Earth Science in 9th and 10th grade were 53% of students; those who had taken Biology in 9th and 10th grade were 31.7% and those who had taken Earth Science in 9th and 10th grade were 45.8%; only 4.3% had taken Physics in 9th and 10th grade. Finally, 9th and 10th graders that had taken chemistry were 4.%.

As shown on Table 1, the predictor variables as a group did a moderate job for explaining variation in the dependent variables. The regression results on mathematics achievement scores and the independent variables had an overall R^2= .48. Moreover, regression results demonstrated that the best predictor for math achievement scores in the MCAS were courses taken previously (R^2= .42), while race accounted for R^2= .11 and SES and sex combined accounted for R^2=.05.

As indicated in Table 1, Unique and Total variances were computed and the Common variances were obtained by subtraction.

In Table 1, the best predictor variables, as a group did a moderate job for explaining variation in the dependent variable in science achievement score. Thus the overall was R^2=.42 for science achievement score. Regression results indicated that courses taken previously in science accounted for .34 of the variance and that race accounted for .14 of the variance and SES and sex combined accounted for .06 of the variance. Unique and total variances were computed as shown in Table 1.

Table 1

Comparison of Unique, Common and Total R^2 for 10th Grade Math and Science MCAS Results for Courses, Race/Ethnicity and SES and Gender.

UNIQUE	Mathematics	Science
Courses	.3538	.2653
Race/Ethnicity	.0371	.0511
SES and Gender	.0035	.0084
TOTAL		
Courses	.4263	.3443
Race/Ethnicity	.1091	.1387
SES and Gender	.0507	.0715
COMMON		
Courses	.0725	.0790
Race/Ethnicity	.0720	.0876
SES and Gender	.0472	.0631
R^2 TOTAL	.4781	.4235

Figure 1: Unique Variance for 10th Grade Math MCAS Results for Courses, Race a and SES and Gender.

