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ABSTRACT

National Assessment of Educational Progress (NAEP) results indicate that most students understand the fundamentals of reading, writing and mathematics; and that achievement levels have remained stable across time for older students and may be improving for younger students, particularly in the areas of reading and writing. However, NAEP data suggest that curriculum still emphasizes instruction in component skills apart and separate from the application of these skills. Many students evidence difficulty with tasks requiring higher-order skills. Gains evidenced by younger students in groups traditionally considered disadvantaged are being accompanied by declines in groups usually considered advantaged. In particular, the older and better students do not appear to be keeping up with their counterparts in earlier assessments. In many instances, differences in performance may be decreasing, but overall performance is not improving. We may be attaining more equality in educational achievement in reading, writing and mathematics, but it appears to be at the expense of declining excellence. Primary type of information provided by the report: Results (Change) (Selective). (Author/PN)

ACHIEVEMENT AND THE THREE R'S: A SYNOPSIS OF NATIONAL ASSESSMENT FINDINGS IN READING, WRITING AND MATHEMATICS

No. SY-RWM-50

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ACHIEVEMENT AND THE THREE R'S:
A SYNOPSIS OF NATIONAL ASSESSMENT FINDINGS
IN READING, WRITING AND MATHEMATICS

INTRODUCTION

Since 1969, National Assessment has collected information about the levels of educational achievement across the country and reported its findings. The educational attainments of 9-, 13- and 17-year-olds, as well as young adults, have been surveyed. Data have been collected in 10 learning areas: art, career and occupational development, citizenship, literature, mathematics, music, reading, science, social studies and writing. Different learning areas are periodically reassessed in order to measure possible changes in educational achievement. Since 1969, National Assessment has interviewed and tested more than one million young Americans.

Each learning assessment is the product of a consensus process, which is the result of several years of work by a great many educators, scholars and lay persons from all over the nation. Initially, these people design objectives for the subject area, proposing general goals they feel Americans should be achieving in their education. After careful reviews, these objectives are given to groups of

exercise (item) writers, who create measurement instruments appropriate for the objectives.

After the items have been extensively reviewed and field tested, they are administered to probability samples. Respondents who make up these samples are selected in such a way that the results of their assessment can be generalized to an entire national population. That is, on the basis of the performance of about 2,500 9-year-olds on a given exercise, estimates are made of the performance of all 9-year-olds in the country. The performance of a number of population subgroups is also estimated, for example, region of the country, sex, race, type of community and level of parental education.

When assessment data have been collected, scored and analyzed, National Assessment publishes reports to disseminate the results and findings as widely as possible. Not all of the items used in an assessment are released for publication. Because NAEP will administer some of the same exercises in the future to determine whether the performance levels of Americans have increased, remained stable or decreased, it is essential that they not be released in order to preserve the integrity of the study.

THE NATIONAL ASSESSMENT OF READING

Overview

Although young readers in America appear to have the basics well in hand, there is growing concern on the part of educators and researchers because our students are declining in their performance on tasks that involve higher-order skills. Mixed results were obtained in the most recent reading/literature assessment; on the positive side, overall reading performance is stable or improving for the decade. On the negative side, on inferential items, which require more cognitive processing on the part of the reader, performance is declining for our 17-year-olds and showing no gain for 13-year-olds. Furthermore, when asked to respond in writing to a variety of reading passages, students performed at a startingly low level on tasks involving analyzing or generalizing skills. While able to make judgments about a piece of writing, students showed very little evidence of being able to move beyond some superficial evaluative statement to support or defend their view.

Of additional concern are the findings that some of the traditionally advantaged groups (those whose parents have post-high school education, those attending school in advantaged-urban areas, and those in the highest achievement levels) actually showed the largest declines (or smallest

gains) in performance. This is offset, to some extent, by findings that other groups traditionally below the national performance level (blacks, students attending school in disadvantaged urban areas, students in the southeast and students whose parents have not graduated from high school) are closing the performance gap between themselves and the nation.

Comprehending

The items used to measure changes in reading performance over the decade from 1970-80 are items developed during the late 1960s. These were first assessed in the 1970-71 school year, measured again during 1974-75 and reassessed during 1979-80. The same items were used for all three assessments to allow comparisons to be made across time. In addition, results were analyzed for three subsets of item types -- literal comprehension (the ability to locate or remember the exact meaning of a word, sentence or paragraph), inferential comprehension (gleaning from a passage some idea that is not stated explicitly) and reference skills (using special skills such as locating a resource and organizing and interpreting resource information).

At age 9 the overall performance gains are the largest ever reported by NAEP for any learning area. As reflected in Table 1 mean performance gains were posted on all three

subsets of items, with the largest gains occurring in the latter half of the decade.

TABLE 1

NATIONAL MEAN CHANGES IN PERCENTAGES OF CORRECT RESPONSES FOR 9-YEAR-OLDS ACROSS THREE READING ASSESSMENTS

	1971-75	1975-80	1971-80
All Reading Items	1.3%*	2.6%*	3.9%*
Literal Comprehension Items	1.0	2.8*	3.9*
Inferential Comprehension Items	0.9	2.5*	3.5*
Reference Skills Items	2.3*	2.6*	4.8*

(*) = Significant change; figures may not total due to rounding differences.

For all reading items, the gain for the decade was 3.9 percentage points with gains of 3.9, 3.5 and 4.8 for the literal comprehension, inferential comprehension and reference skills items, respectively. Clearly, 9-year-olds at the end of the decade were performing at a higher level than were their counterparts at the beginning of the decade.

Table 2 contains the results for 13-year-olds. These are considerably different from those at age 9. There is relative stability in the performance of 13-year-olds

overall, with essentially no change across the decade, except for a small, but significant gain on the literal comprehension items at the end of the nine-year period.

TABLE 2

NATIONAL MEAN CHANGES IN PERCENTAGES OF CORRECT RESPONSES FOR 13-YEAR-OLDS ACROSS THREE READING ASSESSMENTS

	1970-74	1974-79	1970-79
All Reading Items	-0.1%	0.9%	0.8%
Literal Comprehension Items	0.7	0.9	1.6*
Inferential Comprehension Items	-0.8	0.2	-0.6
Reference Skills Items	-1.7*	2.6*	0.9

(*) = Significant change; figures may not total due to rounding differences.

The results for 17-year-olds still attending school, presented in Table 3, reflect a different picture than that for the 9-year-olds and 13-year-olds. Again, for overall reading performance, there is no significant change for the decade. However, the mean percentages of change on the subsets of items reveal that performance on critical-thinking skills may not have kept pace with other

kinds of reading skills. The 2.1 percent decline in performance on inferential comprehension items may be cause for concern.

TABLE 3

NATIONAL MEAN CHANGES IN PERCENTAGES OF CORRECT RESPONSES FOR IN-SCHOOL 17-YEAR OLDS ACROSS THREE READING ASSESSMENTS

	1971-75	1975-80	1971-80
All Reading Items	0.0%	-0.8%	-0.7%
Literal Comprehension Items	0.5	-0.7	-0.2
Inferential Comprehension Items	-0.9	-1.2	-2.1*
Reference Skills Items	0.6	0.2	0.8

(*) = Significant change; figures may not total due to rounding differences.

As results at all three ages demonstrate, the basic reading skills are stable or improving; it is the higher-level critical thinking skills among teenage students that give most cause for concern to educators.

As the results in Table 4 indicate, the performance changes for the decade observed across the three ages are not distributed uniformly across reporting subgroups.

TABLE 4

GROUP MEAN CHANGES IN READING PERFORMANCE
ACROSS THREE READING ASSESSMENTS
FOR THREE AGES

	AGE 9 1971-80	AGE 13 1970-79	AGE 17 1971-80
Northeast	4.1*	-0.5%	-2.4%
Southeast	7.5*	2.6	1.7
Central	2.2*	0.8	-1.0
West	3.4*	0.4	-0.1
Black	9.9*	4.2*	0.5
White	2.8*	0.0	-0.7
Male	4.4*	1.1	-0.3
Female	3.5*	0.3	-1.0
Not Graduated High School	4.0*	0.2	-1.3
Graduated High School	2.4*	-0.9	-2.6*
Post High School	1.4*	-1.0	-1.7*
Rural	6.0*	1.8	-1.1
Disadvantaged Urban	5.2*	3.6	-1.4
Advantaged Urban	1.6	0.8	-2.2

(*) = Significant change in performance between assessments

Black students posted the largest gain at age 9, the only significant gain at age 13 and narrowed the gap between themselves and the nation slightly at age 17. Gains for 9-year-old blacks were highest in the southeast and central regions, 12.7 and 9.7 percent, respectively, although this

trend was less evident at ages 13 and 17. Males at all three ages were performing closer to the level of females at the close of the decade. Students attending school in disadvantaged-urban and extreme-rural areas gained at age 9, while performance of students attending school in advantaged-urban areas remained stable. At ages 13 and 17, the disadvantaged-urban groups narrowed the gap somewhat between themselves and the nation. Students who reported that neither parent had graduated from high school also gained more (or declined less) than students whose parents had higher education levels.

For the 1979-80 reading/literature assessment NAEP used a new background variable, labelled achievement class level, that partitioned the national sample into four performance ranges, from low to high achievers. All of NAEP's traditional reporting groups are represented in each achievement class level. The inclusion of this new variable provides an additional means for examining the loci of any observed changes. As the results in Table 5 indicate, gains and losses are <u>not</u> distributed equally across the various achievement classes. At age 9, the figures demonstrate quite clearly that the major contribution to the overall performance gains for the nation occurred for the two lowest achievement classes with no significant change taking place for the highest achievement classes. This same pattern appears in the results for 13-year-olds with the noticeable

addition of a significant decline in the mean performance of the highest achievement group. For the 17-year-olds, the lowest-three achievement groups had relatively stable performance across the decade, but again, the highest achievement group posted a significant decline.

TABLE 5

NATIONAL AND GROUP MEAN CHANGES IN PERCENTAGES OF CORRECT RESPONSES TO ALL READING ITEMS ACROSS THREE AGE GROUPS BETWEEN 1970-71 AND 1979-80, FOR FOUR ACHIEVEMENT CLASS LEVELS

	National	Achievement Class 1 (Lowest)	Achievement Class 2	Achievement Class 3	Achievement Class 4 (Highest)
Age 9	3.9*	8.8*	4.0*	2.0	0.8
13	0.8	3.6*	2.2*	-0.2	-2.4*
17**	-0.7	1.2	-0.2	-1.5	-2.3*

(*) = Significant change; figures may not total due to rounding differences

(**) = 17-year-old data reported in this table is for 17-year-olds in-school.

Not only did the lowest achieving groups evidence the largest relative gains, but the composition of the lowest achievement classes (and the highest) has also changed over the three assessment periods. There has been a steady

increase in the proportion of southeastern students and black students within the highest achievement class. At age 9, for example, blacks gained from 5.8 percent representation in 1971 to 10.4 percent in 1980; the southeast gained 6 percentage points -- from 18.6 percent in 1971 to 24.6 percent in 1980.

