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ABSTRACT

This report contains preliminary results from the 1992 mathematics assessment by the National Assessment of Educational Progress (NAEP) of nationally representative samples of about 26,000 4th, 8th and 12th grade students in 1,500 public schools and private schools in 44 states; and compares data to findings from the 1990 NAEP mathematics tests. An introduction addresses specifications for the 1992 assessment, and describes reporting in terms of achievement levels established by the National Assessment Governing Board (NAGB). Another section offers national student profiles for the three grades, including comparisons to student profiles from the 1990 assessment. A mathematics achievement section considers national performance by race/ethnicity, gender, region, community type, and school type; and offers comparisons with 1990 assessment data. Data show that: (1) student mathematics achievement improved between 1990 and 1992 (the average proficiency score increased for the 3 grades, a greater percentage of students at all 3 grade levels reached the achievement level standard of basic or above, and a greater percentage of students in grades 4 and 8 reached the achievement level standard of proficient or above); and (2) about 2 in 10 students reached the solid academic achievement level (proficient or above), while nearly 4 in 10 did not reach the partial mastery level (basic or above), 18 percent of fourth graders reached the proficient level or above, as did 25 percent of the eighth graders and 16 percent of the 12th graders, 36 to 39 percent of the students were below the basic level, and 2 to 4 percent reached the advanced level. Six tables are included. An appendix provides additional data and supporting material. (RLC)

NATIONAL CENTER FOR EDUCATION STATISTICS

A Preliminary Report of National Estimates from the National Assessment of Educational Progress 1992 Mathematics Assessment

U.S. Department of Education
Office of Educational Research and Improvement NCES 93-447

What is The Nation's Report Card?

THE NATION'S REPORT CARD, the National Assessment of Educational Progress (NAEP), is the only nationally representative and continuing assessment of what America's students know and can do in various subject areas. Since 1969, assessments have been conducted periodically in reading, mathematics, science, writing, history/geography, and other fields. By making objective information on student performance available to policymakers at the national, state, and local levels, NAEP is an integral part of our nation's evaluation of the condition and progress of education. Only information related to academic achievement is collected under this program. NAEP guarantees the privacy of individual students and their families.

NAEP is a congressionally mandated project of the National Center for Education Statistics, the U.S. Department of Education. The Commissioner of Education Statistics is responsible, by law, for carrying out the NAEP project through competitive awards to qualified organizations. NAEP reports directly to the Commissioner, who is also responsible for providing continuing reviews, including validation studies and solicitation of public comment, on NAEP's conduct and usefulness.

In 1988, Congress created the National Assessment Governing Board (NAGB) to formulate policy guidelines for NAEP. The board is responsible for selecting the subject areas to be assessed, which may include adding to those specified by Congress; identifying appropriate achievement goals for each age and grade; developing assessment objectives; developing test specifications; designing the assessment methodology; developing guidelines and standards for data analysis and for reporting and disseminating results; developing standards and procedures for interstate, regional, and national comparisons; improving the form and use of the National Assessment; and ensuring that all items selected for use in the National Assessment are free from racial, cultural, gender, or regional bias.

The National Assessment Governing Board

NATIONAL CENTER FOR EDUCATION STATISTICS

A Preliminary Report of National Estimates from the National Assessment of Educational Progress 1992 Mathematics Assessment

Compiled by Emerson J. Elliott
Commissioner of Education Statistics

from a draft report by
Ina V.S. Mullis, John A. Dossey, Eugene H. Owen, and Gary W. Phillips

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U.S. Department of Education
Office of Educational Research and Improvement NCES 93-447

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National Center for Education Statistics

"The purpose of the Center shall be to collect, analyze, and disseminate statistics and other data related to education in the United States and in other nations."—Section 406(b) of the General Education Provisions Act, as amended (20 U.S.C. 1221e–1).

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A PRELIMINARY REPORT OF NATIONAL ESTIMATES FROM THE NATIONAL ASSESSMENT OF EDUCATIONAL PROGRESS 1992 MATHEMATICS ASSESSMENT

The 1992 National Assessment of Educational Progress (NAEP) mathematics assessment, and results of comparable 1990 and 1992 NAEP math tests show:

STUDENT MATHEMATICS ACHIEVEMENT IMPROVED BETWEEN 1990 AND 1992.

- The average proficiency score increased for grades 4, 8, and 12.
- A greater percentage of students at all three grade levels reached the achievement level standard of Basic or above, where students should exhibit evidence of "partial mastery of the knowledge and skills that are fundamental for proficient work."
- A greater percentage of students in the fourth and eighth grades reached the achievement level standard of Proficient or above where students should exhibit evidence of "solid academic performance."

ABOUT TWO IN TEN STUDENTS REACHED THE "SOLID ACADEMIC ACHIEVEMENT LEVEL," WHILE NEARLY FOUR IN TEN DID NOT REACH THE "PARTIAL MASTERY" LEVEL.

- 18 percent of fourth graders reached the Proficient level or above, as did 25 percent of eighth graders and 16 percent of twelfth graders.
- 36 to 39 percent of students were below the Basic level.
- 2 to 4 percent reached the Advanced level.

These are the principal findings from the 1992 National Assessment of Educational Progress (NAEP), a recurring Congressionally mandated survey of educational achievement of American students and of changes in that achievement over time. This report contains preliminary results from NAEP's 1992 mathematics assessment of nationally representative samples of public and private school students from grades 4, 8, and 12 and provides comparisons to the findings from a comparable survey in 1990.

The report has three major sections. The Introduction sets forth the rationale for this preliminary report and describes reporting in terms of achievement levels as established by the National Assessment Governing Board (NAGB). The specifications for the 1992 assessment are also set forth. The second section, Student Profiles, offers national student profiles for each of the three grades, including comparisons to student profiles from the 1990 assessment. The third section, Mathematics Achievement by Selected Characteristics, looks at national performance by race/ethnicity, by gender, by region, by type of community, and by type of school. Again, comparisons with the 1990 assessment are offered. The Appendix provides some additional information and supporting material.

I. INTRODUCTION

This report presents initial findings from the 1992 NAEP mathematics assessment. The findings are preliminary in that they represent only a small portion of the full information that will be published later. Further, the findings released here are at the national level only. Reviews of the entire set of data are currently underway. One of the main features of the 1992 assessment was the participation of 44 States, territories, and the District of Columbia, in separate trial State assessments. These results, with material on student background, instruction, and courses, will be released in the Spring (see the Appendix, pp. 27-28, for a listing of forthcoming reports).

Reporting with Achievement Levels

This is the first National Center for Education Statistics (NCES) report of the National Assessment data using newly established "achievement levels," or standards of student performance. Over the years, NAEP results have been reported in a variety of ways. Interpreting the results has always been a challenge, and different methods of reporting have different strengths and weaknesses. (Among the reports forthcoming is one detailing these differences.) Achievement levels have been created by the NAEP policy body, the National Assessment Governing Board (NAGB). They are an attempt to characterize the student performance needed to attain Basic, Proficient ("solid academic achievement"), or Advanced levels at grades 4, 8, and 12. NAGB is developing achievement levels for all NAEP subject areas as a means to implement its statutory authority to take "appropriate actions ... to improve the form and use of the National Assessment" and to identify "appropriate achievement goals for each ... grade and subject area to be tested in the National Assessment." [GEPA, Section 406(i)(6)(A)(ii)(viii)]

Setting achievement levels is a method for setting standards on the NAEP assessment that identifies what students should know and should be able to do at various points along the proficiency scale. The method depends on securing and summarizing a set of judgmental ratings of expectations for student educational performance on specific items. The NAEP proficiency scale is a numerical index of students' performance in mathematics ranging from 0 to 500 and has three achievement levels--Basic, Proficient, and Advanced--mapped onto it for each grade level assessed.