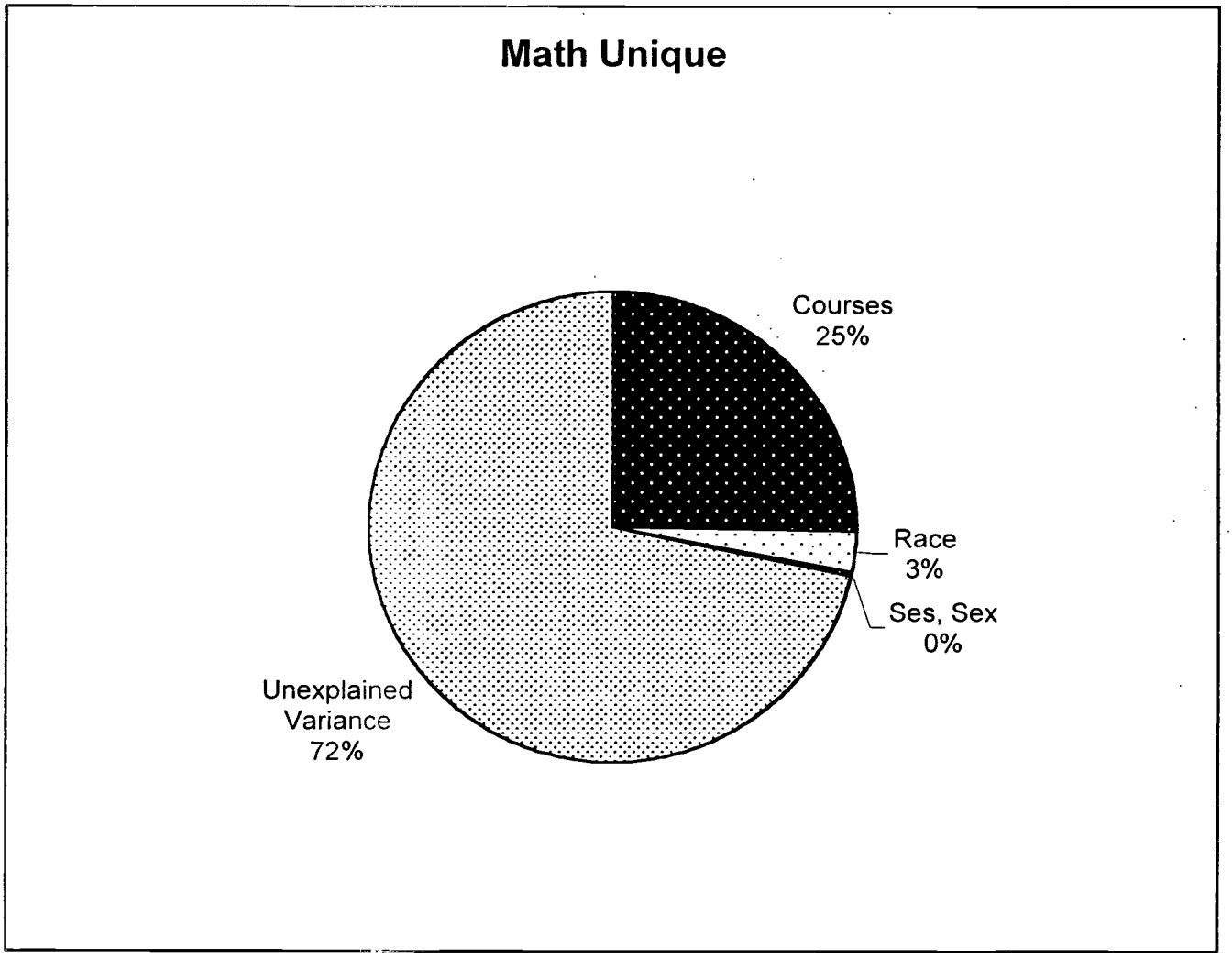


Figure 2: Total Variance for 10th Grade Math MCAS Results for Courses, Race, SES and Gender.