In contrast, the representation of the advantaged-urban group in the top achievement class declined by more than 5 percent. At age 13, these proportional changes are less dramatic. Black student representation remained stable, while students in the southeast gained 3.9 percent. Among 17-year-olds, the representation of black students in the highest quartile actually declined by 1.8 percentage points, but Southeasterners gained by 2.5 percent. As these achievement class results show, the primary gains in reading performance occurred among the lowest achievers and among some groups whose performance has traditionally been below the national level.

In addition to the reading change items already discussed, many new items were developed for use in the 1979-80 survey. These new baseline items were designed to assess four major areas: 1) values reading and literature, 2) comprehends written works, 3) responds to written works, and 4) applies study skills in reading.

The comprehending objective deals with understanding the meaning of written materials with meaning being

described in terms of propositions. The underlying theoretical construct treats reading as an interactive process that requires an active involvement on the part of the reader. Comprehension is the foundation upon which the other objectives are predicated.

For 9-year-olds, there were 130 of these new comprehending items administered, 156 new items at age 13 and 122 at age 17. At age 9, the mean percent correct was 58 percent, while at age 13 the mean was 74 percent and at age 17 it was 79 percent. The sets of items were different across the three ages, and the items selected for the 9-year-olds proved to be more difficult than those used for the teenagers.

Comprehension items are separated into four arbitrary subcategories: words (measuring skill in understanding word meanings), lexical relationships (understanding the relationships among actors, actions and recipients of action), propositional relationships (understanding the implied relationships between two or more propositions within a focused part of the text) and textual relationships (understanding relationships that are established across more than one paragraph). Because the same item sets were not used for all three ages, meaningful comparisons can not be made across the three age groups. Within the three age groups, however, item types can be compared for similarities or differences. For example, as the figures in Table 6

reflect, the word meaning items proved to be the most difficult for all three ages.

TABLE 6

MEAN PERCENTAGES CORRECT FOR FOUR TYPES OF COMPREHENDING ITEMS FOR THREE AGE GROUPS

	All Comprehension	Lexical	Propositional	Textual	Words
Age 9 Mean Percent	58.2	68.8	58.7	54.3	46.5
Number of Items	(130)	(28)	(49)	(40)	(13)
Age 13 Mean Percent	74.0	79.2	76.0	70.5	69.1
Number of items	(156)	(31)	(54)	(50)	(21)
Age 17 Mean Percent	79.1	83.8	82.5	75.9	75.9
Number of Items	(122)	(22)	(33)	(50)	(17)

Next, from lowest to highest percentages correct, are the textual, propositional and lexical categories. Although the differences between and among items types are not significant in all cases, the pattern is virtually identical for the three age groups.

Study Skills

Patterns of performance on the subsets of change items designated as reference skills and on baseline items in the category labelled study skills were similar in most respects to performance on comprehending items. For the change items, performance means on reference skills items were higher at the end of the decade for 9-year-olds and stable

for the teenagers. The performance patterns on baseline study skills items across the age groups and among the various reporting groups also closely paralleled those for comprehension. In Table 7 are displayed the national means for study skills items across the three ages.

TABLE 7

MEAN PERCENTAGES CORRECT FOR THREE TYPES OF STUDY SKILL ITEMS FOR THREE AGE GROUPS

	All Study Skills	Book Parts	Library and Reference Materials	Charts and Graphs
Age 9 Mean Percent	64.4	57.6	64.8	67.7
Number of items	(53)*	(10)	(29)	(11)
Age 13 Mean Percent	67.2	64.8	68.0	69.0
Number of Items	(69)*	(19)	(25)	(22)
Age 17 Mean Percent	78.8	77.0	78.6	80.7
Number of Items	(68)*	(19)	(24)	(22)

(*) Note: The total study skills pool included three items at each age that were not classified into these three subcategories.

Responding to Written Works

The results on open-ended responding tasks yielded a gloomy picture of students' performance when asked to respond in writing to a variety of reading passages. On the three open-ended items assessed at age 9, the mean percent of acceptable responses was 9.7 percent. For age 13 (13 open-ended items), the mean performance was 47.8 percent. At age 17, the mean percent acceptable on a set of 16 open-ended items was 42.4 percent.

At all ages, the mean percentages correct were much higher on multiple-choice items that assessed awareness of literary techniques and devices used in the same reading passages -- 64.1 percent correct at age 9 (3 items), 81.1 percent (20 items) at age 13 and 87.4 percent (20 items) for 17-year-olds. These results provide a clear indication that students are able to identify metaphors, hyperbole, similes and puns when given specific examples and directions in multiple-choice format. It is when asked to explain or defend in writing a judgment or point of view about a passage that students do dramatically less well.

Furthermore, within the different types of responding items there is a great amount of variability in performance levels depending upon the nature of the task required. For example, 12-16 percent of 9-year-olds gave adequate written responses to items asking for an inference or expression of feeling, but only two percent gave adequate responses to an

item that required an evaluation with supporting evidence from the passage. The adequate performance scores of the 13-year-olds ranged from 21 percent on an inferencing item to 62 percent on one requiring an expression of feelings or emotion. However, for the evaluation tasks that required supporting evidence, the acceptable response percentages ranged from 4-11 percent. The pattern was essentially the same at age 17. On mood or character inferencing tasks and on an emotional responding item, acceptable response percentages ranged from 38-58 percent. On items requiring analysis of theme the adequate response percentages were 5-10 percent, and on the evaluating tasks requiring supporting evidence the range was 4-21 percent. Clearly, the extent to which students are asked to support or defend their views produces a marked change in the proportion of students producing acceptable written responses. These low percentages on open-ended items are in sharp contrast to the much higher percentages observed on the multiple-choice items.

Habits, Attitudes and Experiences

The final aspect of the 1979-1980 assessment to be discussed is the general category of items that pertain to reading habits, attitudes and experiences associated with reading comprehension, study skills and responding to written works. Although the amount of time spent watching

TV declines as age increases, performance means are related to amounts of TV viewing in different ways for the three age groups. For age 9, the highest mean performance occurs among respondents who report watching TV three to four hours daily (about 25 percent). At age 13, as the amount of TV viewing declines, this shifts downward so that only students watching TV two hours or less perform above the nation (about 51 percent). At age 17, with 69 percent of the students watching TV less than three hours daily, the group reporting the least daily TV viewing performed at the highest level.

Teenagers were also asked about time spent on homework the preceding day. At age 13, the groups performing above the nation were those who spent less than two hours doing their homework, while at age 17, those who spent more than two hours on homework were five percentage points above the mean, compared with three percent and one percent above the nation, respectively, for those reporting one to two hours, or less than one hour of homework.

Self-perception as a reader accurately reflects reading performance differences. Readers rating themselves as "very good" performed above the nation at all ages, while "good" and "poor" readers were below the mean. Only those readers who enjoy reading "somewhat" were above the national mean for 9-year-olds; but for 13-year-olds and 17-year-olds, only those who report enjoying reading "very much" performed

above the nation. More than 95 percent of students at all three ages viewed reading as "very important".

When asked about preferences in reading materials, students reporting either a preference for fiction or an equal liking of fiction and nonfiction performed above the mean at all three ages. Readers preferring nonfiction materials were below the mean. Preferences in reading materials also varied with the sex of the reader with males generally preferring nonfiction and females tending to prefer fiction.

Most students value reading for a variety of purposes. Interest levels declined slightly across the three ages, but older students tended to value reading for personal growth and knowledge more highly than did younger students. In summary, readers with positive attitudes and values toward reading tended to perform better than the nation.

All of the reading/literature results discussed thus far have one finding in common; as items require more critical thinking skills, performance levels tended to decline, even among the groups that usually are considered to be advantaged. The basics seem to be available to most students, but higher-level reading and responding skills are not in evidence for a large proportion of students at all ages.

THE NATIONAL ASSESSMENT OF MATHEMATICS

Overview

National Assessment has conducted two mathematics assessments and is collecting data for a third assessment in the 1981-82 school year. Data for the first mathematics assessment were collected in the 1972-73 school year; the second assessment was conducted five years later, in 1977-78. The objectives for the second mathematics assessment were organized as a content by cognitive-process matrix. The cognitive-process dimension of the second assessment objectives became the framework used in reporting changes in achievement between the assessments as well as the status of overall mathematics achievement in 1977-78. A unique feature of the second mathematics assessment is the fact that at each of the ages there was one assessment booklet that required the use of an electronic hand calculator.

During the latter part of the decade of the 1970s, many mathematics curriculum materials reflected pressures of the "back to the basics" movement by including many pages of computation drill and practice exercises. In addition, much of the notation and language popularly believed to represent the so called "new mathematics", was deleted from many of the new curriculum materials. The advent of the inexpensive electronic hand calculator was perceived as having the potential to radically change mathematics education.

In the second mathematics assessment, National Assessment included 55 items at age 9, 77 items at age 13 and 102 items at age 17 that had also been administered in the 1972-73 mathematics assessment. On the basis of these exercises, National Assessment estimated changes in mathematics achievement between 1972-73 and 1977-78. Changes were estimated for the nation at each age and for a number of population subgroups. Data were aggregated across all exercises at an age as well as by the basic cognitive-process categories.

At age 9, there was a slight overall decline in mathematics performance of about 1.3 percent. At age 13 the decline in achievement was about 2 percent and at age 17 there was a decline between 1973 and 1978 of about 3.6 percent. While these overall declines in mathematics performance are not large, they may be cause for concern. Change results for the four cognitive-process levels are discussed below. Changes in mathematics performance are displayed in Tables 8a-8c.

Table 8a

Age 9 -- Mean Change in Mathematics Performance From 1973-78

	All Exercises (55 Exercises)				Knowledge (17 Exercises)			
	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error
Nation	-1.27	0.66			-0.78	0.84		
Northeast	0.04	0.90	1.31	0.86	1.87	1.13	2.65*	1.10
Central	-1.23	1.26	0.04	1.04	0.36	1.54	1.14	1.27
West	-3.69*	1.46	-2.42	1.25	-3.39	2.02	-2.61	1.69
Southeast	0.37	1.21	1.64	1.13	-1.47	1.31	-0.69	1.28
Male	-1.18	0.72	0.09	0.28	-0.26	0.93	0.52	0.45
Female	-1.36	0.71	-0.09	0.28	-1.29	0.96	-0.51	0.45
White	-1.98*	0.69	-0.71	0.36	-1.45	0.90	-0.67	0.44
Hispanic	0.55	1.51	1.82	1.52	1.15	2.31	1.93	2.22
Black	2.89*	0.76	4.16*	0.89	3.39*	1.44	4.17*	1.50
Post high school	-1.68*	0.81	-0.41	0.47	-0.72	1.02	0.06	0.70
Graduated high school	-2.39*	0.84	-1.12	0.61	-2.08	1.22	-1.30	0.90
Not graduated high school	-2.34*	1.11	-1.07	1.02	-2.22	1.62	-1.44	1.41
Advantaged urban	-0.68	1.35	0.59	1.43	-1.60	1.71	-0.82	1.83
Disadvantaged urban	2.45	1.61	3.72*	1.63	2.69	2.62	3.47	2.61
Extreme rural	-1.87	1.82	-0.60	1.78	-1.62	2.11	-0.84	1.98
Fringes around big cities	-1.01	1.37	0.26	1.31	0.71	1.86	1.49	1.74
Big cities	-1.38	1.15	-0.11	1.04	-1.69	1.32	-0.91	1.26
Medium cities	-1.71	1.67	-0.44	1.70	-0.52	1.98	0.26	2.04
Small places	-1.08	1.11	0.19	0.87	-0.73	1.38	0.05	1.03
3rd grade	-0.41	0.91	0.86	0.68	-0.07	1.27	0.71	0.94
4th grade	-1.43	0.72	-0.16	0.34	-0.77	0.93	0.01	0.46