These three levels have been set by NAGB:

- Students at the BASIC level should be able to demonstrate a partial mastery of the knowledge and skills that are fundamental for proficient work.

- Students at the PROFICIENT level should be able to demonstrate solid academic performance.

- Students at the ADVANCED level should be able to demonstrate superior performance beyond PROFICIENT grade-level mastery.

(The full statements of the policy definitions of achievement levels are contained in the Appendix, p. 30.)

In developing the threshold values for the levels, a broadly constituted panel of 68 judges--including 50 percent teachers, 20 percent non-teacher educators, and 30 percent non-educators--rated a grade-specific item pool using the Board's policy definitions for Basic, Proficient, and Advanced. Non-educators represented business, labor, government service, parents, and the general public.

These policy definitions were operationalized by the judges in terms of specific mathematical skills, knowledge, and behaviors that were in accordance with the current mathematics assessment framework, and were generally agreed to be appropriate expectations for students in each grade at each level. The judges' operationalized definitions were incorporated into lists of descriptors that represented what borderline students should be able to do at each of the policy levels. The purpose of having panelists develop their own operational definitions of the achievement levels was to ensure that all panelists would have a common understanding of borderline performances and a common set of content-based referents to use during the item-rating process.

The judges (24 at grade 4, 22 at grade 8, and 22 at grade 12) each rated half of the items in the NAEP pool in terms of the expected probability that a student at a borderline achievement level would answer the item correctly, based on the judges' operationalization of the policy definitions and the factors that influence item difficulty. To assist the judges in generating consistently scaled ratings, the rating process was repeated twice, with feedback. Information on consistency among different judges and on the difficulty of each item was fed back into the first repetition (round two). Item difficulty estimates were based on a preliminary, partial set of responses to the national assessment. Information on consistency within each judge's set of ratings was fed back into the second repetition (round three). The third round of ratings permitted the judges to discuss their ratings among themselves to resolve problematic ratings. The mean final rating of the judges aggregated across items yielded the threshold values in the percent correct metric. These cut scores were then mapped onto the NAEP scale (which is defined and scored using item response theory, rather than percent correct) to obtain the scale scores for the achievement levels. The Board accepted the panel's achievement levels and, for reporting purposes, set final cutpoints one standard error (a measure of consistency among the judges' ratings) below the mean levels.

After the ratings were completed, the judges for each grade level reviewed the operationalized descriptions developed by the judges of the other grade levels as well as their own descriptions and came up with achievement level descriptions that were generally acceptable to all three grade-group judges. However, the descriptions varied in format, sharpness of the language, and degree of specificity of the statements. Therefore, another

panel at a subsequent validation meeting improved the working and modified the language of the achievement level descriptions to reflect more closely the terminology of the *NCTM Standards* for mathematics.

Figures 1.1 through 1.3 in the Appendix, pp. 31-33, provide the final descriptions of the three achievement levels for each grade. In principle, the descriptions of the levels, though based on the 1992 item pool, apply to the current assessment framework and will not change from year to year (that is, until the framework changes).

Lessons from Statistical Practice

Reporting NAEP data in terms of achievement levels is a significant change in reporting practice for NCES. Frequently, when a statistical agency makes such a change, the data release is accompanied by considerable explanatory material and information on previous methods of reporting to enable readers to compare and contrast past reporting with the new form. The Center's planned release of the full 1992 National and State findings will include such material. In particular, the various ways to give meaning to the NAEP results will be described.

This preliminary NCES data release uses achievement levels to report the proportions of students in the ranges on the NAEP scale that NAGB has designated for each achievement level (see above). The Center is continuing to examine whether the achievement level descriptions can also serve as explanations of what students know and can do at each level. A substantial number of studies are under way to examine the characteristics of the new achievement levels and to evaluate their validity for various uses. Some of these studies will be available at the time of the Center's release of the full mathematics data while others will come in subsequent months.

Why, then, are these preliminary data being released now when the studies have not been completed? First, the NAEP assessments were conducted in the Winter and Spring of 1992, and it is desirable to make results known, at least in summary form, as early as possible. Second, the achievement level information is potentially a powerful new addition to our collection of national statistics about education. The purpose of NAEP is to provide the public with information about student academic performance in order to inform the important public debate about the condition and progress of education. This debate is on-going and can be enriched by this preliminary report.

Some experience from the handling of adjustments for the population undercount in the 1990 Census serves as an appropriate analogy. Following the conduct of the 1990 Census, a "post-enumeration" survey was undertaken and various statistical evaluations were made to determine the size of the undercount and the extent to which various subpopulations were affected. All of these studies were intended to inform eventual decisions as to whether and how the official population counts should be adjusted.

Even as the studies were underway, the Bureau of the Census reported national (unadjusted) totals for the purpose of apportioning Congressional seats. Individual State highlights were also reported prior to the first decisions on adjustment. After completion of the first round of studies, the Secretary of Commerce determined that no adjustment would be made for use in redistricting, but that adjustment decisions for other purposes would be made "as appropriate."[1]

In the case of the achievement levels for NAEP, studies were conducted on the Governing Board's initial level-setting project in 1990 and 1991. Evaluators included the National Academy of Education-American Institutes for Research,[2] the Technical Review Panel,[3] and the General Accounting Office.[4] Studies of the 1992 achievement levels are underway by the NAE-AIR group. Topics that have been addressed, and are currently under study, include the process by which the levels were set, the "validation" of the levels, and the inferences that can be made from achievement levels about actual performance capabilities of students who score at or above the levels.

The experience of the Census suggests that making data available to the public can serve a useful purpose even as studies about these data proceed. The Census releases permitted those who would be affected either by making or not making an adjustment to assess their case and to participate in the public debate about the issue. In the case of the achievement levels in NAEP, while the evaluations have brought individuals who have powerful technical skills together with others who have policymaking and leadership roles, the general public has not yet been effectively engaged. Issuing a preliminary report of the NAEP results is a way to facilitate that engagement. In addition, the analogy reminds us that on-going studies may have implications for some uses of NAEP data and not for others.

As in all analogies, there is a limit to this one. The first Decennial Census data are released under legal mandate; no such mandate pertains to use of achievement levels for reporting NAEP results. Population counts are a matter of fiscal consequence because they are widely used as a factor in allocating Federal funds; certainly this is not the case with NAEP data. Then, as difficult as it is to count people accurately, it is even more difficult to test them.

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[1]56 FR 33582, July 22, 1991, decision effective July 15, 1991.

[2]Assessing Student Achievement in the States. The First Report of the National Academy of Education Panel on the Evaluation of the NAEP Trial State Assessment: 1990 Trial State Assessment. National Academy of Education, Stanford, CA: 1992.

[3]Linn, R.L.; Koretz, D.M.; Baker, E.L.; and Burstein, L. The Validity and Credibility of the Achievement Levels for the 1990 National Assessment of Educational Progress in Mathematics, Technical Report CSE No. 330, Center for Research on Evaluation, Standards, and Student Testing, UCLA, Los Angeles, CA: June 1991.