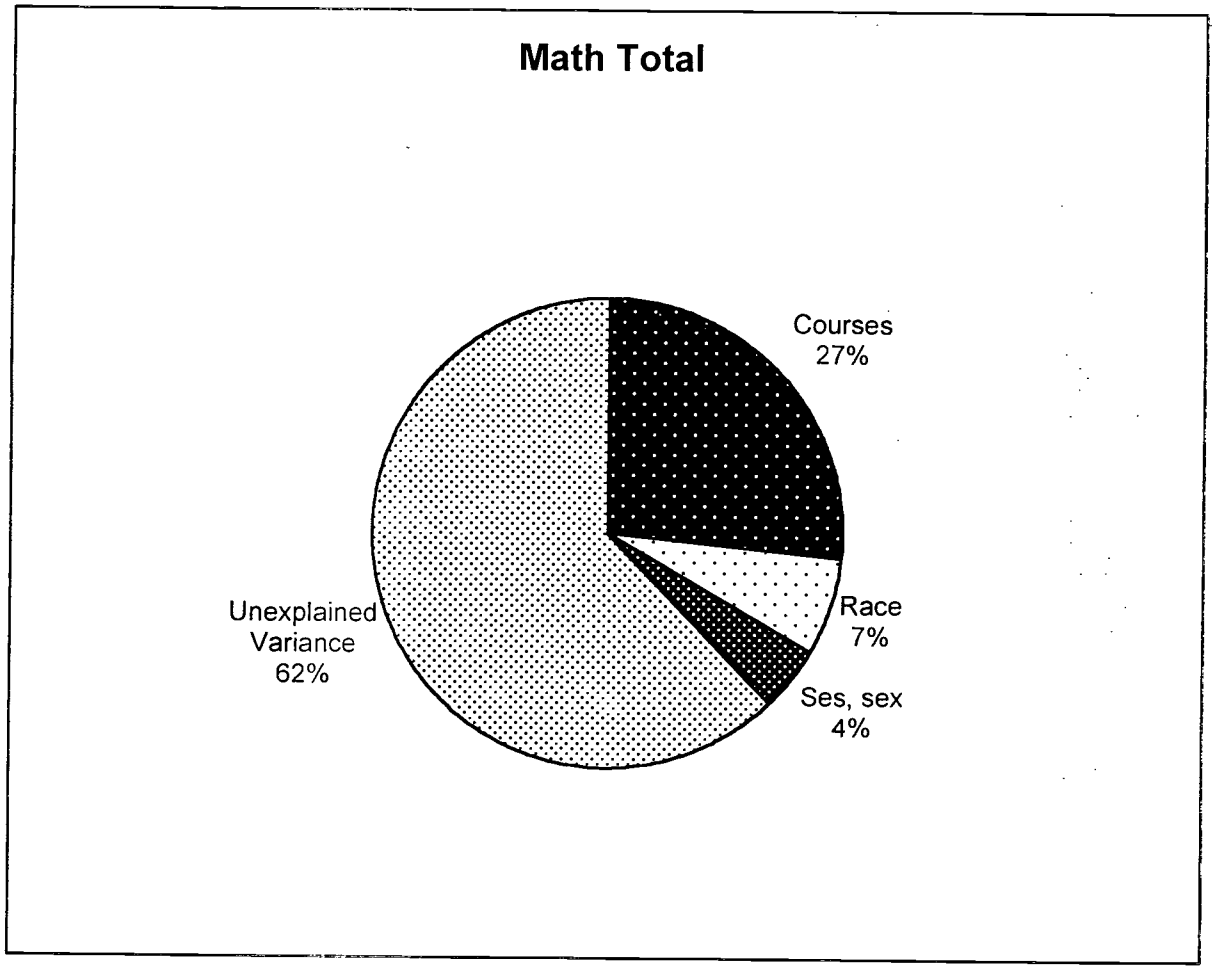


Figure 3: Unique Variance for 10th Grade Science MCAS Results for Courses, Race, SES and Gender.

