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AUTHOR Suydam, Marilyn N.

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ABSTRACT

Data from 32 state assessments in mathematics (conducted in 1984 and earlier) are analyzed in this document. The high degree of variability across the states is stressed, with some of the points of variation in the test development, administration, and analysis process noted. Information is then presented on topics on which students are doing well and those with which they are having difficulty. Achievement trends and achievement patterns by topic are summarized on tables and graphs, and the conclusions of a 1978 analysis are verified. That students are achieving rather well on computation, especially with whole numbers, was confirmed, while there is an indication that problem solving continues to be of concern. Appended are the sets of data on mathematical achievement from the state reports. Six pages of references cited by state are also listed. (MNS)

by
Marilyn N. Suydam

ASSESSING ACHIEVEMENT ACROSS THE STATES: MATHEMATICAL STRENGTHS AND WEAKNESSES

ERIC Clearinghouse for Science, Mathematics and Environmental Education
The Ohio State University
College of Education
1200 Chambers Road, Third Floor
Columbus, Ohio 43212

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Mathematical Strengths and Weaknesses

Marilyn N. Suydam

Once Upon a Time . . . The Purpose

Over the past 15 years, a huge amount of paper has been consumed with assessments of achievement. We have long had a concern about achievement: it is, after all, one of the professed goals of schools, ranking far higher than teaching children how to learn. But the accountability movement that began in the 1970s put new emphasis on testing children, and state after state mandated or legislated that some type of regular assessment must be made of the products of schools.

There the similarity almost ends. For one cannot look long at the various ways in which the various states have accomplished this task before one realizes the infinite variations possible.

- Some states use standardized tests; other states have developed their own.
- Some states have tested only (bare) minimum skills; other states have broadened the scope to attempt to ascertain how extensively students have learned a wide range of topics.
- Some tests have focused on knowledge; others have attempted to measure higher levels of learning.
- Some states have involved panels of teachers and other mathematics educators in developing the tests, and have even collected data on the validity and reliability of the tests, while others have used state department personnel.
- Some states have carefully built in comparisons with data from the

National Assessment of Educational Progress (including, frequently, using NAEP items for at least a part of their testing), others have run comparisons with norms from one or more standardized tests, while still others have made no comparisons.

- Some have kept track of how the achievement in their state changes from year to year, while others give little indication of prior tests.
- Some have given assessments every year, on a (somewhat) established time table, while others have given them once or twice -- or at an interval of ten years.
- Some few assess every grade level; most assess what they have identified as focal points -- but the focal points differ from state to state.

And then there are the endless variations in how the data are reported.

- Some states which use standardized tests report only the two or three subtest scores we have come to expect: computation, concepts, applications. Some report only total scores. A few, however, report the data for each separate item.
- Some states which use standardized tests report percent correct; others report percentiles; others, stanines; others, mean scores; others, scale scores. Only occasionally does a state report more than one.
- For states that have developed their own tests, there is more similarity in the reporting of the data: the two main variations are percent correct and percent mastering the objective or standard, according to a pre-determined criterion.
- Some states that develop their own tests have had teachers (and sometimes parents or a lay group) predict what the scores on the various items will or should be, and then compare this prediction with the

actual scores attained by students.

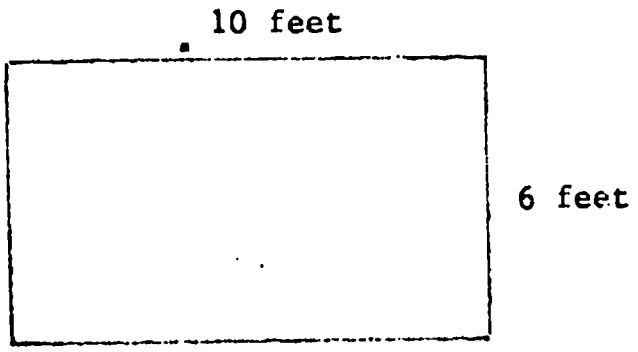
- Some states have panels of teachers and other educators review the test results and discuss strengths and weaknesses; others just report data. Some even have teachers provide general or specific suggestions (or activities) that other teachers could use to improve children's learning on topics on which weaknesses are evidenced.

The list of variations could go on for some further pages -- but it is time to make the point that prompted the listing of them: because of the variability, it is a hazardous activity to attempt a comparison of the assessment data. This report has not attempted the impossible: it is simply an effort to identify those topics on which students are doing well and, in particular, those with which they are having difficulty, that is, where scores are low.

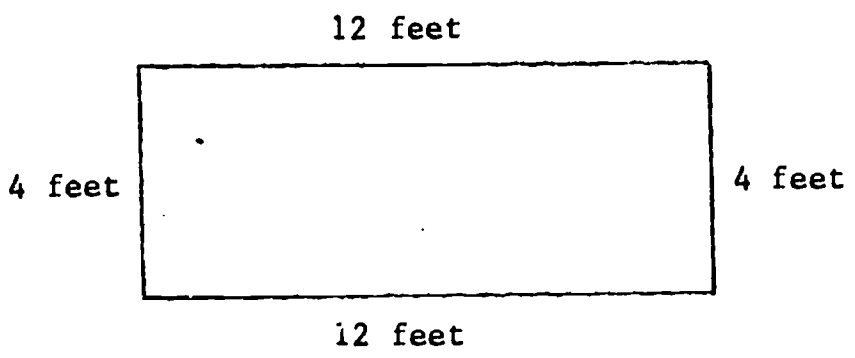
It may occur to some readers that we already know the topics with which children have a greater degree of difficulty than they do with others. We already know that some topics in mathematics are more difficult than others, and we know what those topics are, by and large. Right! This is, therefore, a verification study, to ascertain whether these "known" difficulties are continuing to show up in the achievement data.

Even that humble goal is fraught with a problem: it is quite possible to write items to test an objective that are easier than other items which might be written to test that same objective. Consider, for instance, two variations of an item designed to assess whether students can identify and calculate the perimeter (see Figure 1). Item 1-a is likely to be more difficult than item 1-b -- not because of differences in shape and size of the rectangles, but because all measurements are given in the second item but only two are supplied in the first item. A similar prediction can be made about items 2-a and 2-b. That this effect might be "washed out"

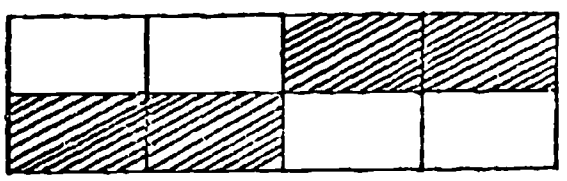
Item 1-a What is the perimeter of this rectangle?



Item 1-b What is the perimeter of this rectangle?



Item 2-a. What fractional part of the figure below is shaded?



Item 2-b What fractional part of the figure below is shaded?

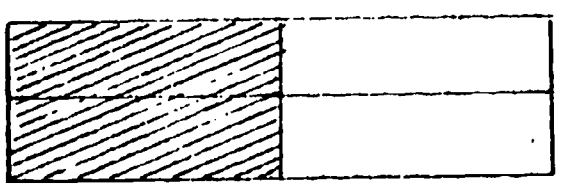


Figure 1. Examples of items
at differing levels of difficulty.

across numerous tests is the presumption, however. If a topic is difficult, scores will be lower across a range of items.

There is also another type of verification which this report is attempting. In 1978, George Bright studied a number of the reports of assessments of achievement (Bright, 1978, pp. 148-162). As a result of his analysis, he drew five conclusions:

- First, there is general improvement in performance across grades. This result is not unexpected, and it is consistent with the results of the grade-equivalent studies . . .
- Second, the levels of performance decrease as the items become more complex.
- Third, performance tends to stabilize. For the areas discussed in this article, stabilization seems to occur during the junior high school years . . .
- Fourth, stabilization of performance for whole-number computation occurs earlier and at a higher level than for fractional-number computation. Perhaps this is a practice effect that reflects the introduction of whole-number computation before fractional-number computation.
- Fifth, for all computation skills considered, there is no decline -- or at least no important decline -- in the performance of adults in comparison to that of high school students. In the context of improvement of skill performance across grades, this suggests that once skills are mastered, they are not forgotten. (p. 160)

A look will be taken at newer evidence on each of these points, in-so-far as it is possible.

Another point of verification was one raised by the data from the National Assessment: are scores on problem solving/applications (seriously)

lower than scores on computation? Are scores on comprehension, in fact, rather high or at least as high as can realistically be expected, contrary to a still-widespread public presumption/misconception?

It is to these points of verification that we will turn, after first describing the process by which the answers were reached.

And Goldilocks Went Walking . . . The Procedures

If one is going to analyze state assessment documents, obviously one must first obtain these state assessment documents. A search of the ERIC files revealed that relatively few states have stored their reports in ERIC (or, alternatively, it is very difficult to locate their documents if they have been stored). In addition, many of the documents located, even when put into ERIC comparatively recently, were far older than expected. Therefore, the avenue was clear: the state mathematics supervisors could provide the perfect contact.

Accordingly, a letter was sent to each of the state mathematics supervisors, or, in the cases where such a person is not identified, to the state department as an entity. The letter stated the problem and asked that a copy of "the most recent mathematics assessment results" be sent to the author.

My faith in state mathematics supervisors was clearly justified. They sometimes sent the materials themselves; in other cases, a person working directly with the assessment process replied. In all, 38 states responded; three with letters that they had no state assessment[1], three with test documents but no data[2], and the remainder (32) with documents containing data.