[4]National Assessment Technical Quality. GAO Correspondence to Congressmen Ford and Kildee dated March 11, 1992. GAO/PEMD-92-22R.

Moreover, reporting a population count is quite straightforward in comparison with reporting what a test result means.

Still, the positive terms of the analogy suggest that as long as a reporting agency makes clear what is being reported so that no one is misled, it is preferable for the public to be informed as soon as possible. It is in that spirit that these data on the 1992 mathematics assessment are being released.

Specifications for the 1992 Mathematics Assessment

The Students

As with all NAEP assessments, the schools and students participating in the 1990 and 1992 mathematics assessments were selected through scientifically designed, stratified random-sampling procedures. Approximately 26,000 fourth, eighth, and twelfth graders in 1,500 public and private schools across the country participated in the national assessment.

The Test

The mathematics objectives that formed the basis for the assessments were designed as a matrix comprising five broad content areas and three types of mathematical abilities. The five content areas are: numbers and operations; measurement; geometry; data analysis, statistics, and probability; and algebra and functions. The mathematical abilities are: conceptual understanding, procedural knowledge, and problemsolving.

The 1990 assessment included a broad range of questions that required students to solve problems in both constructed-response and multiple-choice formats, provide responses using protractors/rulers, and use calculators (four-function at grade 4 and scientific at grades 8 and 12). For 1992, the assessments were expanded to include "manipulable" geometric shapes as well as questions that allowed students about 5 minutes to demonstrate--in writing and diagrams--their mathematical reasoning and problemsolving abilities. Also, a special component of the assessment in which students were led by audiotape through a series of tasks designed to measure their estimation skills (conducted only at the national level in 1990) was included in the state assessments in 1992. By pacing students through a series of problems, this portion of the assessment reveals whether students can provide reasonable estimates of answers without doing the actual computation. To supplement the achievement results, students, teachers, and school administrators were asked to complete questionnaires about their backgrounds and instructional practices in mathematics (most of the latter will be published in subsequent reports).

1990-1992 Comparisons

To measure trends between 1990 and 1992, identical assessment instruments were used in both the national and trial State assessments and a portion of the questions in the 1992 assessment were carried over from 1990.

Companion Trial State Assessment

The results of the national sample are the focus of this preliminary report. However, the 1992 assessment also tested samples of fourth and eighth graders attending public schools in 44 States, territories, and the District of Columbia. The results of these separate State surveys will be available in Spring 1993. The participating States (and territories and the District of Columbia) are listed in the Appendix (p. 29).

Note on Statistical Significance

Unless otherwise noted, all changes or differences discussed in this report are statistically significant at the .05 level of significance. This means that the observed differences are unlikely to be due to chance or to sampling variability.

It is more difficult to interpret the meaning of cases where no change is observed or where a change is not statistically significant. The lack of statistical significance means that the Center cannot rule out chance or sampling variability as a reason for the difference observed. For example, although it may appear that there has been an increase in the percentage of eighth graders reaching the advanced level (from 2 percent to 4 percent), the difference is not statistically significant. The lack of significance means that we cannot assert that a real change has occurred; the observed difference may simply be due to sampling variability or chance.

On the other hand, the lack of significance is a statistical statement and does not prove that there has been no change. In fact, there may be no change; however, it may be the case that there is truly a change, but the observed difference was not large enough to be significant given the sample sizes used in this survey. Thus, it is important to examine carefully patterns of performance as well as individual differences, and to take into consideration, when evaluating observed differences, the sample sizes, degree of variability in the subgroups, consistency of patterns over time and across subgroups. As the Center accumulates data over time, we will be examining the data in this way.

It should also be noted that the results presented in this report examine one variable at a time. A multivariate analysis which controls for a set of variables while examining the differences between levels of other variables might find different results. In addition, in this report, we have examined changes in mean achievement and in the percentage at or above the achievement level cutpoints. There may be changes at other points along the NAEP scale, particul -ly at the lower end of the scale, which have not been examined in this report.

II. STUDENT PROFILES

TABLE 1. National Average Mathematics Proficiency and Achievement Levels, Grades 4, 8, and 12

Grades	Assessment Years	Average Proficiency	% Students Advanced	% Students Proficient	% Students Basic	Percentages Below Basic
4	1992 1990	218(0.7)> 213(0.9)	2(0.3) 1(0.4)	18(1.0)> 13(1.1)	61(1.0)> 54(1.4)	39(1.0)< 46(1.4)
8	1992 1990	268(0.9)> 263(1.3)	4(0.4) 2(0.4)	25(1.0)> 20(1.1)	63(1.1)> 58(1.4)	37(1.1)< 42(1.4)
12	1992 1990	299(0.9)> 294(1.1)	2(0.3) 2(0.3)	16(0.9) 13(1.0)	64(1.2)> 59(1.5)	36(1.2)< 41(1.5)

>The value for 1992 was significantly higher than the value for 1990 at about the 95 percent confidence level. <The value for 1992 was significantly lower than the value for 1990 at about the 95 percent confidence level. The standard errors of the estimated percentages and proficiencies appear in parentheses. It can be said with 95 percent confidence for each population of interest, the value for the whole population is within plus or minus two standard errors of the estimate for the sample.

Data for the following "Student Profiles" come from Table 1 and from Tables 2-6 in Section III.

Fourth Grade

Attainment of Achievement Levels

Sixty-one percent of students are estimated to be at or above the Basic level of performance where "some evidence of understanding the mathematical concepts and procedures in the five NAEP content areas" is required.

Eighteen percent are estimated to be at or above the Proficient level where students should "consistently apply integrated procedural knowledge and conceptual understanding to problem solving."

Two percent are estimated to have reached the Advanced level where they should "apply integrated procedural knowledge and conceptual understanding to complex and nonroutine real world problemsolving."

Change in student performance, 1990 to 1992

Between 1990 and 1992, there were significant increases in performance for:

- U. S. average proficiency as well as the proportion of students reaching Proficient and Basic levels
- white students' average proficiency as well as the proportion of white students reaching Proficient and Basic levels
- male average proficiency as well as the proportion of males reaching Proficient and Basic levels
- female average proficiency as well as the proportion of females reaching the Basic level
- students' average proficiency in the Northeast, Southeast, and Central regions and the proportion of Central region students reaching the proficient level
- public school average proficiency, and the proportion of students reaching Proficient and Basic levels
- Catholic school average proficiency
- average proficiency of students in "other" communities (that is, not "advantaged urban," "disadvantaged urban," or "extreme rural") and the proportion of those students reaching Proficient and Basic levels.

There were no statistically significant decreases in performance in these categories among fourth graders.

Eighth Grade

Attainment of Achievement Levels

Sixty-three percent of students are estimated to be at or above the Basic level of performance where students should "exhibit evidence of conceptual and procedural understanding in the five NAEP content areas. This level of performance signifies an understanding of arithmetic operations--including estimation--on whole numbers, decimals, fractions, and percents."

Twenty-five percent are estimated to be at or above the Proficient level where students should "apply mathematical concepts and procedures consistently to complex problems in the five NAEP content areas."

Four percent are estimated to have reached the Advanced level where students should be able to "reach beyond the recognition, identification, and application of mathematical rules in order to generalize and synthesize concepts and principals in the five NAEP content areas."