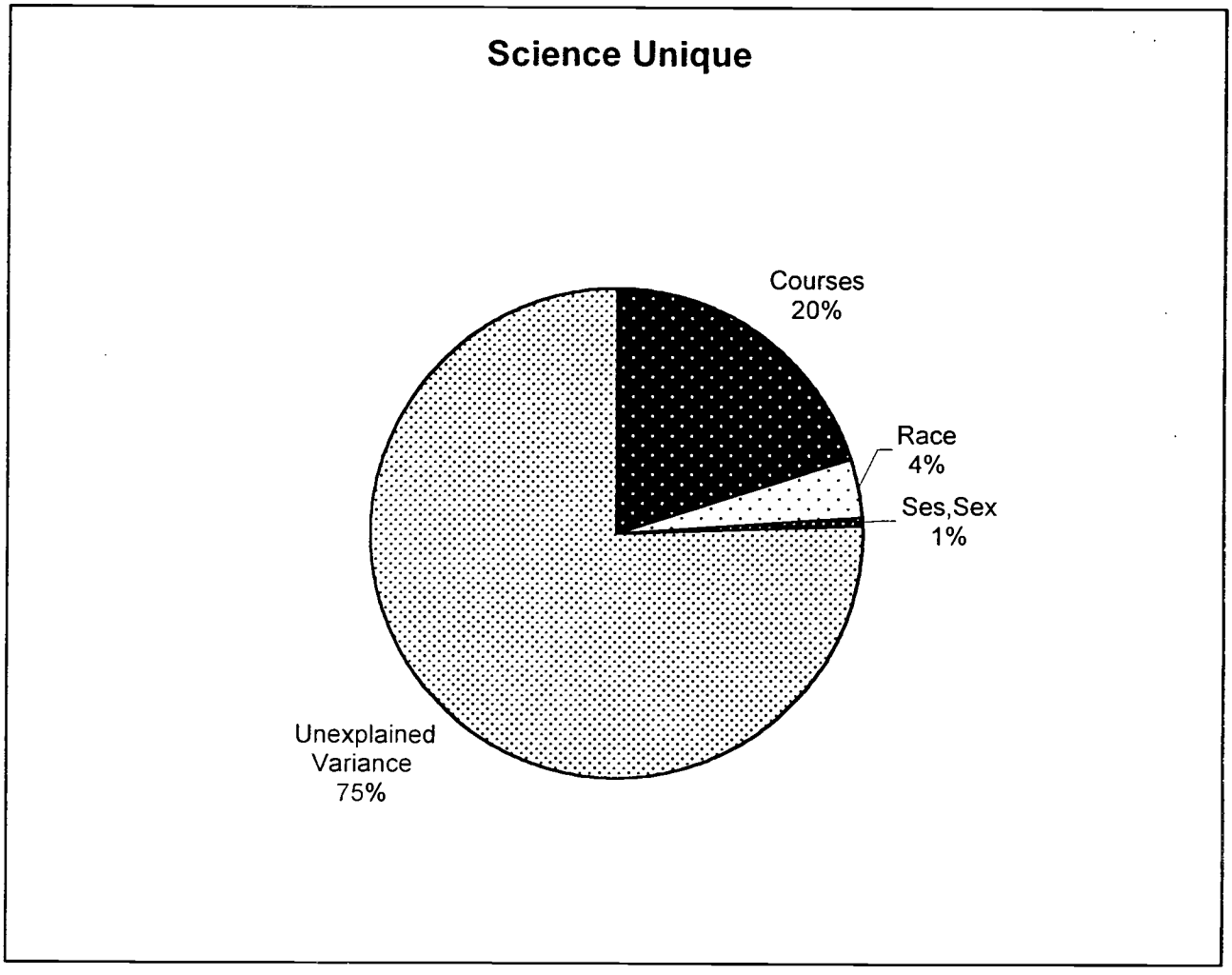
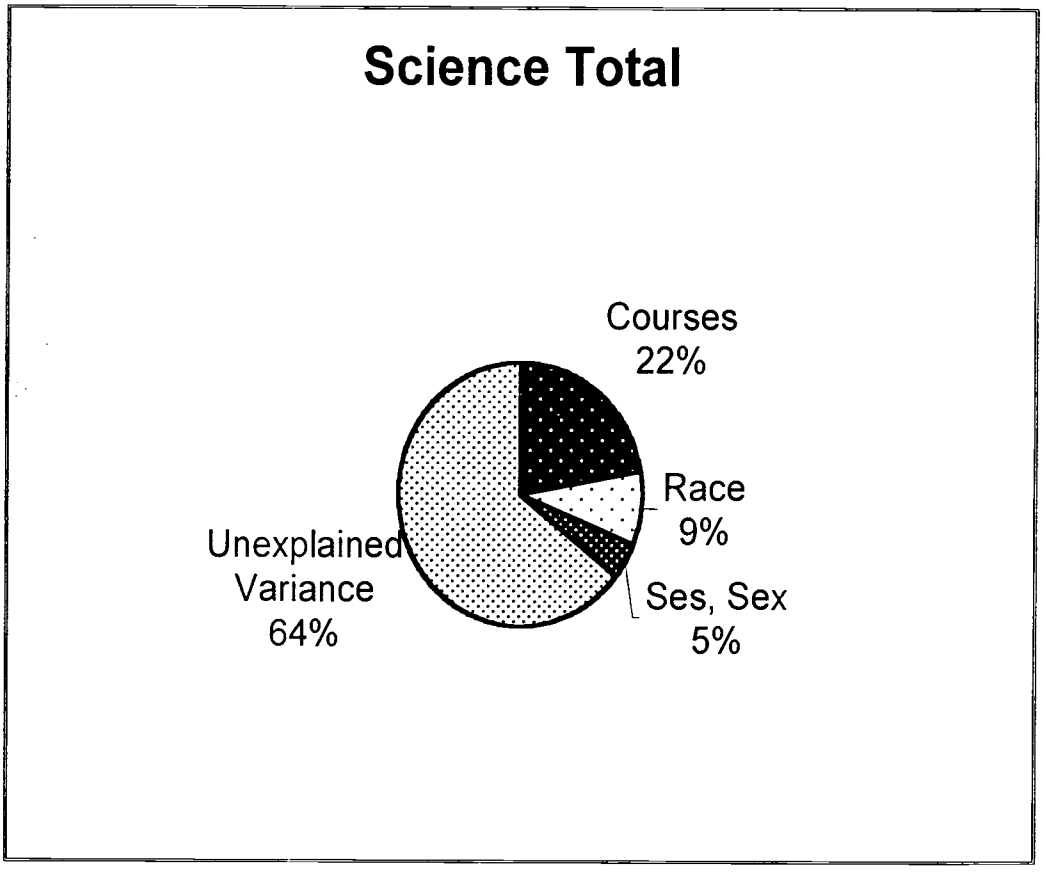