---

[1] Nebraska, South Dakota, Vermont

[2] Maine, Massachusetts, New York

When the documents were in hand, the second stage began: that of identifying pertinent information in each of them. That was when I first became aware of the amazing versatility and ingenuity at work across the states. As you can well imagine, that versatility and ingenuity nearly bogged down my efforts totally. It took weeks just to decide how to cope with the variaions. After finally sleeping one night, however, the answer came out of the g ay (the skies are often gray in Columbus): first, separate the tests by standardized/normed or state-developed.

This done, the next set of ingenuities, those of how the data were reported, became even more apparent, as well as a more major fact: on occasionally were a number of states testing the same objective, unless the objective was stated broadly. (Compare, for instance, the competencies cited by Nevada and the standards set for Massachusetts, each found in the Appendix.) This delimits the findings of this report, because the degree of specificity concerning mathematical topics is not as fine as could be wished.

On another gray day, it became clear that it was extremely difficult to cope with data that were sometimes reported to four decimal places and sometimes only to the whole number, nor was it easy to move readily from data in tables and data in graphs (it seemed difficult even to read and interpret some of the graphs). Anyway, a major decision was to organize all of the data in a similar form: in tables, expressed in rounded numbers. Clearly some information is lost that way -- but for the present purposes, it does not seem relevant. It is clearly much easier to cope with numbers of two digits than with numbers of two to six digits.

Soon there were two piles of information -- one for states giving normed tests and one for states giving their "own" tests -- and the data could be compared somewhat easily. Except for one problem -- that of the

items which the data represented. This was the start of a task that really isn't completely finished.

Some states provide nice, neat lists of items, with the data right alongside. Other states provide nice, neat lists of items, with the data somewhere else. Clearly, I could put the two pieces together, and I did (correctly, I trust). But then there were other states, which didn't provide nice, neat lists at all -- or if they did, there was no indication of which data went with which item. They sometimes, however, gave tests or test items, with the data attached. I had only to identify the purpose of the item, and I could make these states' results look like the others.

This proved to be a major task. Oh, not for all the items -- sometimes it was extremely apparent what the objective was (e.g., for "4 x 6 = __", write "The child is able to multiply two 1-digit numbers"). But for other items, the intention of the item-writer was less clear -- the item might have measured one of two or more outcomes. All I can say is that I did the best I could.

Finally, I was sitting there with data matched with items/objectives/skills/standards/clusters/topics/whatever for approximately 32 states. Then came the intriguing part: what did the data mean? What are the broad findings across the sets of results? What are the strengths in achievement that our children (whether in grade 3 or 6 or 9 or 12) have attained? What are the weaknesses, where they have simply not learned the content? And if they don't know it at one point, will they learn it later? Or, if they do know it, will they forget it later and have declining scores?

That is the part of the story that comes next.

And They All Lived . . . The Findings

On Table 1, the information received from each state is summarized. The name of the test is preceded by a symbol: N for normed test or S for state-developed test. The date indicates times when a test was given for which data were sent and therefore analyzed for this report (it does not indicate all of the times when a test was given in a state). Similarly, the levels and number tested pertain only to the data received.

The variability in the tests given, in dates of administration, in grade levels tested, and in numbers of students tested is clear. As was previously noted, there was obviously no attempt made to provide a basis for comparing students across the country on a common set of objectives or outcomes. This report is an attempt to find points which the data indicate are common, despite the limitations of the testing processes used.

Tables of the data received from each state are included, in alphabetical order, in the Appendix. In the previous section, the process of culling these data was described.

Achievement Trends

The general trend in achievement is upward, at least since the beginning of the 1980s, as indicated by the state assessment results. Table 2 depicts the patterns indicated by data from 17 states for which data from two or more years were received. In 33 instances, scores rose between assessments. In 11 instances, scores declined, while in 19 instances, they remained approximately the same. Caution must be taken, however, since dates as well as type of test are varied. This is illustrated, for instance, in the case of Iowa. The table indicates that scores in Iowa declined between assessments. However, the data received from Iowa were for tests given between 1955 and 1977. A recent document from Iowa in which trends were analyzed

TABLE 1

SUMMARY OF DATA RECEIVED

State		Type of Test	Date Given	Levels Tested	Number Tested
Alabama	N	California Achievement Test	April 1984	2	49 939
				4	50 531
				5	51 430
				8	53 233
				10	45 798
	S	Basic Competency Testing Program	Spring 1984	3	51 007
				6	53 571
				9	52 403
	S	High School Graduation Examination	October 1983	12	44 824
			April 1984	12	4 922
Arkansas	S	Minimum Performance Testing Program	1982/1983	3	
				6	
				8	
California	S	Survey of Basic Skills	1979-80	3	
			1980-81	3	
			1981-82	3	
			1982-83	3	278 837
			1981-82	6	
			1982-83	6	299 609
			1975-76/	12	
			1982-83	12	213 500
Connecticut	S	Basic Skills Proficiency Test	October 1980	9	41 565
			October 1981	9	39 453
			October 1982	9	37 747
			October 1983	9	38 492
Delaware	N	California Achievement Test	March 1981	1-8, 11	58 000+
			1982		
			1983		
	N	Comprehensive Tests of Basic Skills	Spring 1984	1-8, 11	60 000

TABLE 1 (continued)

State		Type of Test	Date Given	Levels Tested	Number Tested
Florida	S	State Student Assessment Test	October 1982	3	101 791
				5	106 984
				8	109 803
			April 1982	10	100 000
Hawaii	N	Stanford Achievement Test	1981	2	
			1982	2	
				4	
				6	
			Fall 1983	4	11 413
				6	11 458
Idaho	S	Proficiency Tests	1984	8	14 647
				9	20 659
Illinois	S	Inventory of Educational Progress	1976-83	4	
				8	
				11	
Indiana	N	Varied standardized tests	1980-81	primary	250 594
			1981-82	intermediate	162 418
				Junior/middle	
				high	
Iowa	S	Assessment Test	1975-76	5	11 528
				8	16 131
	N	Iowa Tests of Basic Skills	1955-77	3-8	
	N	Iowa Tests of Educational Development		9-12	
Kansas	S	Minimum Competency Test	1982-83	2	30 493
				4	29 241
				6	32 122
				8	30 897
				11	27 534
Louisiana	S	State Assessment Test	1982	7	
				10	

TABLE 1 (continued)

State		Type of Test	Date Given	Levels Tested	Number Tested
Louisiana (continued)			Spring 1983	7	55 568
				10	46 202
			1984	7	55 529
				10	45 975
Maine	S	Assessment Test	1984	4	
				8	
				11	
Massachusetts	S	Test of Basic Skills	January 1979	age 9	
				17	
Michigan	S	Educational Assessment Program	1980-81	4	
				7	
				10	
Minnesota	S	Educational Assessment Test	1978-79	4	
				8	
				11	
			Fall 1982	4	5 536 (12%)
			Winter 1983	8	6 735 (11%)
			Spring 1983	11	6 523 (11%)
Mississippi	N	California Achievement Test	1977-1983	4	34 969
				6	37 465
				8	37 396
Montana	S	School Testing Service - Consumer Mathematics	198_	6	
				11	
Nevada	S	High School Proficiency Examinations	1979-1983	9	11 000
			1980-1983	11	10 500
	N	Stanford Achievement Test	1979-1983	3	
				6	
New Hampshire	S	Educational Assessment	1980	5	1 514 (11.5%)
				9	2 695 (17%)
				12	1 884 (15%)

TABLE 1 (continued)

State		Type of Test	Date Given	Levels Tested	Number Tested
New Jersey	S	Minimum Basic Skills Test	1977-78/ 1982-83	9 10	87 168 11 422
New Mexico	N	Comprehensive Test of Basic Skills	March 1984	3 5 8	
New York	S	Pupil Evaluation Test in Mathematics		3 6	
North Carolina	N	Diagnostic Mathematics Inventory	Spring 1983	1 2	82 218 81 276
	N	California Achievement Test	Spring 1983	3 6 9	82 696 93 550 87 269
North Dakota	S	Mathematics Assessment	Spring 1975 Spring 1978 Spring 1979	6 11 4 8	2 693 1 422 1 298 1 475
Ohio	S	Needs Assessment	April 1977 1978	8 4 12	3 042 3 253 2 887
Oregon	S	Assessment Test	March 1982	4 7 11	2 306 3 710 2 912
Pennsylvania	S	Educational Quality Assessment	1983	5 8 11	40 000 40 000 40 000
Texas	S	Assessment of Basic Skills Test	1981-1983 1980-1983 1980-1983 1981-1983 1982-1983 1983	3 5 9 10 11 12	220 987 217 508 54 715 25 236 15 508

TABLE 1 (continued)

State		Type of Test	Date Given	Levels Tested	Number Tested
Virginia	N	SRA Test	1981-82/ 1983-84	4 8 11	207 500
Washington	N	California Achievement Test	Spring 1979 Spring 1981 Fall 1983	8 11 4	
West Virginia	N	Comprehensive Tests of Basic Skills	1976-77/ 1979-80	3 6 9 11	
Wisconsin	S	Pupil Assessment Program	1976-1982	4 8 12	
Wyoming	S	Educational Needs Assessment Project Test	1977	12	869

TABLE 2

TRENDS IN ACHIEVEMENT

State	Grade 3	4	5	6	7	8	9	10	11	12
Arkansas	↑			↑		↑				
California	↑			=						=
Connecticut							↑			
Delaware	↓	↑	↑	↑	↑	↑			=	
Hawaii		=		↓						
Illinois		↑				↑			↑	
Indiana	=	=	=	=	=	=	=	=	=	=
Iowa	=	↓	↓	↓	↓	↓				
Louisiana					↑			↑		
Minnesota		=				↑			↑	
Mississippi		↑		↑		↑				
Nevada	↓			↓			↓		↑	
New Jersey							↑			
Texas	↑		↑				↑	↑	=	
Virginia		↑				↑			↑	
West Virginia	↑			↑			↑		↑	
Wisconsin		↓				=				=

for the period from 1955 through 1984 indicates that:

> The achievement trend reached its minimum in the 1974-75 school year. Since that time, achievement has increased slowly but consistently. During the past year, achievement was at or near an all-time high in Grades 3-6 in most test areas. In Grades 7-8, achievement is still below the 1965 level but has been steadily improving. (Hoover, 1985, p. 1)

In general, the pattern across tests seems to be that scores rose between 1955 and 1965, declined virtually continuously between 1965 until the middle to late 1970s, and since then have been increasing -- slowly in most cases, dramatically in others.