Change in Student Performance

Between 1990 and 1992, there were significant increases in performance for:

- U.S. average proficiency as well as the proportion of students reaching Proficient and Basic levels
- white students' average proficiency as well as the proportion of white students reaching Proficient and Basic levels
- male average proficiency
- female average proficiency as well as the proportion of female students reaching the Proficient and Advanced levels
- Central region average proficiency as well as the proportion of those students reaching the Proficient level
- West region average proficiency
- public school average proficiency as well as the proportion of those students reaching the Proficient level
- the proportion of Catholic school students reaching the Proficient level

- o the average proficiency of students attending "other" private schools as well as the proportion of those students reaching the Proficient and Advanced levels
- o average proficiency of students in "other" communities (that is not "advantaged urban," "disadvantaged urban," or "extreme rural") as well as the proportion of these students reaching the Proficient level
- o the proportion of "advantaged urban" students reaching the Proficient level.

Between 1990 and 1992, there were significant decreases in performance for "disadvantaged urban" students' average proficiency as well as the proportion of these students at or above the Basic level.

Twelfth Grade

Attainment of Achievement Levels

Sixty-four percent of students are estimated to be at or above the Basic level of performance where students "should demonstrate procedural and conceptual knowledge in solving problems in the five NAEP content areas."

Sixteen percent are estimated to be at or above the Proficient level of performance where students should "consistently integrate mathematical concepts and procedures to the solutions of more complex problems."

Two percent are estimated to have reached the Advanced level of performance where students should "be able to generalize and synthesize concepts and principles."

Change in student performance, 1990 to 1992

Between 1990 and 1992, there were significant increases in performance for:

- o U.S. average proficiency as well as the proportion of students reaching the Basic level
- o white, black, and Hispanic students' average proficiency
- o male average proficiency
- o female average proficiency
- o Southeast region average proficiency as well as the proportion of those students reaching the Proficient level

- o average proficiency of students in "other" communities (that is, not "advantaged urban," "disadvantaged urban," or "extreme rural")

- o average proficiency of students attending "other" private schools (that is, not public or Catholic) as well as the proportion of those students reaching Basic and Proficient.

There were no statistically significant decreases in performance in these categories among twelfth graders.

III. MATHEMATICS ACHIEVEMENT BY SELECTED CHARACTERISTICS

National Performance by Race/Ethnicity

Average mathematics performance and the percentages of students at or above the three achievement levels for students in five racial/ethnic groups in grades 4, 8, and 12 for 1990 and 1992 are presented in Table 2.

- For both assessments and at all three grades, the overall pattern of average proficiency is the same: Asian/Pacific Islander and white students had higher average proficiency in mathematics than black students. Hispanic and American Indian students performed somewhere in between.

- Average proficiency of black twelfth graders was about the same as that of white eighth graders in both 1990 and 1992. The average proficiency of Hispanic twelfth graders was about the same as that of Asian eighth graders in both 1990 and 1992.

- Average performance in mathematics increased significantly between 1990 and 1992 for white students at all three grades, and for black and Hispanic students at grade 12.

- Relatively few students in any racial/ethnic groups at any grade achieved the Advanced level in either 1990 or 1992. The percent of students reaching this level were higher among Asian/Pacific Islanders and whites at every grade level. The percentages were lower among American Indians, black, and Hispanic students, across all three grades assessed. Although the percentage of Asian/Pacific Islanders reaching the Advanced level was not statistically significantly higher than whites, there was a consistent pattern in that direction across all grades and in both years.

- Differences in performance among the racial/ethnic groups showed similar patterns at the Proficient and Basic levels.

TABLE 2 **Average Mathematics Proficiency and Achievement Levels by Race/Ethnicity, Grades 4, 8, and 12**

	Assessment Years	Percent of Students	Average Proficiency	Percentage of Students At or Above			
				Advanced	Proficient	Basic	Below Basic
Grade 4							
White	1992	70(0.2)	227(0.9)>	3(0.4)	23(1.4)>	72(1.2)>	28(1.2)<
	1990	70(0.2)	220(1.1)	2(0.5)	17(1.5)	64(1.7)	36(1.7)
Black	1992	16(0.1)	192(1.3)	0(0.0)	3(0.7)	24(1.8)	76(1.8)
	1990	15(0.1)	189(1.8)	0(0.1)	2(0.5)	22(2.5)	78(2.5)
Hispanic	1992	10(0.2)	201(1.4)	0(0.2)	6(1.1)	37(2.1)	63(2.1)
	1990	10(0.2)	198(2.0)	0(0.2)	5(1.2)	34(3.0)	66(3.0)
Asian/Pacific Islander	1992	2(0.2)	231(2.4)	5(2.1)	30(4.7)	76(3.4)	24(3.4)
	1990	2(0.2)	228(3.5)	4(3.8)	24(5.0)	69(6.5)	31(6.5)
American Indian	1992	2(0.2)	209(3.2)	2(1.3)	10(3.6)	46(4.5)	54(4.5)
	1990	2(0.2)	208(3.9)	0(0.5)	5(2.7)	48(8.4)	52(8.4)
Grade 8							
White	1992	70(0.2)	277(1.0)>	4(0.5)	32(1.3)>	74(1.3)>	26(1.3)<
	1990	71(0.3)	270(1.4)	3(0.5)	24(1.5)	68(1.5)	32(1.5)
Black	1992	16(0.1)	237(1.4)	0(0.4)	3(0.8)	27(2.1)	73(2.1)
	1990	15(0.2)	238(2.7)	0(0.3)	6(1.2)	28(3.1)	72(3.1)
Hispanic	1992	10(0.2)	246(1.2)	1(0.5)	8(1.0)	39(2.0)	61(2.0)
	1990	10(0.2)	244(2.8)	0(0.0)	6(1.5)	38(3.1)	62(3.1)
Asian/Pacific Islander	1992	2(0.2)	288(5.5)	14(4.5)	44(7.3)	80(4.1)	20(4.1)
	1990	2(0.5)	279(4.8)!	6(2.5)	38(5.5)	76(5.3)	24(5.3)
American Indian	1992	1(0.2)	254(2.8)	0(0.0)	9(3.5)	47(4.7)	53(4.7)
	1990	2(0.6)	246(9.4)!	0(0.0)	9(8.7)	39(11.0)	61(11.0)
Grade 12							
White	1992	71(0.6)	305(0.9)>	2(0.4)	19(1.1)	72(1.3)	28(1.3)
	1990	74(0.6)	300(1.2)	2(0.4)	16(1.3)	67(1.7)	33(1.7)
Black	1992	15(0.4)	275(1.7)>	0(0.2)	3(0.6)	34(2.5)	66(2.5)
	1990	14(0.5)	268(1.9)	0(0.0)	2(1.0)	28(2.7)	72(2.7)
Hispanic	1992	10(0.5)	283(1.8)>	1(0.4)	6(0.8)	45(2.1)	55(2.1)
	1990	8(0.2)	276(2.8)	0(0.4)	4(1.2)	37(4.2)	63(4.2)
Asian/Pacific Islander	1992	4(0.2)	315(3.5)	6(1.4)	31(5.7)	81(4.3)	19(4.3)
	1990	3(0.3)	311(5.2)	5(2.6)	25(6.2)	76(5.0)	24(5.0)
American Indian	1992	1(0.1)	281(9.0)	0(0.0)	4(2.7)	46(16.3)	54(16.3)
	1990	1(0.3)	288(10.2)!	0(0.0)	4(6.8)	62(15.9)	38(15.9)

>The value for 1992 was significantly higher than the value for 1990 at about the 95 percent confidence level. < The value for 1992 was significantly lower than the value for 1990 at about the 95 percent confidence level. ! Interpret with caution -- the nature of the sample does not allow accurate determination of the variability of this estimated statistic. The standard errors of the estimated percentages and proficiencies appear in parentheses. It can be said with 95 percent confidence for each population of interest, the value for the whole population is within plus or minus two standard errors of the estimate for the sample. When the proportion of students is either 0 percent or 100 percent, the standard error is inestimable. However, percentages 99.5 percent and greater were rounded to 100 percent and percentages 0.5 percent or less were rounded to 0 percent. Percentages may not total 100 percent due to rounding error.