Figure 4: Total Variance for 10th Grade Science MCAS Results for Courses, Race, SES and Gender



As the figures above show the variance explained in both math and science by courses taken previously predict a moderate amount of variance in scores obtained in these two subjects. As some researchers have discussed, income does not have a strong influence in achievement scores obtained in MCAS scores in both mathematics and science

Thus, hypothesis one—are there differences between low income students achievement scores in math and science when types of courses are taken previously are taken into consideration? The results showed that in math when taken into consideration type of courses taken previously, this accounts for more of the variability than low income. Consequently, low income only contributes to a very small part of the variability in achievement test scores. The same can be said for science achievement scores although in this case courses taken previously account for less variability as compared with math. Moreover, the results in this study contradict those who claim low income is a strong predictor of test scores.

Hypothesis two, in this study investigated gender differences in math and science achievement scores; found that gender differences only contribute to a small amount of variance on achievement test scores in both mathematics and science.

Finally, the third hypothesis tested in this study which tested if race has an effect on mathematics and science achievement scores; found that race contribute only a small proportion of the variance in both , math and science achievement scores.

Discussion and Public Policy

The results of this study showed that low income does not contribute, as has been widely discussed by researchers, as a large proportion of variance in test scores. In this particular study, low income only contributed with a very small proportion of the variance in both, math and science achievement scores. . Thus, these results demonstrated that quality of education and courses offered in high school have a strong impact on achievement scores. These results support the view that socioeconomic background is not a factor of academic success rather it is schools who have an influence for the academic failure of its students as Garibaldi (1997) and other authors have argued. In other words, quality of education has a greater impact on math and science scores. As discussed by Garibaldi (1997) schools having higher concentrations of poor students, and urban schools were less likely to offer gifted and talented programs as well as availability of advanced courses.

The findings in this study, courses taken in math and science increase achievement scores, also support the research of Jones et al (1986) and Schimdt (1983) which showed that courses taken in math and other subjects enhance the performance of students. These results indicate that tracking, which channels poor and minority students into low tracks (Loveless, 1998), does have a negative effect on the performance of these students. Thus, differences in learning environments particularly those who undermine the potential of these students, and dooms them into an inferior education; for which there is little hope later.

Another important result in this study was that race does not contribute, as it has widely discussed by genecists, as a large proportion of variance in test scores. As shown in the previous figures, type of courses taken previously

accounted for the greater proportion of variance than race, low income and gender.

The MCAS has caused great controversy in Massachusetts. Numerous articles were published in the newspapers during the Spring of 2000; where parents and students voiced their opinions about the unfairness, an irrelevant questions of the MCAS, and criticized teachers for not teaching students how to take the test. Even a student protest challenged the governor of the state to take the MCAS. Nationally, more states are requiring students to pass standardized tests as a condition of getting a high school diploma. Internationally, comparisons with other nations have demonstrated that U.S students are performing poorly in some subjects when compared to other countries. Moreover, our country has been concerned, for the last two decades, with the state of education.