	Skills (21 Exercises)				Computation (12 Exercises)			
	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error
Nation	-0.39	0.65			-0.58	0.80		
Northeast	-0.34	0.92	0.05	0.90	-1.08	1.32	-0.50	1.17
Central	-1.07	1.32	-0.68	1.07	-1.56	1.69	-0.98	1.37
West	-2.24	1.55	-1.85	1.31	-1.80	1.58	-1.22	1.41
Southeast	2.59*	1.14	2.98*	1.09	2.82*	1.33	3.40*	1.30
Male	-0.65	0.75	-0.26	0.31	-1.04	0.89	-0.46	0.42
Female	-0.13	0.71	0.26	0.33	-0.10	0.93	0.48	0.43
White	-1.00	0.69	-0.61	0.34	-1.54	0.85	-0.96*	0.39
Hispanic	1.46	1.70	1.85	1.68	2.54	2.34	3.12	2.31
Black	3.02*	0.79	3.41*	0.89	4.41*	1.15	4.99*	1.15
Post high school	-1.38	0.93	-0.99	0.58	-2.15	1.11	-1.57*	0.70
Graduated high school	-0.50	0.89	-0.11	0.71	-0.08	1.03	0.50	0.84
Not graduated high school	-1.11	1.25	-0.72	1.17	-0.80	1.51	-0.22	1.43
Advantaged urban	1.12	1.66	1.51	1.61	1.72	2.21	2.30	2.07
Disadvantaged urban	0.86	1.24	1.25	1.32	2.14	1.97	2.72	1.98
Extreme rural	-1.87	2.01	-1.48	1.98	-3.22	2.24	-2.64	2.23
Fringes around big cities	-1.08	1.39	-0.69	1.26	-0.65	1.62	-0.07	1.45
Big cities	-1.14	1.30	-0.75	1.12	0.10	1.51	0.68	1.37
Medium cities	-1.35	1.64	-0.96	1.63	-2.58	1.83	-2.00	1.73
Small places	0.44	0.98	0.83	0.81	-0.54	1.21	0.04	0.99
3rd grade	0.45	0.83	0.84	0.76	0.69	0.95	1.27	0.91
4th grade	-0.59	0.79	-0.20	0.37	-0.82	0.98	-0.24	0.46

**Indicates mean percentages significantly different from the nation at the .05 level.*

Table 8a (Continued)

Age 9 -- Mean Change in Mathematics Performance From 1973-78

	Applications (9 Exercises)			
	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error
Nation	-5.90*	0.96		
Northeast	-5.26*	1.74	0.64	1.53
Central	-5.53*	1.75	0.37	1.47
West	-8.36*	1.78	-2.46	1.61
Southeast	-3.61	2.14	2.29	1.88
Male	-5.90*	1.14	0.00	0.59
Female	-5.90*	1.13	0.00	0.60
White	-6.92*	1.02	-1.02	0.52
Hispanic	-3.69	2.60	2.21	2.66
Black	0.19	1.54	6.09*	1.55
Post high school	-6.11*	1.31	-0.21	0.84
Graduated high school	-8.37*	1.42	-2.47*	1.17
Not graduated high school	-8.45*	1.89	-2.55	1.85
Advantaged urban	-5.97*	2.48	-0.07	2.48
Disadvantaged urban	2.40	2.91	8.30*	2.92
Extreme rural	-2.52	2.60	3.38	2.60
Fringes around big cities	-6.36*	2.07	-0.46	1.93
Big cities	-4.75*	1.84	1.15	1.74
Medium cities	-7.17*	2.59	-1.27	2.48
Small places	-5.62*	1.57	0.28	1.22
3rd grade	-3.74*	1.39	2.16	1.18
4th grade	-6.57*	1.03	-0.67	0.48

Indicates mean percentages significantly different from the nation at the .05 level.

Table 8b

Age 13 -- Mean Change in Mathematics Performance From 1972-77

	All Exercises (77 Exercises)				Knowledge (16 Exercises)			
	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error
Nation	-2.04*	0.98			-0.27	0.99		
Northeast	-1.60	1.84	0.44	1.58	-0.27	2.18	0.00	1.80
Central	-2.12	1.98	-0.08	1.60	0.72	2.00	0.99	1.61
West	-1.41	1.74	0.63	1.58	-1.56	1.59	-1.29	1.51
Southeast	-2.58	1.96	-0.54	1.83	0.49	1.76	0.76	1.71
Male	-1.79	0.97	0.25	0.30	0.57	1.02	0.84	0.43
Female	-2.31*	1.07	-0.27	0.31	-1.15	1.06	-0.88	0.45
White	-2.36*	0.84	-0.32	0.50	-0.47	0.90	-0.20	0.50
Hispanic	-2.98	1.50	-0.94	1.59	-2.74	2.29	-2.47	2.31
Black	0.57	1.19	2.61	1.35	2.38	1.78	2.65	1.81
Post high school	-2.54*	0.91	-0.50	0.50	-0.66	1.02	-0.39	0.67
Graduated high school	-2.56*	0.95	-0.52	0.56	-0.30	1.10	-0.03	0.71
Not graduated high school	-2.53*	1.07	-0.49	0.97	-1.62	1.33	-1.35	1.32
Advantaged urban	-4.23*	1.08	-2.19	1.30	-2.65	1.97	-2.38	1.98
Disadvantaged urban	1.97	2.67	4.01	2.66	4.96	3.34	5.23	3.28
Extreme rural	-4.80	2.65	-2.76	2.52	-4.77	3.06	-4.50	2.94
Fringes around big cities	-0.47	1.64	1.57	1.39	1.02	1.99	1.29	1.71
Big cities	-1.89	1.91	0.15	1.76	1.02	1.91	1.29	1.83
Medium cities	3.17	3.26	5.21	3.06	4.31	3.02	4.58	2.86
Small places	-3.37*	1.48	-1.33	1.16	-1.65	1.52	-1.38	1.16
7th grade	-0.77	1.12	1.27	0.77	0.02	1.37	0.29	1.01
8th grade	-2.40*	0.94	-0.36	0.36	-0.12	0.93	0.15	0.41

	Skills (37 Exercises)				Computation (17 Exercises)			
	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error
Nation	-2.42*	1.11			-2.78*	1.18		
Northeast	-1.67	1.90	0.75	1.69	-1.82	1.89	0.96	1.73
Central	-3.17	2.15	-0.75	1.77	-3.92	2.23	-1.14	1.83
West	-0.42	2.21	2.00	1.93	-0.33	2.28	2.45	2.01
Southeast	-3.87	2.29	-1.45	2.09	-4.35	2.67	-1.57	2.38
Male	-2.01	1.16	0.41	0.39	-2.69*	1.24	0.09	0.40
Female	-2.82*	1.20	-0.40	0.39	-2.85*	1.25	-0.07	0.41
White	-2.87*	0.99	-0.45	0.54	-3.17*	1.02	-0.39	0.55
Hispanic	-2.44	1.93	-0.02	2.00	-4.04	2.39	-1.26	2.35
Black	0.71	1.38	3.13*	1.50	0.30	1.66	3.08	1.59
Post high school	-3.24*	1.08	-0.82	0.54	-3.77*	1.07	-0.99	0.59
Graduated high school	-3.01*	1.09	-0.59	0.67	-3.59*	1.20	-0.81	0.74
Not graduated high school	-2.77*	1.25	-0.35	1.01	-2.51	1.66	0.27	1.37
Advantaged urban	-5.29*	1.41	-2.87	1.59	-3.91*	1.66	-1.13	1.85
Disadvantaged urban	1.92	2.87	4.34	2.84	2.74	3.85	5.32	3.75
Extreme rural	-4.15	2.57	-1.73	2.51	-4.67	3.36	-1.89	3.20
Fringes around big cities	-0.61	1.93	1.81	1.60	-0.97	2.03	1.81	1.70
Big cities	-1.39	2.15	-0.97	1.95	-2.87	2.21	-0.09	2.04
Medium cities	4.13	3.73	6.55	3.49	2.69	4.00	5.47	3.72
Small places	-3.76*	1.59	-1.34	1.29	-4.31*	1.79	-1.53	1.35
7th grade	-0.35	1.23	2.07*	0.86	0.18	1.44	2.96*	0.96
8th grade	-3.11*	1.08	-0.69	0.44	-3.67*	1.11	-0.89	0.45

*Indicates mean percentages significantly different from the nation at the .05 level.

Table 8b (Continued)

Age 13 -- Mean Change in Mathematics Performance From 1972-77

	Understanding (12 Exercises)				Applications (12 Exercises)			
	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error
Nation	-1.91	0.99			-3.89*	1.05		
Northeast	-1.22	1.65	0.69	1.51	-3.55	2.16	-0.16	1.86
Central	-2.52	2.28	-0.61	1.76	-2.30	2.26	1.09	1.77
West	-1.52	1.67	0.39	1.57	-4.17*	1.59	-0.78	1.54
Southeast	-1.89	2.01	0.02	1.86	-3.41	2.12	-0.02	1.96
Male	-2.25*	0.99	-0.34	0.44	-3.86*	1.07	-0.47	0.53
Female	-1.60	1.17	0.31	0.45	-2.96*	1.27	0.43	0.55
White	-2.34*	0.90	-0.43	0.52	-3.39*	0.94	0.00	0.52
Hispanic	-1.36	1.52	0.55	1.63	-6.62*	1.66	-3.23	1.92
Black	0.46	1.59	2.37	1.69	-2.23	1.24	1.16	1.41
Post high school	-2.20*	1.07	-0.29	0.71	-3.26*	1.11	0.13	0.68
Graduated high school	-2.57*	1.21	-0.66	0.89	-4.21*	1.21	-0.82	0.74
Not graduated high school	-2.24	1.52	-0.33	1.35	-3.34*	1.56	0.05	1.57
Advantaged urban	-1.36	1.59	0.55	1.65	-5.95*	1.64	-2.56	1.80
Disadvantaged urban	1.74	3.48	3.65	3.37	-1.70	2.84	1.69	2.71
Extreme rural	-4.52	3.30	-2.61	3.14	-7.14*	3.21	-3.75	2.95
Fringes around big cities	-0.42	1.43	1.49	1.41	-2.08	2.14	1.31	1.77
Big cities	-0.76	2.38	1.15	2.11	-2.37	2.31	1.02	2.08
Medium cities	3.51	3.40	5.42	3.22	-1.65	2.79	1.74	2.69
Small places	-3.94*	1.62	-2.03	1.30	-3.96*	1.53	-0.57	1.24
7th grade	-0.78	1.27	1.13	0.96	-3.12*	1.35	0.27	0.95
8th grade	-2.26*	1.03	-0.35	0.43	-3.47*	1.02	-0.08	0.42

Indicates mean percentages significantly different from the nation at the .05 level.