Another example of the trend between 1980 and 1983 is provided by the results from Connecticut, as noted in Figure 2. Scores have been increasing each year, a pattern also observed in the 33 instances on Table 2.

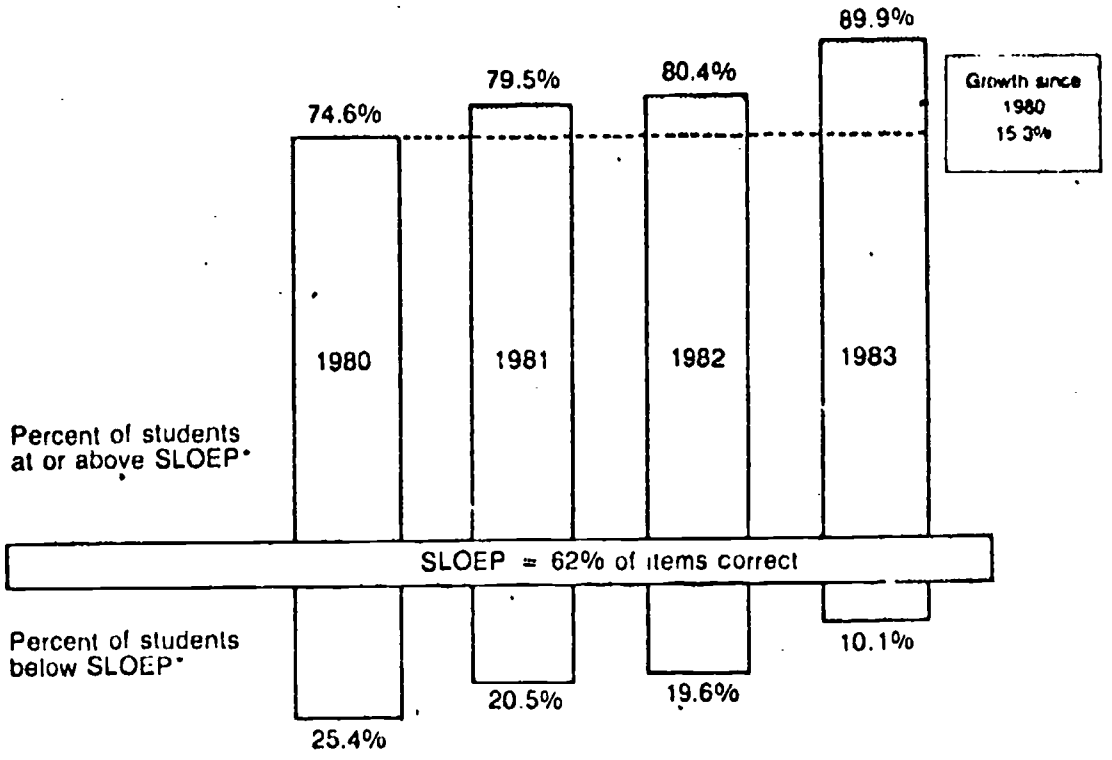
Achievement Patterns by Topic

To illustrate how well students are scoring on particular topics, the data from the latest state-developed test received were collated (from the tables in the Appendix). Data from standardized tests were omitted from this analysis, because the norming factor makes it imperative to have items which are designed to be difficult, a quality not necessarily true of the state-developed tests. It was my intent at first to display summaries of all these data, for every grade level and every topic. But it became apparent as I compiled the scores that there were many topics being tested by only one or two states, and other instances where only one or two states were testing at a particular grade level. The meaningfulness of such a summary was therefore questionable. So I looked for those points at which there were sufficient data being reported (by a number of states, on a number of items) so that the data appeared to show a pattern. The topics which met this criterion are: addition, subtraction, multiplication,

Connecticut

Comparison Across Years for Basic Skills Proficiency Test: Grade 9

Student Achievement in Relation to
Statewide Level of Expected Performance



Average Percent of Items Correct

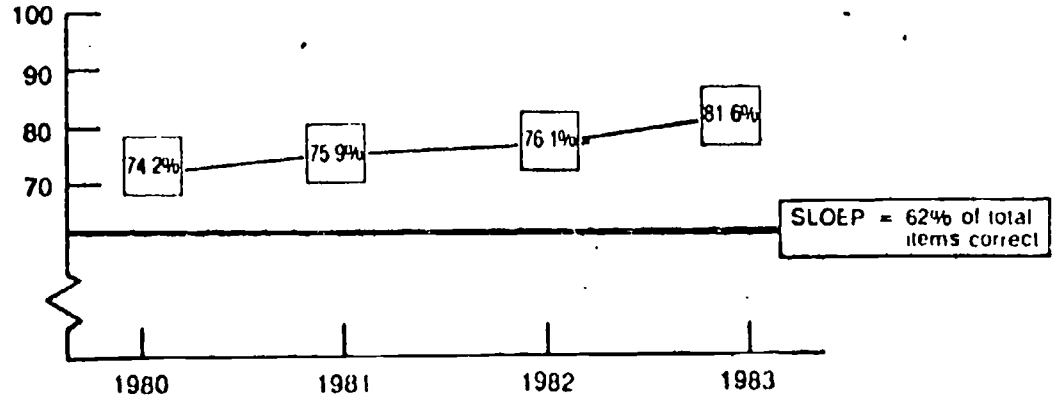


Figure 2.

and division with whole numbers; fractions; decimals; numeration; geometry; measurement; and problem solving.

One point must be re-emphasized: different objectives are being tested. Not only do items for a common objective differ, but across the grades, the objectives tend to increase in difficulty. Thus, while multiplication in grade 4 might be partially assessed by items requiring the multiplication of 1-digit numbers by 2-digit numbers, by grade 9 some items often assess multiplication of two numbers with three or more digits. Nevertheless, certain patterns emerged.

For addition with whole numbers, data for grades 3, 4, 5, 8, and 9 are displayed in Figure 3. Note that almost no scores are below the 80 percent level, and that in all instances they approach the 100 percent level. The range in each case is narrow, and most of the scores on individual items are in the 90s (indicated by the heavier band).

By grade 3, most students are at a high level of proficiency on addition computation, and they retain that proficiency through the grades. This same pattern is true at other grade levels not included in Figure 3.

The picture for subtraction with whole numbers is one of greater variability, especially in grades 3, 4, and 5 (see Figure 4). By grades 8 and 9, however, most students have reached about the same level of proficiency with subtraction as they have attained with addition. Moreover, the same pattern prevails at other grade levels.

For multiplication with whole numbers, the range of scores is also rather broad in grades 4, 5, and 6, but the upper limits are higher than for subtraction at the lower grade levels (see Figure 5). By grade 9, the scores of most of the students indicate mastery, and this is verified by the limited data for grades 10-12.

Addition with Whole Numbers

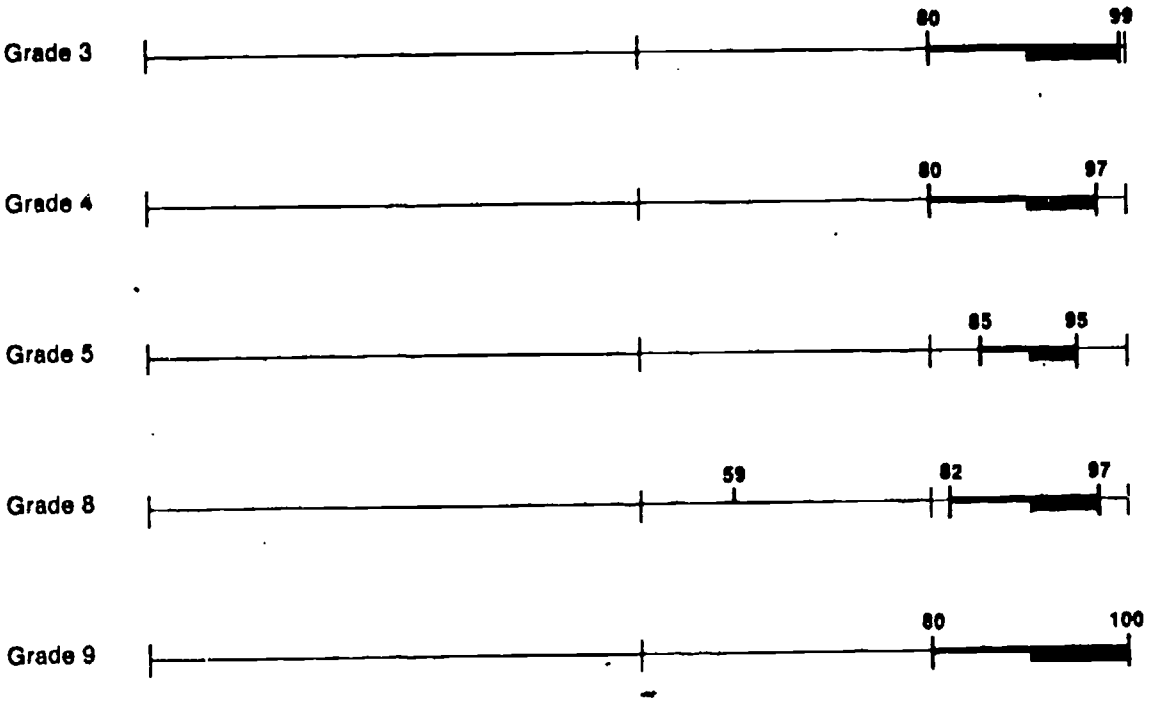


Figure 3.