What needs to be done with the MCAS? The first step is to evaluate this education policy is to improve students' academic performance. The main purpose of the MCAS is a step in the right direction which is to improve education in the state of Massachusetts. The Curriculum Frameworks that provide extensive guidelines for instruction and assessment for math and science and technology provides the basic curriculums in all subjects and for preK to 12 grade for teachers and administrators to improve education in the state, districts and schools. The issue here is not those schools where the curriculum provides high standards in education. The problem is for those schools where there are high numbers of low income and minority students, urban schools where there are low expectations of students and where the curriculum does offer a variety of courses and advance placement courses and where teachers are not well trained.

The MCAS is a form of motivating teachers and administrators to teach students what they need to know in math and science as well as other subjects in order for students to be well prepared for their future careers and workforce. In fact the Curriculum, Frameworks is a guide for teachers and administrators for updating their curriculums while maintaining an independence in the individual curriculums created by them. Thus the state gives independence while providing some guidance in specific subjects to teachers in order to prepare students for a world economy and to guarantee a good education for all students in the state from PRE-K to grade 12.

What about achievement testing of low-income students? Urban schools that serve low-income students have been identified to serve also minority students and to be located in communities with declining fiscal resources and therefore have less resources and less prepared personnel. The problems these schools have are enormous, such as economic pressures, well trained personnel, high dropouts from the population they serve, lack of advance course offerings, and a tendency to group students in low ability groups which has a detrimental effect for students. Thus students in these schools will more likely to under-perform in achievement test scores in mathematics and science. As a result, many students taking achievement test scores from these schools will be more likely to dropout from school where there are already high attrition rates. In fact, as discussed previously, the standards base reform is not a proven theory as Crookson (1995) has discussed and the federal government is moving away from its original attempt to provide a safety net for economically disadvantaged and other underserved students. Finally, as Sizer (1995) discusses, standards

movement ignores intra and inter state disparities in financial resources, which place students in poor neighborhoods at a disadvantage.

The results discussed in this study have strong implications regarding public policy as it relates to the MCAS and the State of Massachusetts. The MCAS objectives and the results of this study demonstrate first that the quality of instruction needs to be re-evaluated across all districts of the state because courses and quality of education have a strong influence on achievement scores. This means that not only quality of instruction has to be re-evaluated at the high school level but needs to be re-evaluated from elementary school on because instruction in the elementary school has also an effect on high school performance. . Consequently, the Curriculum Frameworks provide curriculums at all levels in all subjects to provide better education in the state. Thus, if the goal of the Educational Reform Law of 1993 is to improve student's academic performance changes need to occur in elementary, middle school and high school regarding quality of instruction and availability of courses.

The availability of courses, as indicated in this study, have a strong effect on test scores. Thus, un-tracking and offering more challenging courses to students will increase test scores in the MCAS. The Curriculum Frameworks provide the guidance for upgrading the standards in all subjects from Pre-Kinder to 12 Grade but the problem is if all the schools are going to implement new curriculums according to the guidelines while at the same time each years' students are taking the MCAS and some students are performing poorly.

How long is it going to take for all schools to implement new curriculums so that all student cohorts can benefit from the new standards? What will happen to schools where teachers and administrators do not want to follow this

Curriculum Frameworks or where economics play a big role in providing a better education to students? What is going to be the role of the federal government as it relates to disadvantaged and at-risk students? What effect the MCAS testing will have on at-risk populations and disadvantaged students? Many questions need to be answered still to this new educational policy in the state of Massachusetts and the public is resisting to these changes.