TABLE 8c

Age 17 -- Mean Change in Mathematics Performance From 1973-78

	All Exercises (102 Exercises)				Knowledge (18 Exercises)			
	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error
Nation	-3.55*	0.65			0.12	0.76		
Northeast	-3.21*	1.18	0.34	1.08	0.02	1.54	-0.10	1.33
Central	-1.68	1.31	1.87	1.01	1.74	1.44	1.62	1.13
West	-5.82*	1.31	-2.27	1.15	-2.07	1.31	-2.19	1.22
Southeast	-3.76*	1.23	-0.21	1.20	0.66	1.53	0.54	1.44
Male	-3.92*	0.70	-0.37	0.30	-0.25	0.82	-0.37	0.40
Female	-3.24*	0.73	0.31	0.30	0.43	0.86	0.31	0.37
White	-3.46*	0.57	0.09	0.35	0.45	0.65	0.33	0.39
Hispanic	-2.32*	1.05	1.23	1.13	-0.62	1.90	-0.74	1.93
Black	-2.62*	0.81	0.93	0.81	-0.38	1.50	-0.50	1.34
Post high school	-3.77*	0.62	-0.22	0.35	-0.48	0.74	-0.60	0.46
Graduated high school	-4.57*	0.57	-1.02*	0.42	-0.59	0.87	-0.71	0.57
Not graduated high school	-4.74*	0.85	-1.19	0.70	0.30	1.16	0.18	1.03
Advantaged urban	-2.24	1.30	1.31	1.29	0.72	1.17	0.60	1.28
Disadvantaged urban	-5.68*	1.92	-2.13	2.02	-3.63	2.54	-3.75	2.56
Extreme rural	-2.03	1.68	1.52	1.59	2.36	2.02	2.24	1.98
Fringes around big cities	-2.88*	1.42	0.67	1.30	0.54	1.49	0.42	1.29
Big cities	-1.65	1.91	1.90	1.66	-0.16	2.13	-0.28	1.79
Medium cities	-2.25	1.98	1.30	1.92	1.16	2.43	1.04	2.32
Small places	-4.22*	0.78	-0.67	0.70	0.53	0.80	0.41	0.78
10th grade	-2.11*	0.96	1.44	0.74	0.98	1.21	0.86	1.00
11th grade	-3.60*	0.64	-0.05	0.23	0.44	0.71	0.32	0.28
12th grade	-3.63*	0.92	-0.08	0.77	-1.40	1.41	-1.52	1.13

	Skills (46 Exercises)				Computation (17 Exercises)			
	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error
Nation	-4.56*	0.72			-4.59*	0.84		
Northeast	-4.47*	1.37	0.09	1.24	-3.33	1.85	1.26	1.58
Central	-2.29	1.41	2.27*	1.10	-3.26*	1.58	1.33	1.26
West	-6.51*	1.55	-1.95	1.33	-5.89*	1.69	-1.30	1.47
Southeast	-5.46*	1.30	-0.90	1.26	-6.27*	1.56	-1.68	1.52
Male	-4.78*	0.80	-0.22	0.40	-4.96*	0.91	-0.37	0.51
Female	-4.36*	0.82	0.20	0.38	-4.27*	1.04	0.32	0.48
White	-4.57*	0.65	-0.01	0.39	-4.62*	0.78	-0.03	0.45
Hispanic	-3.66*	1.44	0.90	1.50	-4.65*	2.29	-0.06	2.21
Black	-3.05	1.02	1.51	0.99	-3.06	1.61	1.53	1.54
Post high school	-4.57*	0.74	-0.01	0.44	-4.93*	0.81	-0.34	0.57
Graduated high school	-5.56*	0.68	-1.00	0.50	-5.36*	0.97	-0.77	0.66
Not graduated high school	-6.35*	1.00	-1.79*	0.80	-6.63*	1.39	-2.04	1.15
Advantaged urban	-4.11*	1.51	0.45	1.50	-4.05*	1.58	0.54	1.60
Disadvantaged urban	-6.33*	2.04	-1.77	2.12	-5.43*	2.56	-0.84	2.62
Extreme rural	-2.31	1.78	2.25	1.69	-3.99	2.00	0.60	1.90
Fringes around big cities	-4.22*	1.62	0.34	1.48	-4.12*	1.80	0.47	1.67
Big cities	-2.59	2.02	1.97	1.78	-3.32	2.64	1.27	2.28
Medium cities	-2.52	2.48	2.04	2.38	-3.06	2.25	1.53	2.17
Small places	-5.28*	0.90	-0.72	0.79	-5.10*	1.12	-0.51	0.93
10th grade	-3.47*	1.24	1.09	0.99	-3.13	1.58	1.46	1.18
11th grade	-4.66*	0.70	-0.10	0.26	-4.74*	0.85	-0.15	0.31
12th grade	-4.14*	1.12	0.42	0.95	-4.95*	1.37	-0.36	1.22

*Indicates mean percentages significantly different from the nation at the .05 level.

Table 8c (Continued)

Age 17 -- Mean Change in Mathematics Performance From 1973-78

	Understanding (13 Exercises)				Applications (25 Exercises)			
	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error	Mean Change in Percent Correct	Standard Error	Mean Change in Difference From the Nation	Standard Error
Nation	-4.44*	0.86			-3.85*	0.65		
Northeast	-3.29*	1.44	1.15	1.34	-3.14*	1.13	0.71	1.04
Central	-2.40	1.69	2.04	1.32	-2.62	1.34	1.23	1.00
West	-8.93*	1.89	-4.49*	1.59	-5.61*	1.21	-1.76	1.10
Southeast	-3.17*	1.43	1.27	1.42	-4.09*	1.33	-0.24	1.26
Male	-4.63*	0.97	-0.19	0.50	-4.57*	0.76	-0.72	0.40
Female	-4.28*	1.00	0.16	0.50	-3.25*	0.73	0.60	0.39
White	-4.32*	0.84	0.12	0.40	-3.81*	0.59	0.04	0.35
Hispanic	-2.77	2.31	1.67	2.28	-0.82	1.12	3.03*	1.22
Black	-3.59*	1.27	0.85	1.33	-2.91*	0.75	0.94	0.80
Post high school	-4.58*	0.85	-0.14	0.60	-4.24*	0.74	-0.39	0.43
Graduated high school	-5.84*	1.03	-1.40	0.75	-4.89*	0.68	-1.04	0.57
Not graduated high school	-5.82*	1.49	-1.38	1.34	-4.83*	0.87	-0.98	0.76
Advantaged urban	-1.51	1.41	2.93*	1.46	-1.30	1.85	2.55	1.73
Disadvantaged urban	-8.57*	2.38	-4.13	2.51	-4.42*	1.89	-0.57	1.96
Extreme rural	-3.76	2.32	0.68	2.15	-3.74*	1.78	0.11	1.67
Fringes around big cities	-4.94*	1.87	-0.50	1.69	-1.80	1.42	2.05	1.30
Big cities	-1.07	2.28	3.37	2.06	-1.25	1.82	2.60	1.60
Medium cities	-2.40	1.65	2.04	1.72	-4.11*	1.57	-0.26	1.52
Small places	-5.10*	1.22	-0.66	0.95	-5.19*	0.85	-1.34	0.74
10th grade	-1.94	1.56	2.50	1.34	-1.89*	0.88	1.96*	0.77
11th grade	-4.59*	0.92	-0.15	0.32	-4.01*	0.66	-0.16	0.25
12th grade	-4.71*	1.22	-0.27	1.28	-3.75*	1.20	0.10	1.05

Indicates mean percentages significantly different from the nation at the .05 level.

Mathematical Knowledge

Mathematical knowledge is the first cognitive-process level that will be discussed. This level refers to the recall and recognition of mathematical ideas expressed in words, symbols or figures; it relies, for the most part, on memory. Exercises requiring naming numbers, recalling basic number facts and naming geometric figures are examples of the exercises categorized as knowledge. On exercises like 6 + 3 and 10 - 6, we find that from about 79 percent to 97 percent of students responded correctly, depending on age and arithmetic operation. Performance on basic facts for multiplication and division ran a little lower. Between 85 percent and 97 percent of students at all ages named simple figures such as square, triangle and circle. In general, the level of achievement on National Assessment's mathematical knowledge items seems to be satisfactory. On exercises categorized as knowledge, there were no significant national changes in mean performance between the first and second assessments for any age.

Mathematical Skill

Mathematical skill refers to the routine manipulation of mathematical ideas. This process level relies on algorithmic processes, which are standard procedures that always lead to an answer. Exercises that assess mathematical skill assume that the required algorithm has

been learned and practiced and do not require the respondent to decide what to do or to apply the algorithm to a new situation. Computations with whole numbers are classified as skill. From 90 percent of 9-year-olds to 98 percent of age 17-year-olds could add 21 + 54 correctly. When asked to add three numbers of four digits each, 9-year-olds' performance dropped to 51 percent, but 90 percent of 17-year-olds still answered correctly.

Operations with fractions and decimals are also classified as mathematical skills. Simple reduction of fractions and other equivalence operations with fractions showed performances ranging from 57 percent to 78 percent at age 13 and from 78 percent to 93 percent at age 17. Addition and multiplication of fractions yielded results that ranged from 28 percent to 74 percent at age 13 with most exercises in the 30 to 45 percent range. On these items, age 17 respondents tended to be about 15 percent higher than 13-year-olds in achievement. Although many contend that decimal operations should be easier than fractions, the performance on decimal exercises tended to be lower than was expected. In fact, overall performance on exercises dealing with fractions, decimals and percents was disappointing.

Measurement tasks, reading graphs and tables, geometric manipulation and algebraic manipulation are examples of other mathematical skill exercises. Overall performances on

exercises related to measurement, intuitive geometry and graph and table reading can be viewed as largely acceptable, although results on exercises requiring algebraic manipulation were low.

At age 9, there were no significant national changes in average performance on exercises categorized as skill. Neither were there age 9 national changes in the skill subset classified as computation. However, at both ages 13 and 17 there were significant national performance declines for both the whole set of skill exercises and the computation subset. At age 13, these declines were 2.4 percent and 2.8 percent, respectively, for skill and computation. At age 17, the decline was about 4.6 percent for both classifications of exercises. These declines are in the kinds of learning most emphasized by the "basics" curriculum.

Mathematical Understanding

Mathematical understanding refers to the interpretation and explanation of mathematical knowledge and relies primarily on translation processes. However, understanding involves memory processes as well as processes of associating one fact with another. Often these exercises require translation of a mathematical problem or concept from English or visual respresentation into an algebraic sentence or vice versa.

From 58 percent of 9-year-olds to 86 percent of 17-year-olds understood that the chances of selecting, without looking, the one red marble from a bag of marbles is better with only 5 marbles than with 500. About 65 percent of 17-year-olds understood that measurements are not exact but are to the nearest inch or whatever unit is being used. Understanding the concept of area seems to be troublesome for students at all three ages, as only about three-fourths of the oldest group calculated the area of a rectangle given its dimensions. Congruence was a difficult concept as well, with about 32 percent of the oldest group assuming that simply having the same dimensions would make a parallelogram congruent to a rectangle. From 66 percent at age 9 to 96 percent at age 17 were able to translate a simple word problem into the appropriate number sentence.