Subtraction with Whole Numbers

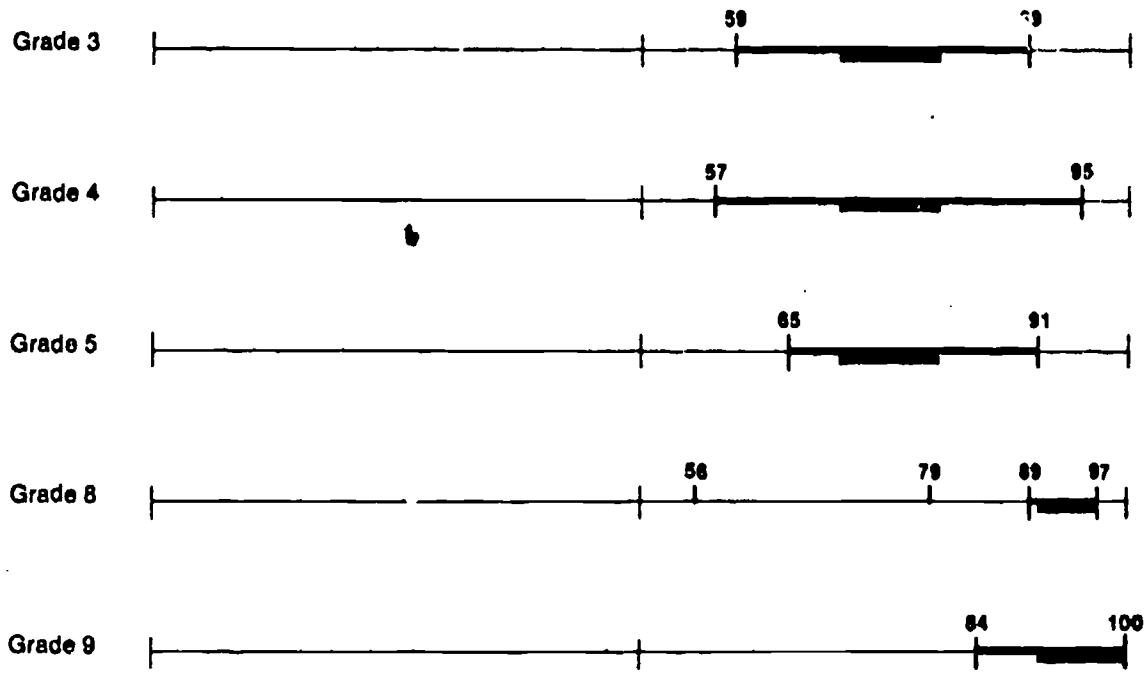


Figure 4.

Multiplication with Whole Numbers

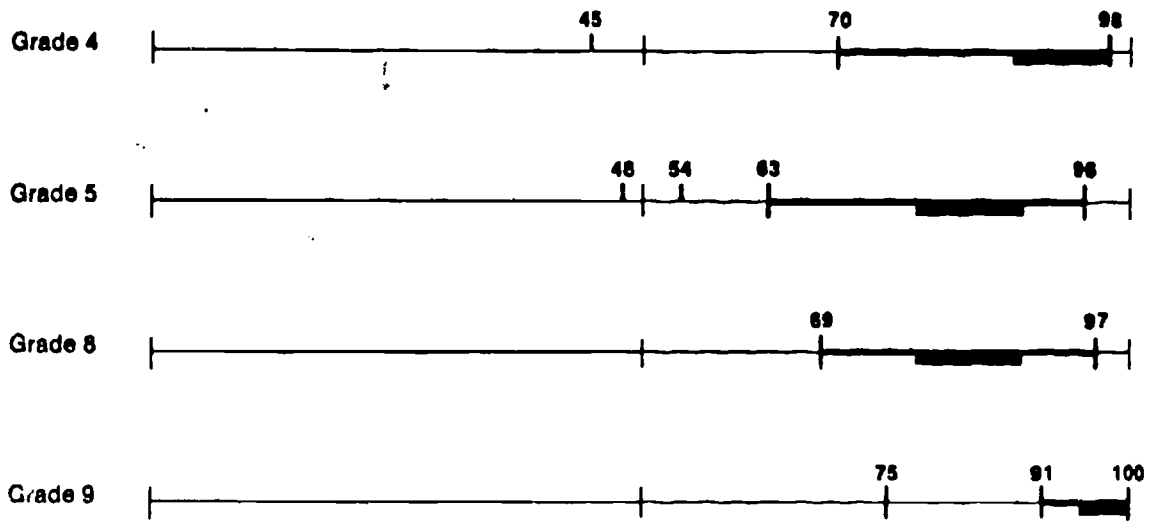


Figure 5.

Not unexpectedly, the ranges of scores for division with whole numbers are broad and tend to remain so across grade levels, although in grades 4, 8, and 9 the upper limit is high and in grade 5 it would appear acceptable (see Figure 6). The band indicating where the most scores at each grade level lie is lower, however -- in the 70s at the lower levels and in the 80s at grade 9. (For addition, the band was in the 90s at all grade levels; for subtraction and multiplication, it rose to the 90s by grade 9.) Division is of continuing difficulty for many students. However, division is the last of the four operations to be introduced to students, and they have had less time to practice and master the algorithm. This time factor combines with the difficulty of the algorithm to depress achievement. Scores do tend to improve in grades 10-12, although they do not reach the high levels attained with the other operations.

In some instances, scores were reported across the four operations with whole numbers. Scores at each grade level averaged approximately 88 percent for grade 3, 71 percent for grade 4, 82 percent for grade 6, 87 percent for grade 7, 83 percent for grade 8, 93 percent for grade 9, 87 percent for grade 10, 88 percent for grade 11, and 88 percent for grade 12. (None were reported for grade 5.) The lack of a pattern would seem to be largely a factor of the limited number of scores reported. However, most of the scores were at an acceptable level of proficiency.

A certain consistency seems to characterize the scores for achievement on fractions (see Figure 7). Depicted are scores of concepts of, for instance, equivalence, as well as scores for computation. In each instance, one or more scores is markedly deviant from the others; in some cases these may indicate that the item was either very difficult or was faulty. The lower limit of scores at most grade levels is around the 50 percent level; while the upper limit is near or in the 90s, the band indicating where most

Division with Whole Numbers

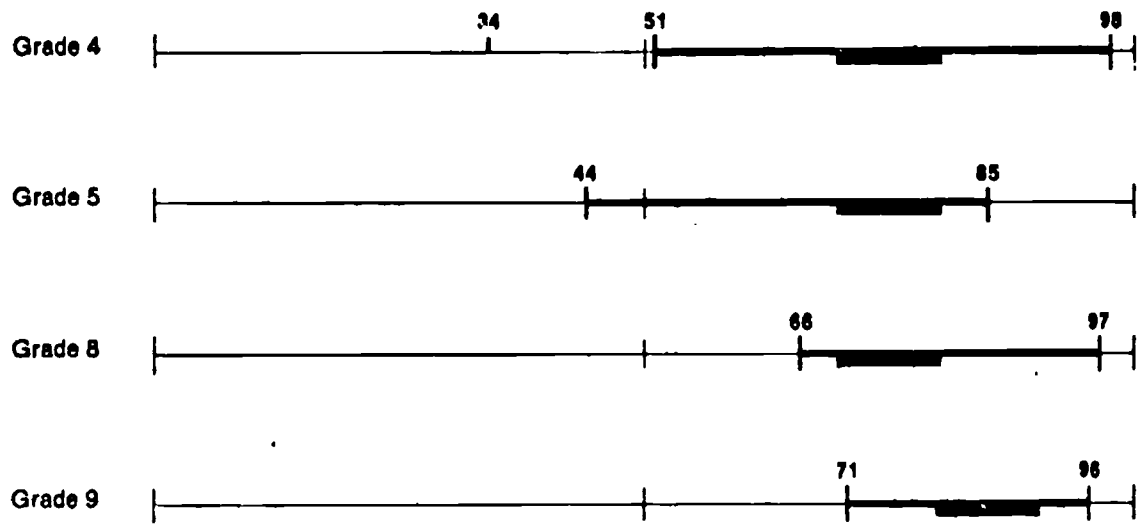


Figure 6.