National Performance by Gender

The national data for average mathematics proficiency and achievement levels for male and female students in grades 4, 8, and 12 for 1990 and 1992 are presented in Table 3.

- In 1992, male students in grades 4 and 12 had higher average proficiency than female students, but there was no significant difference at grade 8. Between 1990 and 1992, there was a significant increase in the mathematics performance of both male and female students at all grade levels.

- In 1992, 4 percent or fewer of either male or female students reached the Advanced achievement level in all 3 grades. Although the percentages are small, significantly more males than females reached the Advanced level in twelfth grade.

- About the same percentages of males and females at grade 4 and 8 reached the Proficient level. At grade 12, however, more males reached this level. Essentially the same proportion of males and females reached the Basic level at all three grades.

- Between 1992 and 1990, fourth-grade boys showed gains at both the Proficient and Basic levels. Increased percentages of females performed at or above the Basic level at grade 4 and at or above the Proficient and Advanced levels at grade 8.

TABLE 3 **Average Mathematics Proficiency and Achievement Levels by Gender, Grades 4, 8, and 12**

	Assessment Years	Percent of Students	Average Proficiency	Percentage of Students At or Above			
				Advanced	Proficient	Basic	Below Basic
Grade 4							
Male	1992	50(0.6)	220(0.8)>	3(0.5)	20(1.1)>	62(1.1)>	38(1.1)<
	1990	52(1.0)	214(1.2)	2(0.6)	14(1.3)	55(1.7)	45(1.7)
Female	1992	50(0.6)	217(1.0)>	2(0.3)	17(1.3)	59(1.5)>	41(1.5)<
	1990	48(1.0)	212(1.1)	1(0.4)	13(1.4)	53(2.0)	47(2.0)
Grade 8							
Male	1992	51(0.6)	267(1.1)>	4(0.6)	25(1.3)	62(1.3)	38(1.3)
	1990	51(1.0)	263(1.6)	3(0.5)	21(1.5)	58(1.8)	42(1.8)
Female	1992	49(0.6)	268(1.0)>	4(0.5) >	24(1.3)>	63(1.2)	37(1.2)
	1990	49(1.0)	262(1.3)	2(0.4)	18(1.2)	59(1.6)	41(1.6)
Grade 12							
Male	1992	49(0.8)	301(1.1)>	3(0.5)	18(1.1)	65(1.3)	35(1.3)
	1990	48(1 0)	297(1.4)	3(0.6)	16(1.5)	61(1.7)	39(1.7)
Female	1992	51(0.8)	297(1.0)>	1(0.3)	14(1.1)	63(1.4)	37(1.4)
	1990	52(1.0)	292(1.3)	1(0.3)	10(0.9)	57(1.9)	43(1.9)

> The value for 1992 was significantly higher than the value for 1990 at about the 95 percent confidence level. < The value for 1992 was significantly lower than the value for 1990 at about the 95 percent confidence level. The standard errors of the estimated percentages and proficiencies appear in parentheses. It can be said with 95 percent certainty for each population of interest, the value for the whole population is within plus or minus two standard errors of the estimate for the sample.

Performance by Region

The national data for average mathematics proficiency and achievement levels by region for students in grades 4, 8, and 12 for 1990 and 1992 are presented in Table 4.

- In general, students in the Northeast, Central, and West regions had higher average proficiencies than those in the Southeast.

- At grade 4, there was an increase in overall mathematics proficiency in all regions except the West, and at grade 8, there were gains in the Central and West regions. At grade 12, students in the Southeast showed improvement.

- Few students in any region across all three grades assessed attained the Advanced level. There was no significant change in any region at this level between 1990 and 1992.

- At grade 4, more students in the Northeast and Central regions, performed at or above the Proficient level than students in the Southeast. There was a significant gain at this level in the Central region between 1990 and 1992.

- Significantly fewer fourth graders in the Southeast reached the Basic level than in the other regions.

- Between 1990 and 1992, there were no statistically significant changes in the percentage of fourth graders performing at or above the Basic level in any of the four regions.

- At grade 8, the only significant increase in the percentage of students reaching any of the achievement levels was shown at the Proficient level in the Central region.

- More eighth graders in the Central region were at or above the Basic level than in the Southeast.

- At grade 12, students in the Southeast showed gains at or above the Proficient level between 1990 and 1992.

TABLE 4 Average Mathematics Proficiency and Achievement Levels by Region, Grades 4, 8, and 12

	Assessment Years	Percent of Students	Average Proficiency	Percentages of Students At or Above			
				Advanced	Proficient	Basic	Below Basic
Grade 4							
Northeast	1992	21(0.9)	223(2.0)>	3(0.9)	24(2.6)	65(2.8)	35(2.8)
	1990	22(1.0)	215(2.9)	2(0.9)	15(3.3)	56(4.1)	44(4.1)
Southeast	1992	24(0.9)	210(1.6)>	1(0.4)	12(1.3)	50(2.2)	50(2.2)
	1990	25(1.1)	205(2.1)	1(0.4)	9(1.6)	43(3.1)	57(3.1)
Central	1992	27(0.5)	223(1.9)>	2(0.5)	21(1.8)>	68(2.6)	32(2.6)
	1990	25(0.8)	216(1.7)	2(1.0)	14(1.5)	59(2.8)	41(2.8)
West	1992	28(0.7)	218(1.5)	2(0.7)	17(2.1)	60(2.1)	40(2.1)
	1990	28(0.8)	216(2.4)	2(0.7)	15(2.3)	57(3.2)	43(3.2)
Grade 8							
Northeast	1992	22(0.8)	269(2.7)	5(1.1)	27(2.8)	62(3.4)	38(3.4)
	1990	20(0.9)	270(2.8)	3(0.8)	25(2.6)	66(3.4)	34(3.4)
Southeast	1992	25(0.7)	260(1.4)	2(0.5)	19(1.3)	55(1.5)	45(1.5)
	1990	25(1.1)	255(2.5)	2(0.5)	15(2.0)	50(2.9)	50(2.9)
Central	1992	25(0.6)	274(1.9)>	3(0.6)	30(2.6)>	71(2.4)	29(2.4)
	1990	24(0.8)	266(2.3)	2(0.6)	21(2.0)	63(2.3)	37(2.3)
West	1992	28(0.7)	268(2.0)>	4(1.1)	25(1.9)	63(2.5)	37(2.5)
	1990	30(1.0)	261(2.6)	3(0.7)	18(2.3)	57(2.7)	43(2.7)
Grade 12							
Northeast	1992	24(0.6)	302(1.5)	3(0.7)	19(1.6)	67(2.0)	33(2.0)
	1990	24(1.2)	300(2.3)	3(0.9)	18(2.0)	65(2.9)	35(2.9)
Southeast	1992	24(0.6)	291(1.4)>	1(0.3)	11(1.2)>	55(2.1)	45(2.1)
	1990	20(1.1)	284(2.2)	1(0.4)	6(1.0)	48(3.8)	52(3.8)
Central	1992	25(0.6)	303(1.8)	2(0.4)	18(1.6)	70(2.6)	30(2.6)
	1990	27(0.8)	297(2.6)	2(0.6)	14(2.2)	64(3.6)	36(3.6)
West	1992	27(0.9)	298(1.7)	2(0.6)	15(2.0)	64(1.8)	36(1.8)
	1990	29(1.2)	294(2.6)	2(0.9)	13(2.4)	58(3.4)	42(3.4)

> The value for 1992 was significantly higher than the value for 1990 at about the 95 percent confidence level. < The value for 1992 was significantly lower than the value for 1990 at about the 95 percent confidence level. The standard errors of the estimated percentages and proficiencies appear in parentheses. It can be said with 95 percent confidence that for each population of interest, the value for the whole population is within plus or minus two standard errors of the estimate for the sample. Percentages may not total 100 percent due to rounding error.