References

American Association of University Women Education Foundation (1998). Gender Gap: Where Schools Fail Our Children. Researched by the American Institute for Research . Washington: DC

American Association of University Women Education Foundation (1992). How Schools Shortchange Girls: The AAUW Report, A Study of Major Findings on Girls and Education. Researched by the Wellesley College Center for Research on Women. New York: Marlowe and Company.

Balfanz, Robert (2000). Why do so many urban public schools students demonstrate so little academic achievement. In Sanders, M., G., (Ed), Schooling Students Placed at Risk: Research, Policy and Practice in the education of Poor Minority Students. Lawrence Erlbaum: New: Jersey, p. 37-62.

Berube, Maurice R., (1984). Education and poverty: Effective Schooling in the United States and Cuba. Greenwood Press: Westport, Connecticut, 3 –134.

Caldas, Stephen J., Bankston III, Carl (1997). Effect of school population socioeconomic status on individual academic achievement. The Journal of Educational Research, May/June, Vol. 90, 5, 269-277.

Cookson, P. (1995). Goals 2000: Framework for the new educational federalism. Teachers College Record, 96 (6), 405-417.

Fenwick, Leslie T., (1996). A Perspective on Race Equity and Science and Math Education: Toward Making Science and Math for All. ED402194. Paper Presented at the Annual Conference of the Georgia Initiative in Mathematics and Science (GIMS) (Atlanta, GA , 1996)

Garibaldi, Antoine M., (1997). Four decades of progress...and decline: An assessment of African American educational attainment. Journal of Negro Education, 66,(2), 105-120.

Hanson, Sandra (1994). Lost talent: Unrealized educational aspirations and expectations among U.S. youths. Sociology of Education 67, 159-183

Jones, L.V., Davenport, E.C., Bryson, A., Bekhus, T., and Zwick, R. (1986). Mathematics and science test scores as related to courses taken in high school and other factors. Journal of educational Measurement, 23 (3), 197-203.

Knapp, M. S.., & Associates (1995). Forces inside the classroom linked with teaching for meaning. In M.S. Knapp & Associates (Eds.), Teaching for meaning in high poverty classrooms , New York : Teachers College, 145-159.

Kulik, C.L., and Kulick, J.A. (1982). Effects of ability grouping on secondary school students: A meta-analysis of evaluation findings. Ameerican Educational Research Journal, 19 (3), 415-428.

Knapp, M.S., Shields, P.M. (1991) Better schooling for the children of poverty: Alternatives to conventional wisdom. San Fransisco: McCutchan.

Knapp, M. S,, Shields, P.M. & Turnbull, B. J., (1992). Academic Challenge for the children of poverty. Washington, DC: U.S. Department of Education.

Kozol, J. (1991). Savage inequalities: Children in America's schools. New York: Crown.

Loveless, Tom (1998). The Tracking and Ability Grouping Debate. Thomas B. Fordham Foundation, 2, number 8, Washington: D.C.

Massachusetts Department of Education (1996, January). Mathematics Curriculum Frameworks. Retrieved September 4, 2000, from the World WideWeb:http://doe.mass.edu/frameworks/archive/math96/Mathguiding.html.

Massachusetts Department of education (1996, January). Science and Technology Frameworks. Retrieve September 2, 2000, from the World Wide Web:http://www.doe.mass.edu//frameworks/achive/sci96/sciencetoc.html.

McLoyd , Vonnie C., (1998). Socioeconomic disadvantage and child development. American Psychologist, Vol. 53, 2, 185-204.

Mehan, Hugh (1992). Understanding inequality in schools: The contribution of imperative studies. Sociology of Education 65,1-20

Mitchell, A., (2000). Historical trends in federal education policies that targer students placed at risk. In Marvis G. Sanders (Ed.) Schooling students placed at risk: Research, policy, and practice in the education of poor and minority adolescents. Lawrence Erlbaum: New Jersey.

Murphy, Anna Marie (2001). Keeping score. Boston College Magazine,Winter, 61,(1), p.48.