Fractions

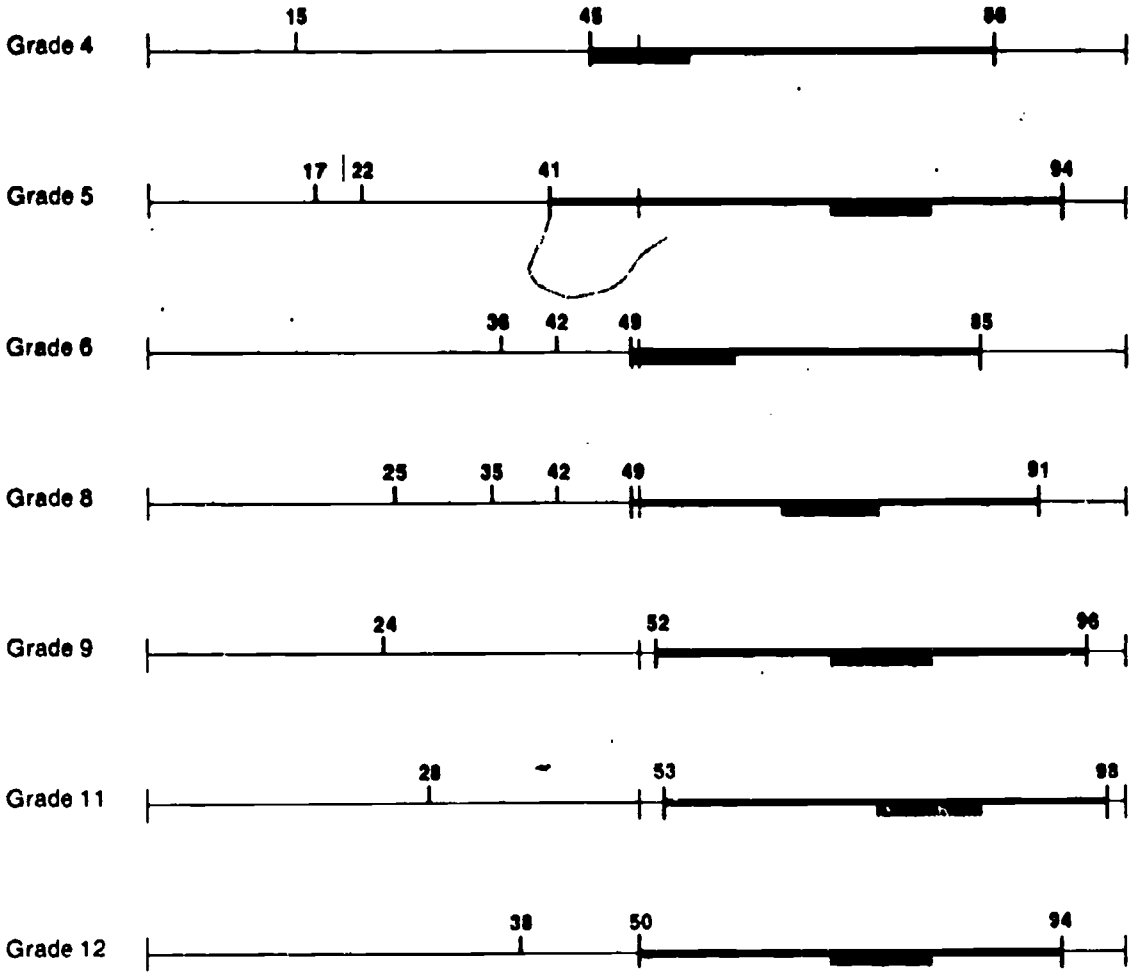


Figure 7.

scores lie is between 75% and 85% only in grade 11. Achievement with fractions for most students is clearly below their level of achievement with whole numbers.

For decimals, a somewhat variable picture is again presented (see Figure 8). Except for the unexplainable case of grade 11, the band where most scores lie is in the 80s, indicating an acceptable level of achievement. However, for many students, on many objectives for work with decimals, difficulties persist through the grades.

On numeration, attainment on most items is acceptable, as shown by the bands in the 90s in grades 3, 4, and 5 and in the 80s in grade 8 (see Figure 9). Why this drops is uncertain, but it may be that concepts taught earlier have not been retained, or it may be that the objectives being tested have expanded to include many topics beyond the place value emphasis in the early years. The limited data for grades 11 and 12 show continued variability, although the band where most students score is in the 90s by grade 12.

Fewer grade levels are depicted for geometry scores, largely because most tests contain few geometry objectives and some tests contain none (see Figure 10). The range of content being tested may account for the variability in scores, especially in grade 5, or the scores may reflect a lack of emphasis in the instructional program. At any rate, the scores approach acceptability in grade 5, but in both grade 8 and grade 11 many items are being answered correctly by only 40% to 50% of the students.

Variability also characterizes the measurement scores (see Figure 11). It is apparent from the data that items assessing skills or understanding with the common English measurement system are easier for students than are items dealing with metric measurement. The bands depict three instances where the same number of items were being answered correctly at two points --

Decimals.

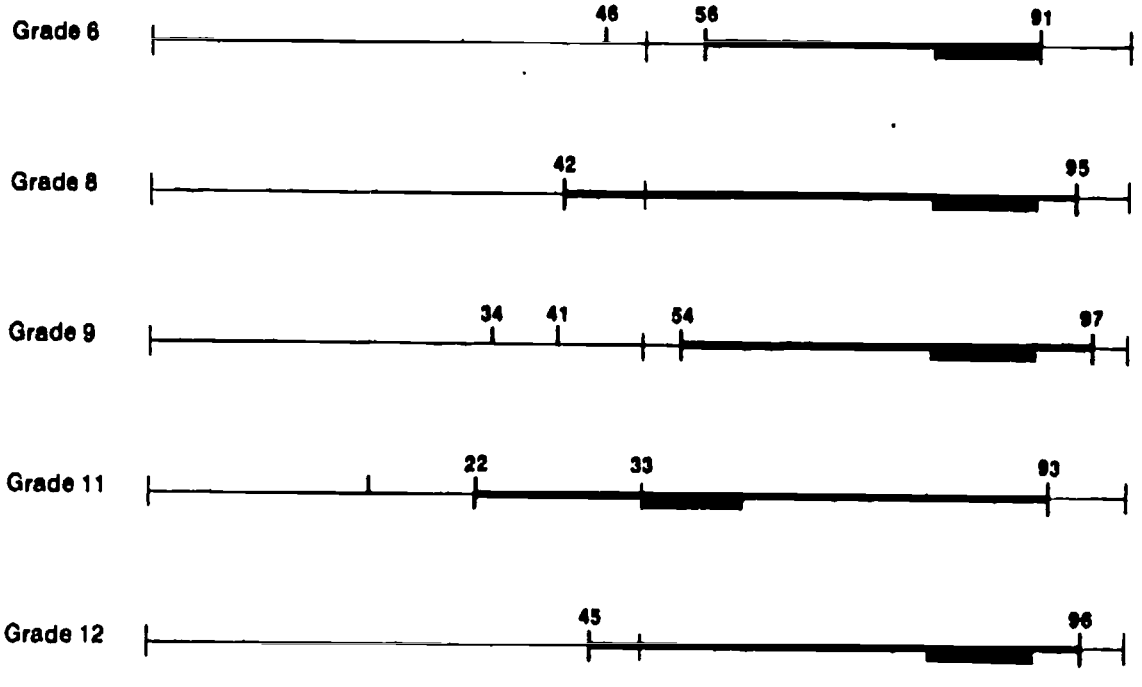


Figure 8.

Numeration

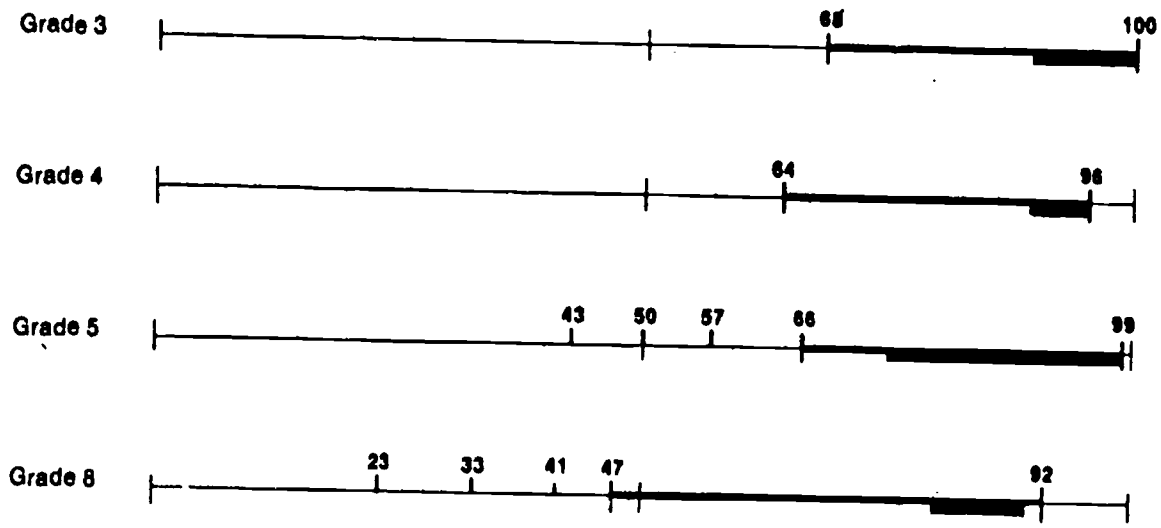


Figure 9.