There were not enough understanding exercises given to 9-year-olds to provide a valid measure of change from the first to the second assessment. At age 13, there was no significant national change in performance on exercises classified as understanding. However, at age 17 there was a significant decline in average national achievement of 4.4 percent on mathematical understanding exercises.

Mathematical Application

Mathematical application refers to the use of knowledge, skill and understanding and requires judgment as well as memory, algorithmic and translation processes. Exercises classified as application may require recalling and translating knowledge, selecting and carrying out algorithms, making and testing conjectures and evaluating the results.

An example of a one-step word problem is:

How far can a girl ride on a bike in 5 hours if she rides 10 miles per hour?

On this exercise, 54 percent, 88 percent and 94 percent of 9-, 13-, and 17-year-olds, respectively, selected the correct answer. One-step word problems requiring division gave lower results, as did those requiring work with fractions. On one free response exercise, 17-year-olds were asked to cut in half a recipe calling for 3 3/4 cups of pineapple. Only about 30 percent gave 1 7/8 cups of pineapple. Applications requiring the use of percents gave generally low achievement levels. When asked to estimate a 15 percent tip on a dinner bill, about 25 percent of 17-year-olds gave correct responses. Only 18 percent of 13-year-olds and 36 percent of 17-year-olds could identify the percent of discount when a regular price and a discount price were given. A ratio and proportion problem with a drawing was given to the older two ages. The correct answer

was selected by 36 percent and 50 percent of the 13 and 17-year-olds, respectively. Nine- and 13-year-olds were asked how many different combinations of slacks and shirts could be obtained with two slacks and three shirts. They correctly identified six, the right answer, 13 percent and 68 percent of the time, respectively. In general, the performance on this section of exercises appears to be less than satisfactory for all three age levels.

Only on mathematics exercises classified as application exercises were there significant national declines at every age assessed. At age 9, the decline was 5.9 percent, which accounts for most of the overall decline at this age. Thirteen-year-olds' decline was about 3.4 percent, and at age 17 the decline was about 3.8 percent. These declines, coupled with generally low scores on all but the simplest application problems, cause the greatest concern.

Hand Calculator

For each age, in the 1977-78 mathematics assessment a number of exercises were presented both with an electronic hand calculator and in pencil-paper format without a hand calculator. There have been a number of hopes and fears with regard to students' use of hand calculators. Some have hoped that their use in classrooms would free students from so many hours of learning rote computation and permit learning "real" mathematics. Others have feared that the

use of calculators will create students and citizens who cannot function mathematically without the aid of a calculator. There have also been those who hoped calculators might help in closing the mathematics performance gap between the disadvantaged and the rest of the population.

Twenty-two exercises given to 9-year-olds were administered with and without calculators. These exercises were categorized as computation (16 exercises) and problem solving (6 exercises). On the entire set, we find for the nation an 18.1 percent difference between calculator and noncalculator exercises with the advantage going to those working with the calculator. White students showed a 19.2 percent gain with the calculator, while black 9-year-olds showed a 14.5 percent increase in performance with the calculator. Students attending school in advantaged-urban areas did 15.1 percent better with a calculator and those in disadvantaged-urban areas did 18.2 percent better with than without calculators. Disadvantaged-urban and black performance appears to be about as far below that of the nation with calculators as it was without calculators. (See Table 9.)

Table 9

Mean Mathematics Performance on
Exercises Given With and Without Calculators

	All Exercises				Computation Exercises				Problem Solving Exercises			
	No Calculator		Calculator		No Calculator		Calculator		No Calculator		Calculator	
	P-Val	SE	P-Val	SE	P-Val	SE	P-Val	SE	P-Val	SE	P-Val	SE
AGE 9												
Nation	37.9	0.53	56.0	0.82	42.4	0.60	63.8	0.82	25.7	0.57	35.1	0.99
White	39.9	0.58	59.0	0.72	44.5	0.65	66.8	0.69	27.5	0.66	38.2	1.00
Black	27.8	0.98	42.3	1.77	32.0	1.16	50.0	2.05	16.7	1.18	21.8	1.50
Advantaged Urban	48.6	1.47	63.7	1.69	53.1	1.37	71.9	1.85	36.7	2.28	42.0	2.50
Disadvantaged Urban	30.0	1.74	48.2	4.26	34.0	2.08	55.4	4.6	19.2	1.51	28.7	3.88
AGE 13												
Nation	33.6	0.52	35.7	0.72	32.3	0.58	42.3	0.70	35.0	0.57	27.8	0.81
White	36.0	0.48	37.9	0.72	34.8	0.55	44.6	0.70	37.4	0.57	30.0	0.84
Black	21.3	0.53	24.3	0.90	19.7	0.66	30.3	1.27	23.1	0.74	17.2	0.77
Advantaged Urban	39.8	1.20	42.9	2.08	38.0	1.44	49.0	1.62	42.0	1.91	35.6	2.81
Disadvantaged Urban	24.3	1.41	30.4	3.14	22.2	1.76	36.9	3.53	26.9	1.34	22.5	2.81
AGE 17												
Nation	45.4	0.56	52.2	0.91	44.3	0.73	55.5	0.78	46.3	0.54	49.7	1.09
White	48.6	0.48	55.4	0.89	47.3	0.70	58.0	0.79	49.7	0.49	53.4	1.05
Black	25.3	0.64	32.2	1.11	25.9	0.97	39.2	1.18	24.9	0.68	26.7	1.32
Advantaged Urban	54.4	1.39	59.8	2.32	52.6	1.72	62.2	2.24	55.7	1.67	58.0	2.51
Disadvantaged Urban	31.6	1.82	39.9	3.20	30.0	1.64	45.6	2.50	32.8	2.46	35.4	4.00

On those calculator and noncalculator exercises classified as computation, there was a 21.4 percent achievement advantage nationally for those using calculators. The four population subgroups discussed above all showed similar increases for calculator computation over the same items without calculators. These increases ranged from 18.1 percent to 22.4 percent. For those exercises categorized as problem solving, there was a 9.4 percent national advantage for those 9-year-olds who used a calculator. Although the absolute value of the differences is somewhat smaller for blacks and advantaged-urban (around 5 to 6 percent), the sampling variation is large enough that there is not in fact any significant difference in these rates of increase.

At age 13, there were again 22 exercises given both with and without calculators, with 12 categorized as computation and 10 categorized as problem solving. Over the whole set of exercises, there is only about a 2.1 percent increase in national performance from no calculator to calculator responses. The subgroup performance increases look similar to the national increases for calculators. On exercises classified as computation, there is about a 9.9 percent increase in achievement nationally for those using the calculators over those without the calculators. The advantage for those with calculators remains about 10 percent for the four subgroups on this set of computation

exercises. The set of exercises classified as problem solving show an advantage in national achievement for the noncalculator group of about 7.2 percent over the performance of students with a calculator. The various subgroups also show a similar trend of either no significant different or an advantage for those students with no calculator.

There were 25 exercises given to 17-year-olds both with and without calculators. Of these, 11 were classified as computation and 14 were classified as problem solving. Nationally, 17-year-olds with a calculator performed 6.8 percent above those without a calculator when performance was averaged across all 25 exercises. The subgroup performance differences were of similar magnitude and in the same direction. Nationally, the calculator group had about an 11.2 percent advantage in performance on computation items over the noncalculator group. This advantage dropped to only 3.4 percent for the set of exercises classified as problem solving. For both item sets, the differences in performance between those with and without calculators were about the same for the population subgroups reported here as for the differences in performance for the nation as a whole.

The comparisons between the subsets of computation and problem solving exercises given with and without calculators suggest that problem solving and mathematical applications

need more attention in the curriculum. Clearly, the presence of a calculator does not make students into better problem solvers unless they know how to solve the problem.

Group Change Results

There were a number of significant changes in population subgroup performance from the first to the second mathematics assessments. The most interesting are those for respondents who are black or disadvantaged-urban. At age 9, there were some significant improvements for blacks in mathematics achievement. In addition, black 9-year-olds closed the gap between their performance and that of the nation, as did those attending schools in disadvantaged-urban areas. The improvement for blacks did not extend to the mathematics application exercises. However, their performance did not decline significantly on this set of exercises, and neither did that of the disadvantaged-urban group. At age 13, neither of these two groups declined significantly either across all exercises or on exercises in any of the four major process categories. At age 17, blacks declined significantly in overall performance as well as on mathematical skills and understanding items. They did not, however, register a significant change on exercises classified as mathematical application. At age 17, the disadvantaged-urban group declined significantly on most exercise sets.

The results for the two population subgroups are not independent since many respondents are in both groups. The results may be indicating that programs which have been aimed at improving educational situations for disadvantaged do help. Most of these efforts have been aimed at younger students and that is where the results are most positive. The ultimate goal, of course, is for some impact to be made for high school students.

Age 17 Mathematics Course Taking

In the second mathematics assessment, National Assessment asked 17-year-old respondents to indicate the number and types of mathematics courses they had taken. The results are given in Table 10. Nearly three-fourths of all 17-year-olds in school say they have taken a first-year algebra course and about half of them have taken a formal geometry course. The number taking higher-level mathematics courses tails off rather rapidly beginning with the second-year algebra course. There are more males in upper level courses than females, but rarely are these differences large enough to be statistically significant.

TABLE 10

Mathematics Courses Taken by 17-Year-Olds, 1977-78

Course	a Percent Having Completed At Least 1/2 Year
General or Business Mathematics	46%
Prealgebra	46
Algebra I	72
Geometry	51
Algebra II	37
Trigonometry	13
Precalculus/calculus	4
Computer Programming	5

Table 11 shows performance levels for males and females who reported taking various types of mathematics courses. These data do not support the hypothesis that course taking is the only major cause of observed average male mathematics achievement superiority at the end of high school. The data indicate that more mathematics course work may improve performance. However, since most NAEP exercises do not require knowledge of formal geometry or a second course in algebra, one wonders why the overall 17-year-old performance is not higher.