National Performance by Type of Community

The national data for average mathematics proficiency and achievement levels by type of community for students in grades 4, 8, and 12 for 1990 and 1992 are presented in Table 5. Students were classified by the type of community in which their schools were located, with the advantaged urban category representing about 10 percent of students at each grade attending schools in communities where high proportions of students' parents had professional or managerial jobs. The disadvantaged urban category represents another 10 percent of students who attended schools in locales where high proportions of parents were on welfare or not regularly employed. The extreme rural category includes the approximately 10 percent of students attending schools in the most rural areas, where many parents were farmers or farm workers. The 70 percent of students not falling into one of these three "extreme" community categories were classified as attending schools in "other" types of communities.

- At all three grades, advantaged urban students performed better than the students in the extreme rural category, who, in turn, performed better than those students attending schools in disadvantaged urban areas.

- There was a decline in the average mathematics proficiency of eighth grade students in disadvantaged urban areas.

- Across the three grades, small percentages of the advantaged urban students attained the Advanced level. In comparison, virtually no disadvantaged urban students at all three grades reached that level. For extreme rural students, few students in the fourth and eighth grade, and virtually no students in the twelfth grade were at the Advanced level.

- One-third to one-half of the urban advantaged students were at or above the Proficient level in the three grades. For disadvantaged urban students, small percentages in all grades were at this same level. The percentages of the extreme rural students classified as Proficient are between those for the other two groups.

- The pattern for all three groups at or above Basic was similar to that for the Proficient level.

- No gains were made between 1990 and 1992 in the percentages of students reaching the Advanced level. Gains at the Proficient level were made by advantaged urban students in grade 8, and by students in other communities in grades 4 and 8. Students in other communities in grade 4 made gains at or above the Basic level. In contrast, there was a significant decline in the number of eighth-grade disadvantaged urban students reaching this level.

TABLE 5 Average Mathematics Proficiency and Achievement Levels by Type of Community, Grades 4, 8, and 12

	Assessment Years	Percent of Students	Average Proficiency	Percentage of Students At or Above			
				Advanced	Proficient	Basic	Below Basic
Grade 4							
Advantaged Urban	1992	12(1.8)	237(2.1)	7(1.8)	36(3.1)	81(2.2)	19(2.2)
	1990	11(2.5)	231(3.0)!	4(1.5)	29(4.8)	77(3.4)	23(3.4)
Disadvantaged Urban	1992	9(1.4)	193(2.8)	0(0.0)	3(1.0)	27(3.2)	73(3.2)
	1990	10(1.5)	195(3.0)	0(0.0)	4(1.2)	31(4.3)	69(4.3)
Extreme Rural	1992	12(2.2)	216(3.6)	1(0.5)	15(2.4)	60(5.1)	40(5.1)
	1990	10(1.9)	214(4.9)	1(1.0)	12(3.0)	56(7.3)	44(7.3)
Other	1992	66(3.0)	219(0.9)>	2(0.3)	18(1.1)>	62(1.2)>	38(1.2)<
	1990	70(3.6)	213(1.1)	1(0.5)	13(1.2)	53(1.6)	47(1.6)
Grade 8							
Advantaged Urban	1992	10(1.8)	288(3.6)	10(2.1)	48(4.2)>	82(3.0)	18(3.0)
	1990	11(2.9)!	280(3.2)	5(1.8)	34(3.2)	78(3.6)	22(3.6)
Disadvantaged Urban	1992	9(1.3)	238(2.6)<	1(0.3)	6(1.5)	28(3.1)<	72(3.1)>
	1990	10(2.5)	249(3.8)!	1(0.7)	11(3.5)	42(4.3)	58(4.3)
Extreme Rural	1992	9(2.6)	267(4.6)!	2(1.0)	21(3.8)	65(6.2)	35(6.2)
	1990	9(2.8)	257(4.4)!	1(0.7)	14(3.5)	51(5.7)	49(5.7)
Other	1992	72(3.1)	268(1.1)>	3(0.5)	24(1.2)>	64(1.5)	36(1.5)
	1990	70(3.9)	262(1.7)	2(0.4)	19(1.2)	58(2.0)	42(2.0)
Grade 12							
Advantaged Urban	1992	12(2.1)	316(2.6)	6(1.4)	32(2.9)	82(2.8)	18(2.8)
	1990	9(2.8)	306(6.2)!	4(1.7)	23(4.9)	72(7.4)	28(7.4)
Disadvantaged Urban	1992	10(1.4)	279(2.4)	0(0.4)	6(1.4)	40(3.0)	60(3.0)
	1990	10(2.7)	276(6.0)!	0(0.0)	5(2.6)	36(7.7)	64(7.7)
Extreme Rural	1992	12(1.6)	293(1.9)	0(0.3)	10(1.6)	56(2.6)	44(2.6)
	1990	10(3.2)	293(3.3)!	1(0.6)	11(1.6)	58(5.6)	42(5.6)
Other	1992	66(3.0)	300(0.9)>	2(0.3)	16(1.0)	66(1.2)	34(1.2)
	1990	71(4.4)	295(1.3)	2(0.3)	13(1.1)	61(1.6)	39(1.6)

> The value for 1992 was significantly higher than the value for 1990 at about the 95 percent confidence level. < The value for 1992 was significantly lower than the value for 1990 at about the 95 percent confidence level. ! Interpret with caution -- the nature of the sample does not allow accurate determination of the variability of this estimated statistic. The standard errors of the estimated percentages and proficiencies appear in parentheses. It can be said with 95 percent confidence for each population of interest, the value for the whole population is within plus or minus two standard errors of the estimate for the sample. When the proportion of students is either 0 percent or 100 percent, the standard error is inestimable. However, percentages 99.5 percent and greater were rounded to 100 percent and percentages 0.5 percent or less were rounded to 0 percent. Percentages may not total 100 percent due to rounding error.

National Performance by Public and Private Schools

Students going to private schools were divided into two categories: those attending Catholic schools and those attending other types of private schools.

- At all three grades, students in private schools, either Catholic or other, had higher average mathematics proficiency than did students attending public schools.

- Between 1990 and 1992, average performance increased for fourth graders attending either public or Catholic schools, and for eighth graders attending either public or other private schools.

- Relatively few students attending any type of school reached the Advanced achievement level in 1992.