Geometry

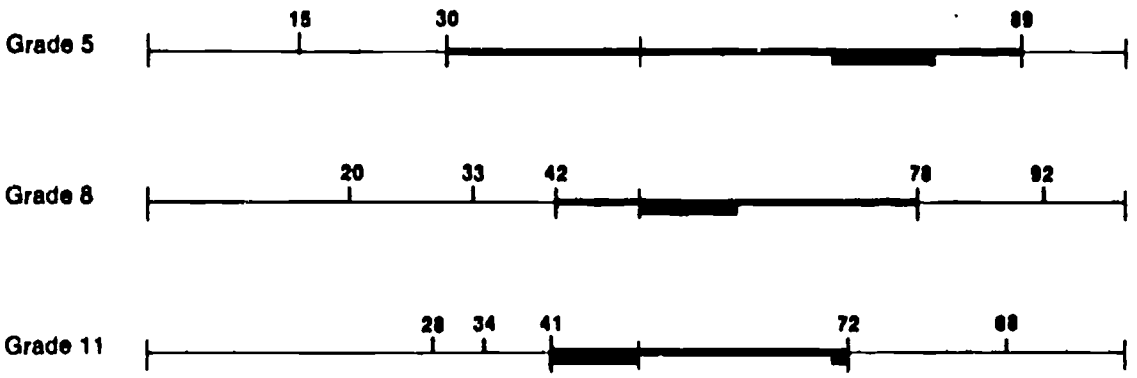


Figure 10.

Measurement

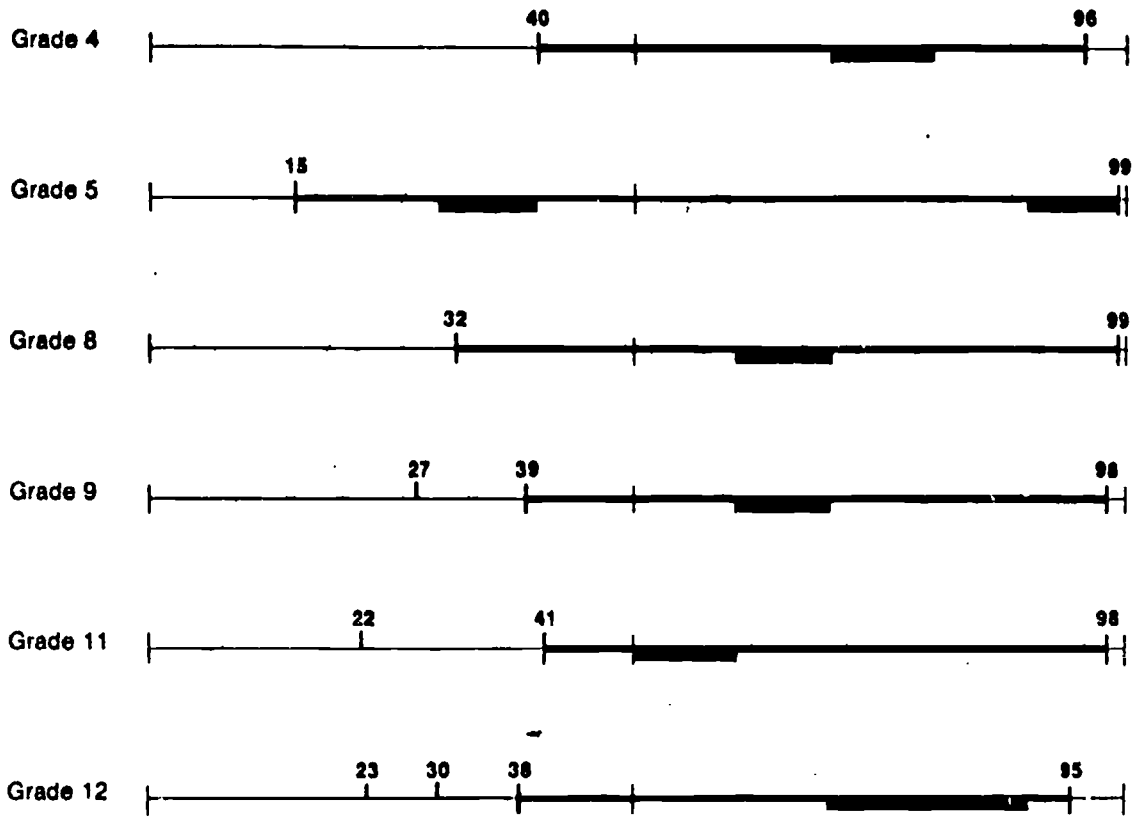


Figure 11.

at grade 5 in the 30s and 90s, at grade 9 in the 60s and 90s, and at grade 12 in the 70s and 80s. An extended look at the curriculum, at what is actually being taught, and at the test items seems needed.

A number of other topics were not answered by sufficient numbers of students to make graphic comparisons seem plausible. Nevertheless, the data were compiled and a summary for several topics follows:

(1) Probability and statistics: Items on these topics were included only in grades 6, 8, 9, 11, and 12, by eight states. Scores range from 18 to 90, with most between 57 and 76. On items for graphs, tables, and charts (considered separately), items were included at all grade levels. The range was from 51 to 99, with one score of 36. The band where most correct scores lie stretched evenly across the 80s and 90s.

(2) Percent and ratio/proportion: Items were included from grades 5 to 12. Scores ranged from 30 to 92, with the majority clustering rather evenly across the 50s through the 80s.

(3) Money: The topic was assessed at most grade levels, although with most items involving problem solving. Most scores were in the 90s, with the range from 66 to 98, plus 'deviant' scores at 41 and 50.

(4) Rounding, estimation, and approximation: Assessed at grade levels 4, 5, 6, 8, 9, 11, and 12 by 11 states, scores on these topics ranged from 37 to 96, with most in the 70s and 80s.

Problem solving scores have not yet been discussed, despite the importance of problem solving in the mathematics curriculum. The great variability of the content included in problems, and the resulting variability in difficulty level, makes graphic display of the data virtually meaningless. Nevertheless, Figure 12 presents the scores for each grade level. No clear patterns emerge, except for the broad range of scores at most grade levels, and the varying points at which most scores cluster.

Problem Solving

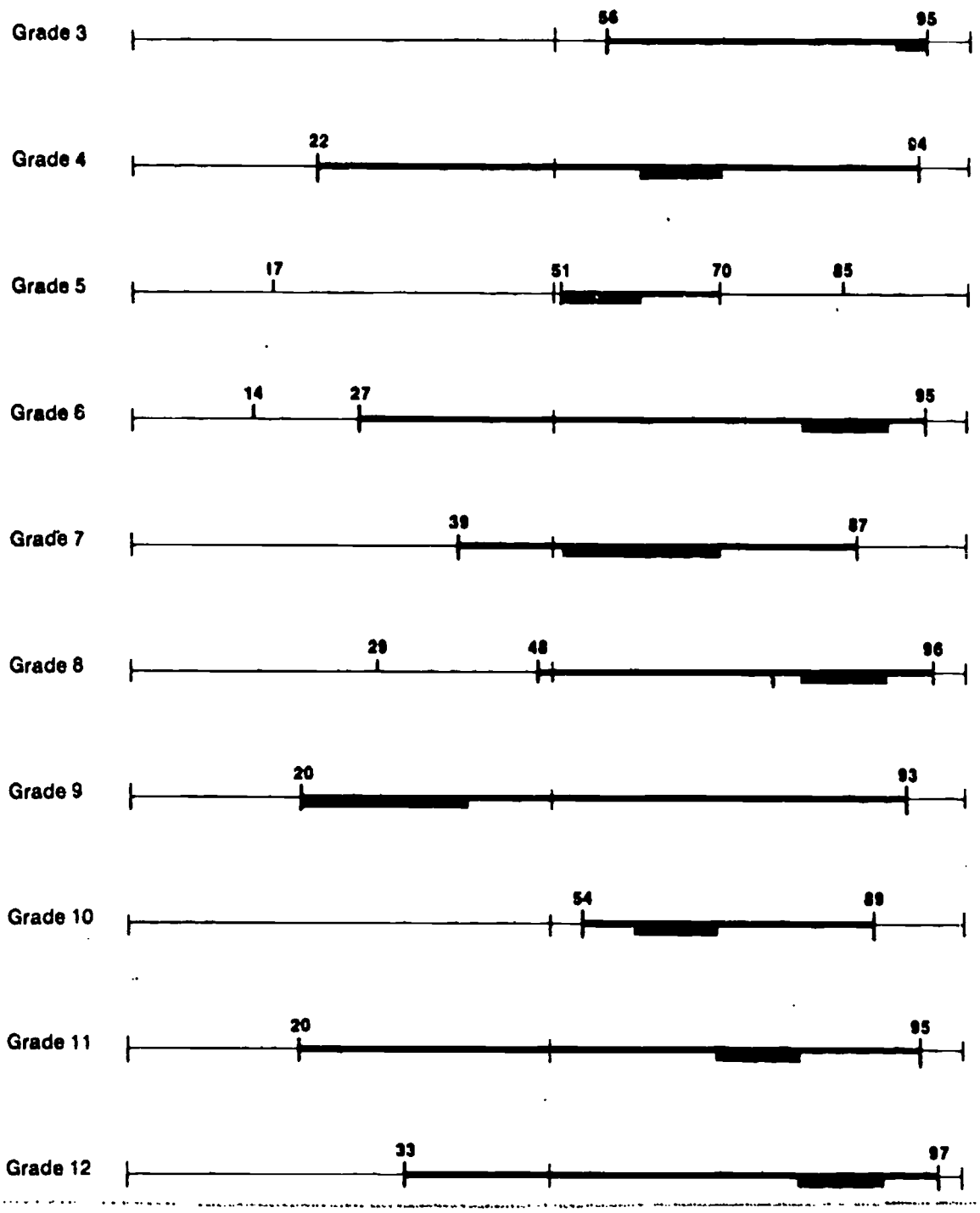


Figure 12.