Table 11

Age 17 Mean Performance Percentages 1977-78

		Mathematical Knowledge		Mathematical Skills	
		Mean Percentage	Standard Error	Mean Percentage	Standard Error
Nation		71.71	0.45	58.97	0.53
Female	Took less than Algebra I	57.52	0.70	41.44	0.56
	Took Algebra I	65.27	0.50	51.74	0.56
	Took Geometry	74.85	0.49	59.67	0.63
	Took Algebra II	78.88	0.56	68.26	0.57
	Took more than Algebra II	85.87	0.66	77.60	0.72
Male	Took less than Algebra I	58.13	0.66	42.08	0.62
	Took Algebra I	67.48	0.52	54.07	0.72
	Took Geometry	77.41	0.65	62.06	0.63
	Took Algebra II	81.11	0.43	71.56	0.60
	Took more than Algebra II	89.05	0.41	81.39	0.55

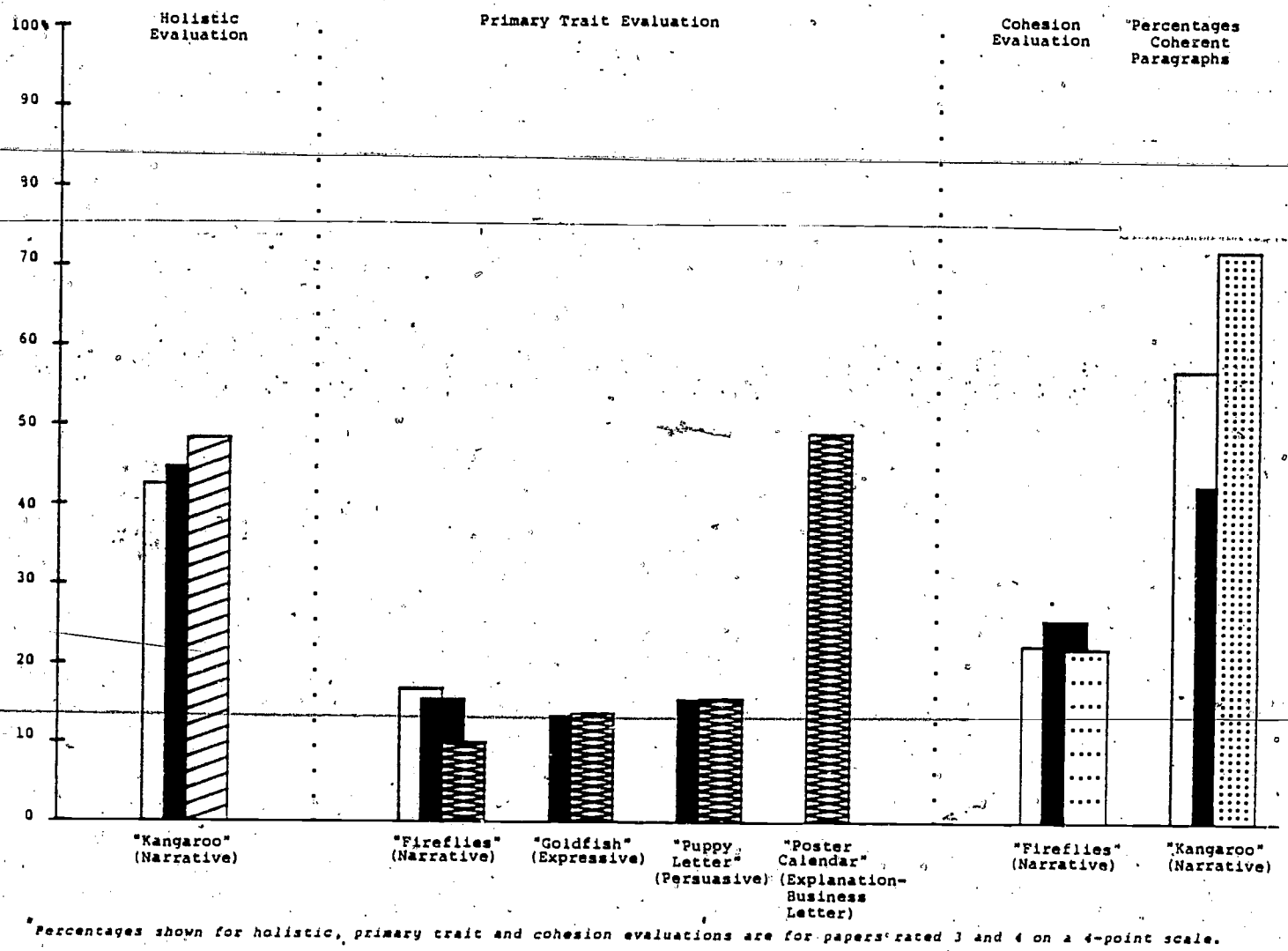
		Mathematical Understanding		Mathematical Applications	
		Mean Percentage	Standard Error	Mean Percentage	Standard Error
Nation		58.01	0.53	43.48	0.49
Female	Took less than Algebra I	40.90	0.66	27.95	0.37
	Took Algebra I	50.13	0.62	34.53	0.61
	Took Geometry	59.92	0.58	43.53	0.52
	Took Algebra II	65.33	0.56	48.73	0.64
	Took more than Algebra II	75.57	0.90	60.29	0.94
Male	Took less than Algebra I	42.65	0.48	30.39	0.48
	Took Algebra I	52.72	0.72	38.92	0.72
	Took Geometry	63.75	0.75	48.07	0.70
	Took Algebra II	69.58	0.69	55.06	0.74
	Took more than Algebra II	80.27	0.54	67.69	0.66

Overview

The results in this section of the paper are based on three national assessments of writing, the first conducted in 1969-70, the second in 1973-74 and the third in 1978-79. Some writing tasks were included in all three assessments, while others were included only in the last assessment. For determining changes in performance, raters scored random mixtures of papers collected from the different assessments.

Changes in the writing of 9-year-olds were assessed with four writing exercises, and a fifth exercise provided further baseline information. One narrative exercise used to measure change across three assessments was evaluated holistically, and another was evaluated for both cohesion and rhetorical effectiveness (primary trait evaluation). Both were exhaustively analyzed in terms of syntax and mechanics. The remaining tasks given to 9-year-olds -- one expressive essay, one persuasive letter and one routine business letter -- were judged for rhetorical effectiveness. Exhibit 1 displays national percentages of good papers for 9-year-olds for all of the writing tasks.

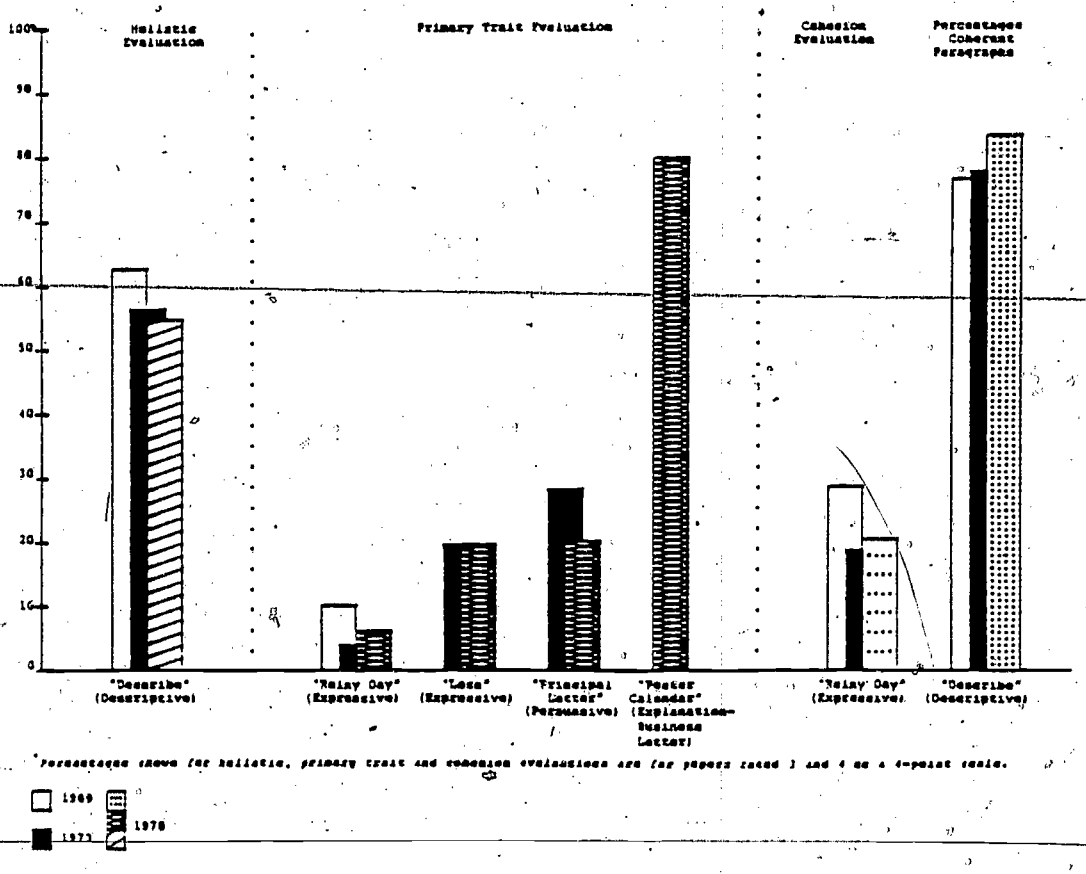
EXHIBIT 1. National Percentages of Good* Papers, Age 9, 1970, 1974, 1979



*Percentages shown for holistic, primary trait and cohesion evaluations are for papers rated 3 and 4 on a 4-point scale.

Changes in the writing of 13-year-olds were assessed with four writing exercises, one of which was evaluated holistically, one of which was evaluated for both cohesion and rhetorical effectiveness (primary trait evaluation) and two of which were evaluated for rhetorical effectiveness alone. A fifth exercise provided further baseline information. In addition, two of the essays were subjected to a detailed analysis of syntactic and mechanical features. Students also answered a number of questions about their writing instruction. Exhibit 2 displays national percentages of performance for 13-year-olds.

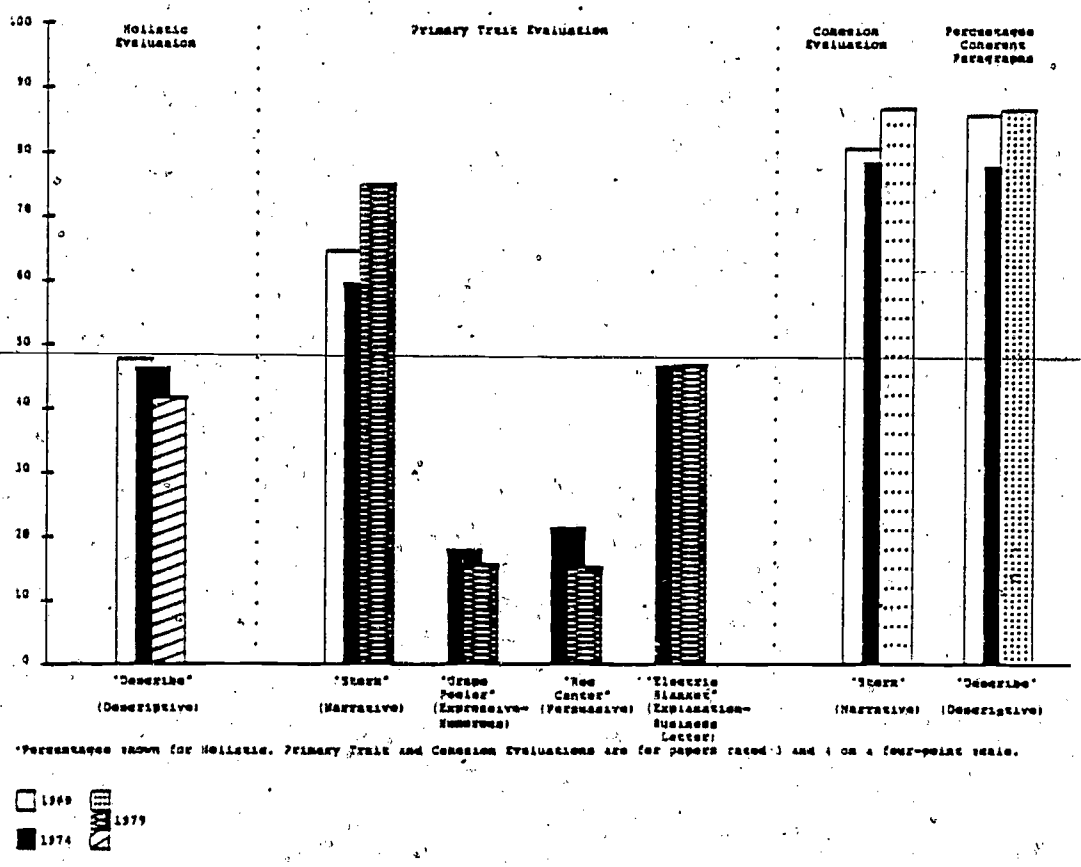
EXHIBIT 2. National Percentages of "Good" Papers, Age 13, 1969, 1973, 1978



*Percentages shown for holistic, primary trait and cohesion evaluations are for papers rated 3 and 4 on a 4-point scale.