- Approximately the same proportion of fourth graders in all three types of schools performed at or above the Proficient level. At grades 8 and 12, the pattern at or above the Proficient level was different. Fewer public-school eighth graders than those in Catholic schools, or those in other private schools were classified as reaching the Proficient level. At grade 12, a small percentage of the public-school students, more of the Catholic-school students, and even more of those attending other private schools reached the Proficient level.

- About 60 percent of the public-school students at all three grades achieved at or above the Basic level, but not as many as those attending private schools (both Catholic and other).

- Compared with 1990, the percentage of students reaching the Advanced level in 1992 increased for eighth graders attending other private schools. Gains at the Proficient level were made by public-school fourth graders, eighth graders in all types of schools, and other private-school twelfth graders. At the Basic level, fourth grade public-school students and twelfth graders attending non-Catholic private schools showed improvement from 1990 to 1992.

TABLE 6 Average Mathematics Proficiency and Achievement Levels by Type of School, Grades 4, 8, and 12

	Assessment Years	Percent of Students	Average Proficiency	Percentage of Students At or Above			
				Advanced	Proficient	Basic	Below Basic
Grade 4							
Public Schools	1992	87(1.0)	217(0.8)>	2(0.3)	18(1.1)>	59(1.1)>	41(1.1)<
	1990	89(1.4)	212(1.1)	1(0.4)	12(1.3)	52(1.6)	48(1.6)
Catholic Schools	1992	8(0.7)	227(1.2)>	2(0.4)	22(1.6)	72(2.4)	28(2.4)
	1990	7(1.2)	219(3.0)	2(0.8)	16(2.6)	63(4.6)	37(4.6)
Other Private Schools	1992	4(0.9)	226(3.7)	4(1.3)	22(3.4)	70(5.7)	30(5.7)
	1990	4(0.9)	232(3.6)!	4(2.6)	30(4.9)	78(5.6)	22(5.6)
Grade 8							
Public Schools	1992	89(0.9)	266(1.0)>	3(0.5)	23(1.1)>	61(1.2)	39(1.2)
	1990	92(1.3)	262(1.4)	2(0.4)	19(1.2)	57(1.4)	43(1.4)
Catholic Schools	1992	6(0.7)	277(2.1)	4(0.9)	32(2.4)>	75(2.6)	25(2.6)
	1990	5(1.0)	271(3.5)	2(0.9)	21(3.1)	70(5.1)	30(5.1)
Other Private Schools	1992	5(0.7)	284(4.1)>	8(1.9)>	43(5.3)>	77(3.5)	23(3.5)
	1990	3(0.8)	272(3.1)!	2(1.1)	24(3.5)	71(4.3)	29(4.3)
Grade 12							
Public Schools	1992	87(1.2)	297(1.0)	2(0.3)	14(1.0)	61(1.3)	39(1.3)
	1990	91(2.0)	294(1.2)	2(0.3)	13(1.1)	58(1.7)	42(1.7)
Catholic Schools	1992	8(1.3)	310(2.5)	2(0.6)	22(2.6)	79(2.9)	21(2.9)
	1990	6(1.6)	301(4.6)!	1(0.7)	15(3.4)	68(5.7)	32(5.7)
Other Private Schools	1992	4(1.0)	319(4.3)! >	6(1.5)	36(5.5)>	84(4.2)>	16(4.2)<
	1990	4(1.4)	298(5.1)!	2(1.8)	10(4.8)	62(7.9)	38(7.9)

> The value for 1992 was significantly higher than the value for 1990 at about the 95 percent confidence level. < The value for 1992 was significantly lower than the value for 1990 at about the 95 percent confidence level. ! Interpret with caution -- the nature of the sample does not allow accurate determination of the variability of this estimated statistic. The standard errors of the estimated percentages and proficiencies appear in parentheses. It can be said with 95 percent confidence for each population of interest, the value for the whole population is within plus or minus two standard errors of the estimate for the sample. Percentages may not total 100 percent due to rounding error.

APPENDIX

FORTHCOMING 1992 NAEP MATHEMATICS REPORTS

Future reports will be available beginning in the Spring 1993 which will describe additional results at the national level and State results. The series of reports will include:

* State Report--A separate report for each of the 44 States, Territories, and the District of Columbia, that volunteered to participate in the 1992 Trial State Assessment. Along with each report, each State or Territory will receive its State data tape and State almanac.

* *The 1992 Mathematics Report Card for the Nation and the States*--includes the same analysis by achievement levels as the State reports for national and State-by-State data with anchor point analysis in an appendix. Background data from the questionnaires will appear in a Compendium and explanatory material will appear in subsequent focused reports. This report would include a preface noting that achievement levels are a new method of reporting and interpreting NAEP data and that a full discussion of methods of reporting and interpreting NAEP scales is presented in the *Interpreting NAEP Scales* report.

* *Executive Summary*--excerpted from the Report Card, this report describes the principal findings with selected tables.

* *Interpreting NAEP Scales*--a readers' guide that describes various past, current, and possible future methods of reporting and interpreting data from the National Assessment of Educational Progress. This includes discussions of, but is not necessarily limited to, percent correct scores, average p-values, scale scores, anchor points, young adult literacy type interpretations (where specific items were mapped on to different points on the scale), achievement levels, and norm- and criterion- referenced interpretations.

* *Compendium of Data from the 1992 NAEP Mathematics*--this report includes tables of data from background questionnaires related to performance on the mathematics assessment -- approximately 750 pages; limited distribution. "Co-statistics" explaining State population and school system characteristics will be included in an appendix.

* *Technical Report for the 1992 NAEP Mathematics Assessment*-this report will discuss the technical aspects of the assessment.

* *Almanacs*--these reports will be available only in electronic format (disks and CD ROM) and would include crosstabulations of all variables in the 1992 NAEP mathematics assessment by the traditional reporting variables (demographics and geographics).

* *Data Tapes*--restricted use data tapes for the 1992 NAEP mathematics assessment for the States and the Nation will be made available to licensees.

* A report on the use of constructed responses in the 1992 mathematics assessment.

* A report on how mathematics is taught in American schools, focusing on the kinds of mathematics students have an opportunity to learn.

* A report on what NAEP results show about the implementation of the National Council of Teachers of Mathematics (NCTM) standards.

PARTICIPATION IN THE 1992 TRIAL STATE ASSESSMENT OF MATHEMATICS

Alabama
Arizona
Arkansas
California
Colorado
Connecticut
Delaware
District of Columbia
Florida
Georgia
Hawaii
Idaho
Indiana
Iowa
Kentucky
Louisiana
Maine
Maryland
Massachusetts
Michigan
Mississippi
Missouri
Minnesota
Nebraska
New Hampshire
New Jersey
New Mexico
New York
North Carolina
North Dakota
Ohio
Oklahoma
Pennsylvania
Rhode Island
South Carolina
Tennessee
Texas
Utah
Virginia
West Virginia
Wisconsin
Wyoming
Guam
Virgin Islands

POLICY DEFINITIONS OF ACHIEVEMENT LEVELS

Basic. This level, below proficient, denotes partial mastery of knowledge and skills that are fundamental for proficient work at each grade--4, 8, and 12. For twelfth grade, this is higher than minimum competency skills (which normally are taught in elementary and junior high schools) and covers significant elements of standard high school level work.

Proficient. This central level represents solid academic performance for each grade tested--4, 8, and 12. It reflects a consensus that students reaching this level have demonstrated competency over challenging subject matter and are well prepared for the next level of schooling. At grade 12, the proficient level encompasses a body of subject-matter knowledge and analytical skills, of cultural literacy and insight, that all high school graduates should have for democratic citizenship, responsible adulthood, and productive work.