Oakes, J. (1985). Keeping Track: How Schools Structure Inequality. New Haven, CT: Yale University Press.

Ogbu, John (1992). Understanding cultural diversity and learning. Educational Researcher, 21, (8), 5-14.

Ogbu, John (1995). Cultural problems in Minority education: Their interpretations and consequences—Part One: Theoretical background. The Urban Review, 27, (3), 189 -205.

Peng, Samuel et al (1995. Understanding Racial-Ethnic Differences in Secondary School Science and Mathematics. Eric_ No: ED381342.

Phillips, M., Brooks-Gunn, J., Duncan, G. J., Klebanov, P., and Crane, J., (1998). Family background, parenting practices, and the black-white test-score gap. In Christopher Jencks and Meredith Phillips (Eds). The Black-White Test Score Gap. Washington, D.C.: Brokkings, Institution Press, 103-145.

Schmidt, W. H., (1983). High school course taking: Its relationship to achievement. Journal of Curriculum Studies, 15, 311-332.

Sizer, T., (1995, April 2). Matching the Grade. Washington Post Education Review, p.12

Solomon, Daniel, Battistich, Victor, and Hom, Allen, (1989). Teacher beliefs and practices in schools serving communities that differ in socioeconomic level. The Journal of Experimental Education, 64, (4), 327-347.

Schwartz, Wendy (1987). Teaching Science and Mathematics to At Risk, Eric Digest. ED2889948.

Suarez-Orozco, Marcelo (1989). Central American Refugees and U.S. High Schools: A psychological Study of Motivation and Achievement. Stanford, Ca: Stanford University Press.

Tapia, Javier., (1998). The schooling of Puerto Ricans: Philadelphia's most impoverished community. Anthropology & Education Quarterly, 29, 297-323.

Worrell, Frank C., (1997). Predicting successful or non-successful at-risk status using demographic risk factors. The High School Journal, October/November, 46-53.

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

REPRODUCTION RELEASE

TM032588

(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: Poverty, Courses Taken and MCAS Test Scores in Mathematics and Science	
Author(s): Ronald L. Nuttall Regina Jean-Van Heel	
Corporate Source: Boston College	Publication Date: April 14, 2001

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign at the bottom of the page.

The sample sticker shown below will be affixed to all Level 1 documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

Level 1 ↑ ☑

Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) *and* paper copy.

The sample sticker shown below will be affixed to all Level 2A documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2A

Level 2A ↑ ☐

Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only

The sample sticker shown below will be affixed to all Level 2B documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2B

Level 2B ↑ ☐

Check here for Level 2B release, permitting reproduction and dissemination in microfiche only

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Sign here, → please

Signature: Ronald L. Nuttall / Regina Jean-Van Heel	Printed Name/Position/Title: RONALD L. NUTTALL/PROFESSOR / REGINA JEAN-VAN HELL
Organization/Address: BOSTON COLLEGE	Telephone: 617 552-8085 FAX: 617 552-1981
CAMPION 336E, BOSTON COLLEGE CHESTNUT HILL, MA 02467-3813	E-Mail Address: NUTTALL@bc.edu Date: 4 APRIL 2001

(over)

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, or, if you wish ERIC to cite the availability of the document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

Publisher/Distributor:
Address:
Price:

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant this reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name:
Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

University of Maryland
ERIC Clearinghouse on Assessment and Evaluation
1129 Shriver Laboratory
College Park, MD 20742
Attn: Acquisitions

However, if solicited by the ERIC Facility, or if making an unsolicited contribution to ERIC, return this form (and the document being contributed) to:

ERIC Processing and Reference Facility
1100 West Street, 2nd Floor
Laurel, Maryland 20707-3598

Telephone: 301-497-4080
Toll Free: 800-799-3742
FAX: 301-953-0263
e-mail: ericfac@inet.ed.gov
WWW: http://ericfac.piccard.csc.com

EFF-088 (Rev. 9/97)