Changes in the writing of 17-year-olds were assessed with five writing exercises, one of which was evaluated holistically, one of which was evaluated for both cohesion and rhetorical effectiveness (primary trait evaluation) and three of which were evaluted for rhetorical effectiveness alone. In addition, two of the five essays were exhaustively analyzed in terms of syntax and mechanics. Students were also asked a number of questions about their school experiences and instruction. Exhibit 3 displays national results for all of the writing tasks.

EXHIBIT 3. National Percentages of Good* Papers, Age 17, 1969, 1974, 1979



*Percentages shown for Holistic, Primary Trait and Cohesion Evaluations are for papers rated 3 and 4 on a four-point scale.

General Fluency

Holistic scoring, a procedure in which readers concentrate on forming an overall impression of each paper relative to the other papers they have read, did not reveal significant changes in the average writing performance of 9-year-olds between 1970 and 1979. However, a six percent increase in papers rated 3 and 4 (on a four point scale) indicates that there may have been some improvement in quality.

Although 9-year-olds were asked to tell a story and general fluency results for 13- and 17-year-olds were based on a task requiring description, it is still interesting to note that the possible improvement noted at age 9 was not observed at ages 13 and 17. At age 13, holistic evaluation revealed a decline in the quality of the essays written. However, decline took place mainly between 1969 and 1973; little changed during the late seventies. For age 17, holistic evaluation did not reveal major changes, but did suggest a slight decline in quality as six percent fewer papers were rated 3 and 4.

Specific Skills

Both the "Standards for Basic Skills Writing Programs" developed by the National Council of Teachers of English (NCTE) and the National Assessment writing objectives call for students to write for a wide range of purposes and to

write in a variety of forms. Thus, the assessment has gathered information about expressive writing, informative writing and persuasive writing, -- including stories, letters, notes and essays. Although some of the same skills are involved in each kind of writing, there are challenges and strategies unique to each, as the results amply illustrate.

Evaluations of student writing for specific tasks were based on the primary trait scoring system. This approach to essay evaluation involves isolating an important writing skill, developing a task to measure it and articulating four levels of proficiency. Generally, level "1" indicates no evidence of the skill; level "2," marginal evidence; level "3," solid performance; and level "4," very good performance. When a reader is rating papers, he or she is rating each paper against criteria spelled out in the scoring guide for that particular task.

Expressive Writing

Both 9- and 17-year-olds were asked to invent a story that explained the situation in a picture. Nine-year-olds were given a picture of a little girl collecting lightning bugs, or fireflies, and asked to write about what the girl was doing and what she might do next. The national results show this was not an easy task for 9-year-olds. In 1970 and 1974, only 16 - 17 percent wrote a narrative judged to be

level 3 or 4; in 1979 the proportion dropped to 10 percent. The tendency was to "tell about" or explain aspects of the picture, not to invent a story. In contrast, 17-year-olds had little difficulty with their narrative task -- to look at a picture of a stork and make up a story about it. Although 17-year-olds' performance declined between 1969 and 1974, it rose considerably from 1974 to 1979. In 1979, three-fourths of the 17-year-olds wrote competent narratives.

At age 9, rhetorical skill on an expressive essay assessed in 1974 and 1979 remained stable. The task, which asked children to write about being something besides a person (goldfish, airplane horse, tree, etc.), was difficult for students in both assessments. About 13-14 percent of the papers received scores of 3 or 4 and 37-40 percent received scores of 2, 3 or 4.

Thirteen-year-olds were given two tasks asking for expression of feelings. The first, an essay about how a rainy school morning makes you feel, required creation of a mood. Even though about two-thirds of the students demonstrated minimal skill in each of the three assessments, performance dropped four percent over the decade for the better papers. On the other expressive task, requiring skill in expressing value and feeling, performance remained at the same level. On this task, which asked students to write about what it is like to lose something important,

about half the students showed minimal ability and 20 percent wrote good papers in both 1973 and 1978.

An expressive task given to 17-year-olds in the 1974 and 1979 assessments required a humorous letter about an electric grape peeler. The task calls for some obvious qualifiers, of course. People have different senses of humor, and some undoubtedly would not find the situation particularly funny -- especially in a testing situation. On the other hand, students simply may not be skilled at humorous writing. Humorous writing is difficult and we would not expect, therefore, that a great many 17-year-olds would do well. The results bear this out. Slightly more than one-third of the students wrote a minimally competent paper in both assessments, but fewer than a fifth clearly attempted to be humorous.

Granted, the expressive tasks given to 9-, 13- and 17-year-olds were difficult and some astonishingly wonderful papers were written. Also, in most cases, expressive writing skills seem to be improving or remaining stable. Still, the tendency of 9-year-olds to write less imaginative and more literal papers and the low percentages of performance at all three ages indicate room for improvement.

Persuasive Writing

For a persuasive writing task, 9-year-olds were asked to imagine they were moving into a new apartment where dogs were banned and had to write the landlord a letter asking that they be allowed to keep their puppy. The task requires a letter that describes the situation and presents arguments that might change the landlord's mind -- either reasonable arguments or appeals to the landlord's feelings. Achievement remained the same between assessments with about 44-46 percent of the students including some appeals and about 16 percent writing letters containing good appeals.

Thirteen-year-olds were asked to write the principal of their school about one thing that could be done to make things better at their school. In order to write a successful letter, a student had to consider the audience, focus clearly on a single problem and argue convincingly that the effort would be worthwhile. On this persuasive task, there was a decline in the percentages of successful letters between 1973 and 1978. The percent able to do a marginal job declined from 69 to 64 percent, and the proportion of letters judged competent or better dropped from 28 to 20 percent.

Rhetorical skill on a persuasive writing task also declined between the last two assessments for 17-year-olds. They were asked to write a speech for a public hearing supporting or opposing a plan to convert an old house into a

recreation center for young people. Students could have appealed to general truths, to experience or to social values in attempts to sway their audience. The proportions writing minimally acceptable papers dropped from 78 to 73 percent, and those writing successful papers declined from 21 to 15 percent.

The disappointing results for persuasive writing, especially at ages 13 and 17, may indicate that students are not given many opportunities to use higher-level cognitive skills in their writing. They may consider writing primarily in the context of giving or retelling information, rather than as a way to present and defend their own ideas or point of view.

Informative Writing

About half the 9-year-olds and 80 percent of the 13-year-olds wrote successful letters to a mail order firm. They were given a mail order advertisement for a poster calendar, given several calendars to choose from and asked to write a letter requesting the calendar of their choice. The exercise required clear communication of the information necessary to insure receipt of a calendar. In other words, the letter needed to include the sender's name and address and a request for a particular calendar.

Seventeen-year-olds were asked to imagine that they ordered an electric blanket from The Big Mart Company, had

received word it was out of stock, had subsequently been billed for it and then finally had received a letter threatening to turn their past due account over to a collection agency. They were to answer this letter, explaining the situation and the fact they had not yet sent the money because they had not yet received the blanket. Performance on this task remained stable between 1974 and 1979 with about two-thirds of the students writing letters that were at least marginally adequate and about half writing successful papers.

Students at all three age levels appear reasonably successful at conveying straightforward information in short notes and letters. Yet, the results show that one-third to one-half the 17-year-olds did not write an effective letter of complaint. These findings may be some cause for concern, as they reflect an inability to handle the routine writing tasks encountered in daily life.

Cohesion/Coherence, Syntax and Mechanics

Most writing programs address organizational strategies, sentence structure, grammar, punctuation, capitalization and spelling. While there were increases at ages 9 and 13 in percentages of coherent paragraphs and no declines at age 17, the results for papers showing good cohesion and coherence are only marginally encouraging.

The cohesion measure of "The Fireflies" narrative task, given at age 9, indicated little change between 1970 and 1979 with about 22 percent of the students writing cohesive papers in both assessments. The percentage of expressive papers written by 13-year-olds displaying good cohesion was low in 1969 and even lower in 1978. Twenty-nine percent of the papers showed good cohesion in 1969; by 1973, the percentage had dropped to 19 percent and in 1978 it was 21 percent. The results for 17-year-olds on the "Stork" writing task suggest that by high school students have a good grasp of the narrative organizing strategy. A measure of cohesion revealed that between the 1969 and 1979 assessments the percentage of papers displaying good cohesion rose from 80 to 86 percent.

There are indications that the embedding and subordination skills of 9-year-olds may have improved from 1970 to 1979, while little changed in proportions using these structures for 13- or 17-year-olds. However, as the results for the 1978-79 assessment shown in Table 12 indicate, the papers are not particularly sophisticated at any age level.

TABLE 12

Means and Percentiles for Errors in Papers
Ages 9, 13 and 17, 1978-79†

	Age 9						Age 13						Age 17					
	Mean	Q1	1979 Median	Q3	90th	Mean Change 1970-79	Mean	Q1	1978 Median	Q3	90th	Mean Change 1969-78	Mean	Q1	1979 Median	Q3	90th	Mean Change 1969-79
	Narrative ("Fireflies")						Expressive ("Rainy Day")						Narrative ("Stork")					
% sentence fragments	6	0	0	0	29	2.5*	4	0	0	0	20	0.9	2	0	0	0	8	0.8*
% run-on sentences	14	0	0	17	52	-0.6	8	0	0	0	33	1.1	5	0	0	6	17	1.3*
% awkward sentences	28	0	20	50	100	0.7	25	0	22	43	67	-2.4	15	0	11	23	40	0.5
# capitalization errors	1	0	0	1	2	0.2*	0	0	0	0	1	0.1	1	0	0	1	2	0.1
% misspelled words	11	3	8	14	24	0.6	4	0	3	5	9	0.1	2	1	2	3	6	0.5*
% word-choice errors	1	0	0	1	3	-0.3*	1	0	0	2	3	0.1	1	0	0	1	2	0.1
% sentences with agreement errors	8	0	0	0	50	2.4	5	0	0	0	25	0.9	2	0	0	0	11	0.0
# total punctuation errors	2	0	1	3	6	0.2	3	1	2	4	6	-0.1	6	3	5	8	13	0.2
Number of respondents			596						680						722			
	Narrative ("Kangaroo")						Descriptive ("Describe")						Descriptive ("Describe")					
% sentence fragments	7	0	0	0	25	0.1	6	0	0	0	15	2.2*	4	0	0	0	14	-0.1
% run-on sentences	15	0	0	25	50	0.3	15	0	6	25	50	2.8	7	0	0	12	33	1.9
% awkward sentences	19	0	0	33	50	-5.8*	23	6	19	33	50	2.4	19	0	15	29	50	3.2
# capitalization errors	1	0	0	1	2	0.1	1	0	0	1	4	0.5*	1	0	0	1	2	0.5*
% misspelled words	9	3	6	13	20	0.4	5	2	4	7	11	0.8*	3	1	2	5	8	0.9
% word-choice errors	1	0	0	1	2	-0.1	1	0	0	1	2	-0.1	1	0	0	1	2	-0.1
% sentences with agreement errors	9	0	0	13	33	-2.8	11	0	0	17	33	-0.7	8	0	0	13	25	1.6
# total punctuation errors	1	0	1	2	3	0.3*	3	1	3	5	8	-0.0	3	1	3	4	7	0.7
Number of respondents			493						536						538			

** Statistically significant at the .05 level.*

† Figures for means and percentiles have been rounded to the nearest tenth.