Advanced. This higher level signifies a superior performance beyond proficient grade-level mastery at grades 4, 8, and 12. For twelfth grade, the advanced level shows readiness for rigorous college courses, advanced technical training, or employment requiring advanced academic achievement. As data become available, it may be based in part on international comparisons of academic achievement and may also be related to Advanced Placement and other college placement exams.

FIGURE 1.1 Description of Mathematics Achievement Levels for Basic, Proficient, and Advanced Fourth Graders

The five NAEP content areas are (1) numbers and operations, (2) measurement, (3) geometry, (4) data analysis, statistics, and probability, and (5) algebra and functions. At the fourth-grade level, algebra and functions are treated in informal and exploratory ways, often through the study of patterns. Skills are cumulative across levels—from Basic to Proficient to Advanced.

Basic 211	**Fourth-grade students performing at the basic level should show some evidence of understanding the mathematical concepts and procedures in the five NAEP content areas.**

Fourth graders performing at the basic level should be able to estimate and use basic facts to perform simple computations with whole numbers; show some understanding of fractions and decimals; and solve some simple real-world problems in all NAEP content areas. Students at this level should be able to use -- though not always accurately -- four function calculators, rulers, and geometric shapes. Their written responses are often minimal and presented without supporting information.

Proficient 248	**Fourth-grade students performing at the proficient level should consistently apply integrated procedural knowledge and conceptual understanding to problem solving in the five NAEP content areas.**

Fourth graders performing at the proficient level should be able to use whole numbers to estimate, compute, and determine whether results are reasonable. They should have a conceptual understanding of fractions and decimals; be able to solve real-world problems in all NAEP content areas; and use four-function calculators, rulers, and geometric shapes appropriately. Students performing at the proficient level should employ problem-solving strategies such as identifying and using appropriate information. Their written solutions should be organized and presented both with supporting information and explanations of how they were achieved.

Advanced 280	**Fourth-grade students performing at the advanced level should apply integrated procedural knowledge and conceptual understanding to complex and non-routine real world problemsolving in the five NAEP content areas.**

Fourth graders performing at the advanced level should be able to solve complex and nonroutine real-world problems in all NAEP content areas. They should display mastery in the use of four-function calculators, rulers, and geometric shapes. These students are expected to draw logical conclusions and justify answers and solution processes by explaining why, as well as how, they were achieved. They should go beyond the obvious in their interpretations and be able to communicate their thoughts clearly and concisely.

FIGURE 1.2 Description of Mathematics Achievement Levels for Basic, Advanced, and Proficient Eighth Graders

The five NAEP content areas are (1) numbers and operations, (2) measurement, (3) geometry, (4) data analysis, statistics, and probability, and (5) algebra and functions. Skills are cumulative across levels—from Basic to Proficient to Advanced.

Basic 256	**Eighth-grade students performing at the basic level should exhibit evidence of conceptual and procedural understanding in the five NAEP content areas. This level of performance signifies an understanding of arithmetic operations -- including estimation -- on whole numbers, decimals, fractions, and percents.**

Eighth-graders performing at the basic level should complete problems correctly with the help of structural prompts such as diagrams, charts, and graphs. They should be able to solve problems in all NAEP content areas through the appropriate selection and use of strategies and technological tools -- including calculators, computers, and geometric shapes. Students at this level also should be able to use fundamental algebraic and informal geometric concepts in problem solving.

As they approach the proficient level, students at the basic level should be able to determine which of available data are necessary and sufficient for correct solutions and use them in problem solving. However, these 8th graders show limited skill in communicating mathematically.

Proficient 294	**Eighth-grade students performing at the proficient level should apply mathematical concepts and procedures consistently to complex problems in the five NAEP content areas.**

Eighth-graders performing at the proficient level should be able to conjecture, defend their ideas, and give supporting examples. They should understand the connections between fractions, percents, decimals, and other mathematical topics such as algebra and functions. Students at this level are expected to have a thorough understanding of basic level arithmetic operations -- an understanding sufficient for problem solving in practical situations.

Quantity and spatial relationships in problem solving and reasoning should be familiar to them, and they should be able to convey underlying reasoning skills beyond the level of arithmetic. They should be able to compare and contrast mathematical ideas and generate their own examples. These students should make inferences from data and graphs; apply properties of informal geometry; and accurately use the tools of technology. Students at this level should understand the process of gathering and organizing data and be able to calculate, evaluate, and communicate results within the domain of statistics and probability.

Advanced 331	**Eighth-grade students performing at the advanced level should be able to reach beyond the recognition, identification, and application of mathematical rules in order to generalize and synthesize concepts and principles in the five NAEP content areas.**

Eighth-graders performing at the advanced level should be able to probe examples and counterexamples in order to shape generalizations from which they can develop models. Eighth-graders performing at the advanced level should use number sense and geometric awareness to consider the reasonableness of an answer. They are expected to use abstract thinking to create unique problem-solving techniques and explain the reasoning processes underlying their conclusions.

FIGURE 1.3 Description of Mathematics Achievement Levels for Basic, Advanced, and Proficient Twelfth Graders

The five NAEP content areas are (1) numbers and operations, (2) measurement, (3) geometry, (4) data analysis, statistics, and probability, and (5) algebra and functions. Skills are cumulative across levels -- from Basic to Proficient to Advanced.

Basic 287	**Twelfth-grade students performing at the basic level should demonstrate procedural and conceptual knowledge in solving problems in the five NAEP content areas.**

Twelfth-grade students performing at the basic level should be able to use estimation to verify solutions and determine the reasonableness of results as applied to real-world problems. They are expected to use algebraic and geometric reasoning strategies to solve problems. Twelfth-graders performing at the basic level should recognize relationships presented in verbal, algebraic, tabular, and graphical forms; and demonstrate knowledge of geometric relationships and corresponding measurement skills.

They should be able to apply statistical reasoning in the organization and display of data and in reading tables and graphs. They also should be able to generalize from patterns and examples in the areas of algebra, geometry, and statistics. At this level, they should use correct mathematical language and symbols to communicate mathematical relationships and reasoning processes; and use calculators appropriately to solve problems.

Proficient 334	**Twelfth-grade students performing at the proficient level should consistently integrate mathematical concepts and procedures to the solutions of more complex problems in the five NAEP content areas.**

Twelfth-graders performing at the proficient level should demonstrate an understanding of algebraic, statistical, and geometric and spatial reasoning. They should be able to perform algebraic operations involving polynomials; justify geometric relationships; and judge and defend the reasonableness of answers as applied to real-world situations. These students should be able to analyze and interpret data in tabular and graphical form; understand and use elements of the function concept in symbolic, graphical, and tabular form; and make conjectures, defend ideas, and give supporting examples.

Advanced 366	**Twelfth-grade students performing at the advanced level should consistently demonstrate the integration of procedural and conceptual knowledge and the synthesis of ideas in the five NAEP content areas.**

Twelfth-grade students performing at the advanced level should understand the function concept; and be able to compare and apply the numeric, algebraic, and graphical properties of functions. They should apply their knowledge of algebra, geometry, and statistics to solve problems in more advanced areas of continuous and discrete mathematics.

They should be able to formulate generalizations and create models through probing examples and counterexamples. They should be able to communicate their mathematical reasoning through the clear, concise, and correct use of mathematical symbolism and logical thinking.