Scores on problems with each operation with each topic are generally lower than scores on the topics alone, when items are parallel. Since the tests were not usually developed to check this conclusion, parallel items seldom occur. The National Assessments do provide support for this idea, however, when parallel items were specifically developed. In addition, some support is generated by the data from standardized tests, on which problem-solving scores generally lie below computation scores.

On most problems focusing on problem-solving strategies (such as guess and test, look for a pattern, or find relevant data), scores tended to cluster around the 60 percent level, with a range of 22 to 96. Scores on consumer or career application items ranged from 14 to 97, with a large cluster in the 80s.

General Conclusion on Achievement

It should be apparent from the data displayed that children are scoring well on items dealing with computation, especially with whole numbers. However, scores on items dealing with concepts and problem solving are not as high. The statements from state report after state report are very clear on this:

> ... schools are doing a good job of teaching tasks requiring computation and recognition. However, increases were relatively small on problem solving and application questions, which require students to think. This weaker growth pattern led the committee to believe that such skills are not being reinforced in classrooms. Simply teaching students low-level knowledge and skills is unlikely to improve substantially higher-level cognitive skills and understanding. Improvements in higher cognitive skills will occur only when higher-level problem solving becomes a curricular and instructional focus. (California, p. 51)

In general, the panel members were highly satisfied with student performance at each grade level on "straight computation" items, feeling that students demonstrated mastery of the basic operations of addition, subtraction, multiplication, and division with whole numbers and decimals. However, there was concern expressed over students' ability to apply basic operations in word problems, and it was felt that much improvement is needed on those items designed to measure specific problem-solving skills. ...
The major implication of these results, panel members agree, is that any additional emphasis on purely computational operations is unnecessary ... Further efforts to improve scores in this area might detract from work that needs to be done in developing students' abilities to understand "real-life" problems and formulate appropriate solution procedures. In an age when computers and calculators are finding widespread use, the ability to analyze a problem and translate it into mathematical language is essential. (Oregon, pp. 42, 47)

Teachers must be made aware of the need to teach students to understand the concepts being studied. The associated skills will follow these understandings. This will result in better performance in higher-level thinking skills such as problem solving and applications of geometry. (Minnesota, p. 43)

Both fourth and eighth graders performed with strength on items related to basic knowledge, recall, and computation with whole numbers. They performed less well on objectives judged to call for higher order cognitive skills applied to problem solving. (North Dakota, p. 57)

Our biggest problem would seem to be to convince the lay public, whether they be parents or not, that problem solving is of far more concern than mere skill development. The report on the third national assessment in mathematics states the concern quite clearly:

> ... it appears that American schools have been reasonably successful in teaching students to perform routine computational and measurement skills, and to answer questions assessing superficial knowledge about numbers and geometry. It is encouraging

> to note positive change on items assessing knowledge and skills not only in numerical computation, but also in geometry and measurement. On the other hand, it appears from the low percentages of success on some items that schools have thus far taught only a small percentage of students how to analyze mathematical problems or apply mathematics to nonroutine situations. (NAEP, 1983, pp. 2-3)

Schools do the best job at teaching children to do that which a $5 tool called a calculator can do -- compute, using a mechanical routine -- and their poorest job at doing that which no one and nothing else can do as well as human being can (if allowed to and encouraged to): think. We are still working very hard at teaching our children to do that which they have to do rarely once they get out of school -- use paper-and-pencil procedures -- and do very little about teaching them the skills we as adults use every day when we deal with numbers -- estimation and mental computation. Schools do a good job at teaching facts, and do much less well at helping children put those facts together to solve problems.

The data tell us more than that children can compute with whole numbers. There is also the clear indication that children do less well with most of the other topics in the curriculum. The connection between the amount of time spent on instruction and the outcomes of instruction is evident.

Strengths in Achievement

Beyond the broad statements about the strengths of students in their mathematical achievement made above lie some more specific topics or objectives on which student achievement is clearly satisfactory. These were culled in part from the data but also from statements from the interpretive sections of various state reports. Considered satisfactory by almost all state reports (as well as the data) is computation with whole numbers. The following list of topics were cited by a number of states, but not all:

computation with decimals (by grade 11)

computation with fractions (by grade 7)

rounding (by grade 5)

expressing numbers in words (by grade 4)

stating value of coins (by grade 4)

interpreting information on graphs (by grade 5)

measurement systems (by grade 11)

recognition of geometric figures (by grade 11)

interpreting tables (by grade 11)

computing simple probabilities (by grade 12)

straightforward word problems (by grade 5)

calculations with personal finance (by grade 8)

consumer problems (by grade 11)

Such a list of topics is, however, only a rough gauge of strengths. Beyond the judgmental level derived from scores on the various state assessments is the vital level of deciding within each state what is acceptable and what is not in terms of the achievement of their students. A number of the state reports contain such lists, and excerpts follow from several. Not only the scores but the expectation level, often considered or developed in relation to the perceived importance of the topic or objective, entered into the decision. As all of us who have worked with evaluation and curricular decision-making are aware, there is no fixed criterion for such judgments: we work from our philosophical beliefs as well as from the data.

California: Areas of strength or improvement, grade 3

Identifying ordinal positions of familar objects

Counting by 1s, 2s, 5s, and 10s

Identification of the place value of a given digit in a numeral

Identification of the digit of a given place value in a numeral

Recognition of numerical values of written numerals

Addition, subtraction, multiplication, and division facts

Word problems involving money

Recognition of geometric terms and concepts

Recognition of simple geometric figures

Location of points on a coordinate grid

Measures of time (clock and calendar)

Measures of temperature

Reading of a bar graph

Reading of a pictograph (especially those involving coins)

Applications involving reading of graphs

Problem analysis

Recognition of a function rule

California: Areas of strength or improvement, grade 6

Identification of rational numbers in word form, given the fraction form

Identification of the place value of a given digit in a whole number

Identification of numerals for whole numbers given in expanded notation

Identification of order symbols

Identification of order relations for a given set of decimals

Identification of odd or even numbers

Identification of multiples of given whole numbers

Application of the order relation using whole numbers

Addition, subtraction, and multiplication of whole numbers

Understanding of the multiplication algorithm for whole numbers

Reduction of fractions to the lowest terms

Applications, one-step, using addition of whole numbers

Evaluation of simple expressions involving addition, subtraction, or multiplication

Identification of appropriate linear units of measure

Calculation of perimeters of common geometric figures

Identification of the mode of a given list of data

Interpretation of data given in the form of a table

Identification of relevant mathematical problems for given situations

Identification of facts, questions, or unknowns in given situations

California: Areas of strength or improvement, grade 12

- Identification of numerals named in words or in standard form
- Addition of whole numbers
- Subtraction of whole numbers with or without renaming
- Division of whole numbers
- Multiplication of whole numbers
- Applications involving division facts
- Subtraction of fractions with like denominators
- Addition, subtraction, and multiplication of decimals
- Recognition of common geometric figures and knowledge of geometric facts
- Operations with denominate numbers involving units of time
- Visualization of fractional parts of given diagrams

Minnesota: Potential strengths, across grades

- Basic problem-solving skills
- Working with money problems
- Reading maps
- Identifying ordered pairs on a coordinate system
- Recall of basic arithmetic facts
- Performing measures in metric
- Reading travel schedules
- Computation with whole numbers
- Making measures using rulers
- Reading graphs

Minnesota: Acceptable, across grades

- Solving word problems
- Unit cost in consumer buying
- Cost per mile for driving a car
- Estimation both in small numbers and large-scale estimation problems
- Multiplication of fractions
- Computing with powers of 10
- Equivalence of fractions and decimals
- Recalling geometric terms
- Customary and metric measuring units

Weaknesses in Achievement

One of the primary purposes of this report was to identify or verify those topics in the curriculum where achievement is poor, or where it is not as high as it "should" be. "Should" is a judgmental word, to which different standards may be applied.

As one aspect in identifying topics where improvement seems needed, I collated the items on which scores were below 50 percent. This level was arbitrarily chosen as a point below which lack of success was clearly non-acceptable; it does not imply that scores of 50 percent, 60 percent, or 70 percent are satisfactory. The task then became one of determining the mathematical focus that sets of these items had in common. The list of these follows, with the grade levels at which the low scores were attained in parentheses. Topics for which scores were attained on only one assessment are bracketed at the end of the list for each topic.