Proportions of mechanical errors in papers seem to have changed little across the last decade. However, writers at all three ages seem to be divided into two camps--a majority who display a general grasp of written conventions and a minority who display massive problems with written language. As the 1978-79 results shown in Table 13 indicate, it appears that a considerable proportion of young people, from 10-25 percent, do not understand the conventions of written language.

Group Results

Group results and changes in them were quite consistent across the three ages. Females wrote more good papers than males in all assessments and the difference did not change appreciably for any age group. Black students improved either absolutely or relatively on many writing tasks, particularly at ages 13 and 17. The disadvantaged-urban group made steady gains at age 17 but lost ground at age 13 and remained at a constant level below the nation at age 9.

Writing Instruction

The National Assessment objectives developed for the fourth writing assessment place heavy emphasis on student understanding of and ability to manage the writing process.

TABLE 13

Means and Percentiles for Number of T-Units and T-Unit Constituents, Expressive Papers, Ages 9, 13 and 17, 1978-79†

	Age 9						Age 13						Age 17					
	Mean	Q1	1979 Median	Q3	90th	Mean Change 1970-79	Mean	Q1	1978 Median	Q3	90th	Mean Change 1969-78	Mean	Q1	1979 Median	Q3	90th	Mean Change 1969-79
# T-units/essay	5.4	2.0	4.0	8.0	12.0	-0.08	6.1	4.0	6.0	8.0	11.0	-0.51	13.6	9.0	13.0	17.0	21.0	-0.27
Avg. # words/T-unit	10.4	7.5	9.1	11.8	15.5	1.17*	12.8	10.0	12.0	15.0	18.7	-0.10	11.4	9.2	10.8	12.8	14.9	-0.01
Avg. # subordinations (embedding)/T-unit	1.1	0.5	1.0	1.4	2.0	0.14*	1.9	1.2	1.7*	2.4	3.3	0.06	1.7	1.1	1.5	2.1	2.6	0.04
Avg. # subordinate clauses/T-unit	0.3	0.0	0.2	0.4	0.8	0.03	0.8	0.4	0.7	1.0	1.5	0.06	0.5	0.3	0.4	0.6	0.8	0.01
Avg. # words/clause	7.4	5.6	6.7	8.5	11.0	0.40*	6.1	5.3	6.1	6.9	7.6	-0.24*	7.3	6.4	7.0	7.9	9.0	-0.09
Avg. # nominalizations/T-unit	0.3	0.0	0.1	0.3	0.7	0.08	0.5	0.2	0.4	0.7	1.0	0.02	0.3	0.1	0.2	0.4	0.5	0.01
Avg. # adjectival (noun) modifications/T-unit	0.7	0.3	0.5	1.0	1.3	0.03	1.0	0.6	0.9	1.4	2.0	-0.04	1.3	0.8	1.1	1.6	2.2	0.05
Avg. # relative clauses/T-unit	0.1	0.0	0.0	0.2	0.3	0.04*	0.3	0.0	0.3	0.4	0.7	-0.04	0.2	0.1	0.2	0.3	0.4	0.02
Avg. # adjectives/T-unit	0.2	0.0	0.1	0.4	0.7	-0.01	0.4	0.1	0.3	0.7	1.0	0.00	0.5	0.2	0.4	0.7	1.0	0.02
Avg. # adverbial modifications/T-unit	0.2	0.0	0.0	0.2	0.5	0.02	0.4	0.0	0.3	0.6	1.0	0.08*	0.1	0.0	0.1	0.2	0.2	-0.03*
Avg. # intra-T-unit coordinations/T-unit	0.5	0.0	0.2	0.5	1.0	0.16*	0.4	0.1	0.3	0.6	1.0	-0.03	0.3	0.1	0.2	0.4	0.5	0.03*
Avg. # subordinations and intra-T-unit coordinations/T-unit	1.4	0.7	1.1	1.8	2.8	0.25*	2.3	1.4	2.0	2.8	4.0	0.03	2.0	1.3	1.7	2.3	3.0	0.07
Number of respondents			596						680						722			

* *Statistically significant at the .05 level.*

† *Figures for means and percentiles have been rounded to the nearest tenth.*

The NCTE guidelines for writing programs indicate that an effective writing program includes clearly identifiable writing instruction, class time devoted to all aspects of the writing process (generating, drafting, revising and editing) and constructive responses from the teachers at various stages in the writing process. Results to questions asking students about their writing instruction are presented in Table 14. It is clear from the responses that neither 13-year-olds or 17-year-olds receive a great deal of direct instruction in writing nor are required to do much writing in school.

Writers who performed well on the assessment appeared to have had more writing assignments in school. Yet, substantial proportions reported that they were assigned little or no writing in school. More than half said they had written three or fewer papers in all their courses combined in the six-week period prior to the assessment. Writers who appeared to have been taught how to engage in writing as a process also performed better on the assessment. However, an analysis across questions concerning the writing process showed that only three percent of 13-year-olds and seven percent of the 17-year-olds said they routinely engage in the full writing process from prewriting activities through improving work after teacher feedback.

Table 14

Responses to Writing Background Questions,
Ages 13 and 17

	Age 13 1978 (n=29,430)	Age 17 1974 (n=34,211)	Age 17 1979 (n=26,651)	Age 17 Change 1974-79
1. How many reports written in last 6 weeks as part of any school assignment?				
0	16.4%	13.0%	13.9%	0.9%
1	16.4	11.4	12.3	1.0
2	17.1	16.3	16.8	0.4
3	12.9	14.7	14.0	-0.6
4	8.6	11.2	11.1	-0.1
5-10	17.2	25.7	22.5	-3.2
More than 10	3.6	6.2	5.3	-0.9
2. Time spent in English class on instruction in writing?				
None of the time	8.8	5.0	3.7	-1.3*
Little of the time	35.3	41.6	33.7*	-8.0*
1/3 of the time	31.4	33.6	31.7*	3.5*
1/2 of the time	15.3	13.8	17.4*	3.6*
Most of the time	8.3	5.8	6.9	1.1
3. A. Taken additional remedial writing course?				
Yes		6.3	8.2	1.9*
B. Taken additional creative writing course?				
Yes		20.5	24.6	4.1*
C. Taken other additional writing course?				
Yes		14.9	16.6	1.6
Total have taken at least one additional course other than remedial		26.1	24.0	-2.1
4. Encouraged to jot down ideas and take notes before writing?				
Usually	40.9		54.4	
Sometimes	47.1		35.1	
Never	10.9		7.7	
5. Encouraged to create outlines?				
Usually	27.5		49.4	
Sometimes	46.4		35.5	
Never	24.4		11.2	
Usually encouraged to prewrite: Notes or outlines or both	52.0		66.0	
Neither notes or outlines	47.0		31.2	
Either notes or outlines	35.6		28.3	
Both notes and outlines	16.4		37.7	

Only about half the students reported that they usually receive written or oral suggestions about their papers from their teachers. Finally, it can be noted that few 17-year-olds reported having taken remedial writing classes -- far fewer than these data suggest need intensive instruction.

SUMMARY AND IMPLICATIONS

The preceding synopsis of National Assessment findings in reading, writing and mathematics was designed to provide a broad portrait of students' skills and understandings in those content areas. In addition to this broad portrait, the earlier sections contain information concerning changes in educational performance over time as well as the differing achievement levels for various subgroups defined by sex, race and type of community.

To summarize across areas, as with most things there is some good news and some bad news. First, the good news: If one looks at isolated skills and understandings in each of the three content areas, there is much to be pleased about concerning what might be defined as low-level or minimal literacy.

When given tasks considered appropriate to their age level, many students appear able to:

READ and

- comprehend explicity stated ideas
- interpret simple charts and graphs

- use basic reference materials such as card catalogues and dictionaires

- give initial reactions or judgments about what they have read

- comprehend even implicit relationships between ideas, if they appear close enough together in a text

- understand the utility and importance of reading for a variety of purposes

WRITE and

- use complete sentences and paragraphs with few mechanical errors

- convey straightfoward information in short notes and letters

- present ideas and experiences with some fluency and coherence

- tell brief, unelaborated stories

and in MATHEMATICS

- recognize basic symbols and terms

- demonstrate knowledge of basic number facts

- perform addition, subtraction, multiplication and division using whole numbers

- perform simple computations, involving fractions and decimals

- use calculators to improve computational facility

Besides this strong evidence from recent National Assessments that most students understand the fundamentals of reading, writing and mathematics, the results indicate that achievement levels have remained stable across time for older students and may be improving for younger students -- particularly in the areas of reading and writing.

Further good news must be noted concerning the results for blacks and students attending school in disadvantaged-urban areas. Although these students still tend to perform below national levels, in many instances they either showed marked improvement or at least narrowed the gap between themselves and the nation.

Now for the bad news. Much has been written, including statements prepared by the National Council of Teachers of English and the National Council of Teachers of Mathematics, emphasizing that a curriculum must include more than teaching the knowledge and skills related to literal comprehension, computational facility and the conventions of written language. Educators stress the importance of students' ability to think and reason logically, solve problems and communicate effectively. However, NAEP data suggest that no matter how prevalent or widespread this point of view, the reality may be that curriculum still emphasizes instruction in component skills apart and separate from the application of these skills.

When given tasks considered appropriate to their age levels, many students evidenced difficulty with tasks requiring higher-order skills.

In reading students evidenced difficulty in:

- comprehending implicit relationships established across more than one paragraph
- using strategies necessary for analyzing or evaluating what they read.

In mathematics students evidenced difficulty in:

- solving multi-step mathematical word problems
- identifying extraneous information when applying mathematical concepts
- translating daily problem situations into mathematical operations.

In writing students evidenced difficulty in:

- elaborating and developing their ideas and feelings
- using writing for generalizing, analyzing, hypothesizing or defending a point of view.

Change results may signal further cause for concern. Declines in inferential reading comprehension at age 17, in mathematical application at all three ages, and in many writing tasks requiring critical thinking may reflect dwindling resources for teaching of applicative and analytic thinking skills. Finally, it should be noted that gains evidenced by younger students in groups traditionally considered disadvantaged are being accompanied by declines in groups usually considered advantaged. In particular, the older and better students do not appear to be keeping up with their counterparts in earlier assessments. In many instances, differences in performance -- between advantaged and disadvantaged students, between males and females, between 13-year-olds and 17-year-olds -- may be decreasing, but overall performance is not improving. In short, we may be attaining more equality in educational achievement in reading, writing and mathematics, but it appears to be at the expense of declining excellence.

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