Whole number operations:

Addition: [addition with regrouping (2); column addition (4)]

Subtraction: subtraction with renaming (2, 3, 11)

subtraction with 3- and 4-digit numbers (4, 5)

[missing addends (2); checking subtraction by adding (3); matching number sentence with number line (4)]

Multiplication: multiplication with 2 or more digits (4, 5)

[missing factor (2); regrouping (11); multiplication with zero (4, 11)]

Division: division by multiple of 10 (5)

division by 2 or more digits (5)

[single-digit divisors (4); division with 0 (11)]

Fractions: equivalent fractions (3, 4, 5, 11)

fraction equivalent of decimal or percent (6, 8, 9, 10, 12)

ordering fractions (3, 12) or mixed number (8)

operations with fractions, mixed numbers (5, 10, 11, 12)

adding fractions, like denominators (4, 5, 7)

adding fractions, unlike denominators (4, 5, 6, 9, 10, or mixed numbers (6)

subtracting fractions, unlike denominators (5, 6, 10) or mixed numbers (5, 7, 8, 11)

multiplying fractions (7) or mixed numbers (6, 8, 9, 10, 12)

dividing fractions (6, 7, 8, 11) or mixed numbers (6, 11)

[fractional part of set (3); subtracting fractions, like denominators (5)]

Decimals: multiplication of decimals (3, 8, 9, 10)

division of decimals (3, 6, 8, 9, 10, 11)

multiplication of mixed number by decimal (8, 11)

rounding decimals (10, 12)

adding decimals (3, 5 8)

subtracting decimals (4, 8)

[word form of decimals (8); betweenness (8); placement of decimal point (11)]

Percent: percent one number is of another (9, 10, 11, 12)

percent of a number (7, 10, 11, 12)

conversion of decimal/percent (8, 9, 11, 12) or fraction/percent (12)

Ratio and proportion: ratio (8, 9, 10)

proportion (8, 11)

Numeration: place value (5, 11, 12)

odd/even numbers (3, 4, 8)

properties (3, 8)

expanded notation (4, 11)

least common multiple (5, 6, 8)

lowest/least common denominator (8, 11)

factors and primes (6, 8)

relations (8, 11)

exponential notation (8, 6, 11, 12)

[solving inequality (3); missing sign (3); ordering (5); greatest common factor (6); true sentences (4); greater than/less than symbols (5)]

Geometry: parallel/perpendicular lines (4, 9, 10, 12)

recognition of figures (6, 8)

circles (5, 8)

triangles (8, 11)

similarity/congruence (11, 12)

plotting/graphing points (8, 11)

terms (radius, diameter, etc.) (11, 12)

[line segments (4); right angles (10)]

Measurement: recognition of correct unit (3, 4, 6)

knowledge of metric system/prefixes (3, 8)

converting in same system (8, 9)

measuring length (English) (3, 4, 5, 8, 11)

measuring length (metric) (3, 4, 6, 10)

reading scale (4, 5)

weight/mass (English) (3, 5, 8)

weight/mass (metric) (5, 6, 8, 10)

capacity (English) (5, 11)

capacity (metric) (5, 8, 10)

time (5, 8, 11)

volume (6, 8, 9, 11, 12)

determining diameter, radius, circumference (8, 9, 10, 11)

perimeter and area (4, 5, 6, 8, 9, 10, 11, 12)

perimeter (5, 8, 9, 11, 12)

area (4, 5, 6, 8, 9, 10, 11, 12)

[angles (11); surface area of solid (11)]

Probability and statistics: frequency tables, charts, graphs (5, 8)

reading/interpreting graphs (11, 12)

line and circle graphs (5, 6, 8, 11, 12)

measures of central tendency (8, 11)

averages (8)

means (5, 9, 11)

probability (6, 8, 9, 11, 12)

Estimation (4, 8, 5, 11)

rounding (4, 5)

estimating measures (5, 6, 8, 11, 12)

estimating length (5, 6, 8, 11)

[estimating area (9); estimating volume, temperature (12)]

Integers: operations (3, 8, 9)

[identity element (11)]

Algebra (4, 5, 8, 11, 12)

box as placeholder (4, 8)

translation into algebraic expressions (11, 12)

formulas (8, 9)

equations (5, 8)

Logic (4, 8, 11)

Trigonometry (11)

Miscellaneous: vocabulary development (3)

money (5, 8, 11)

Problem solving: basic operations (3, 4, 6, 7, 8, 10, 11, 12)

strategies (4, 7, 11)

estimating, approximating answers (4, 7, 11)

fractions (6, 8, 9, 11, 12)

decimals (4, 6, 11)

ratio/proportion, percent (8, 10, 11, 12)

area (6, 11)

geometry (11, 12)

consumer applications (6, 8, 11)

income, banking, cost comparisons, taxes (9, 10, 11, 12)

interest (8, 11, 12)

discounts (8, 9, 11)

algebra (8, 11, 12)

two-step problems (6, 8)

[time/rate/distance (8); money (8)]

In some of the state reports, judgments have been made about the weaknesses or needs of the students. Excerpts from several of these reports follow, indicating awareness of the need to go beyond mere scanning of scores.

New Jersey:

> ... there is still an obvious need in many districts to improve the operational skills using fractions, mixed numbers, and decimals and percent. (pp. 22-23) ... It is important that more emphasis be placed on concepts and meanings as opposed to process. The use of estimations and judging reasonableness of answers should be emphasized in instruction. (p. 25) ... The concept of rounding is still not understood by many students, along with changing fractions to decimals. (p. 25) ... The skills that the lowest percent of students answered correctly were parallel/perpendicular lines, equivalent linear measurement-metric, and area of circle with the formula. (p. 25) ... The remaining skills in the [problem solving] cluster must be improved. (p. 27)

Minnesota: Potential needs -

Making change

Rounding off of numbers

Place value in our number system

Concept of fractions and decimals

Ordering fractions

Computing with decimals

Using formulas for the perimeter, area, and volume of geometric figures

Conversion of values within either the customary or the metric system

Reading and interpreting tables and charts (p. 27)

Michigan:

Examining the chart enables us to pick out the general areas of weakness. These are, in order: metric measurement, fractional numbers, decimals, and ratio-proportion-percent. (p. 8) The reviewers who prepared this report recognized several overall weaknesses across grade levels:

1. Vocabulary
2. Numbers without meaning
3. Use of concrete materials
4. Developmental sequencing of instruction
5. Meaning of operations
6. Place value
7. Metric measurement
8. Time-on-task
9. Multiple modes of learning
10. Reasonableness of answers (pp. 8-12)

It is evident from the Michigan list that the recommendations concern teaching strategies as well as the content of the curriculum. Because of the importance of such an integrated discussion, excerpts from several state reports in which instructional strategies were addressed follow.

Michigan:

1. Vocabulary (particularly at the K-3 level). There is not sufficient stress on basic vocabulary words and phrases such as fewer, greatest, least to greatest, etc. ... Curriculum materials should be searched

and lists made by grade level. These should be practiced in both oral and written form. DO NOT key on just those words found on the assessment tests.

2. Numbers without meaning. Too many students have very inadequate concepts of what symbols like "34", "3/4", and "1.23" mean. Without meaning, the symbols are then pushed around in inappropriate "algorithms" to obtain wrong answers. This kind of result is all too common:

$$\frac{1}{4} + \frac{1}{8} = \frac{2}{12}$$

3. Use of concrete materials. The solution to the previous problem may be in the increased use of concrete materials (particularly K-6), drawings (K-9), pictures, thought action models, etc. The need for this is clear from examining specific objectives below. The increase in time commitment that may be required for this structured use of materials will be more than made up later in increased understanding and performance on computations.
4. Developmental sequencing of instruction. There is a general failure to provide adequate transitions between the meanings of concepts and operations and the achievement of answers through algorithms. If "final" algorithms are pushed too rapidly forward, the student frequently resorts to "symbol pushing" and wrong results.
5. Meaning of operations. Many of the minimal skills required on the tests can be achieved by using an appropriate model of the operation without any formal algorithm at all. Increased attention to finding answers to problems by using concrete or pictorial models will pay dividends in two ways. More students will achieve minimal competency and more students will be able to perform algorithms correctly later, at a much more advanced level.
6. Place value. Both in whole number and decimal work, the lack of understanding of place value has created a large number of errors in computation, ordering, etc. Many of the item analysis comments below pertain to this problem. We simply must devote more time and improve instruction in this area. The use of place value charts in grades K-9 cannot be over emphasized.
7. Metric measurement. This area, as well as non-metric geometry, simply needs more practice time. Students actually need to measure lengths

with a meter stick, find areas, and construct and compute volumes. These necessary objectives are not difficult to mastery, but they do need to be taught.

8. Time-on-task. Teachers must take time to decide curriculum priorities between mathematics and other subject areas. Mathematical skills are vital enough so that time must be devoted to learning them at all grade levels K-9. No grade level should be short-changed. Continuous, adequate learning is essential. Attention also must be paid to providing effective instruction and practice time and avoiding "busy work" that is often more destructive than positive in results.
9. Multiple modes of learning. Teachers must take time to examine their routines. Perhaps students are not learning because of boredom. Break away from ditto-mania and consider alternatives. Involve students more with oral work, manipulative materials, action games, etc. Multiple attacks on curriculum will pay great dividends in skill attainment later. This is particularly true at grades 7-9, where students have frequently "had it" with mathematics. Carefully consider alternatives that may create better learning environments.
10. Reasonableness of results. At all levels, students must be encouraged to discuss the reasonableness of their answers. If teachers don't ask them to do it, only the most talented will do it. This skill needs to be developed early, before long division, fractions, and decimal operations are encountered. (pp. 8-12)

New Jersey:

1. More emphasis should be placed on practical applications in conjunction with basic skills as well as on infusion in all disciplines.
2. Instruction in decimals should begin early in the school year in order to reinforce whole number concepts at that time.
3. There should be more use of consumer and sales advertisements in the teaching of percent and decimals.
4. Activities that are practical and use hands-on experience can improve skills in measurement and problem solving.
5. In-service teachers, administrative training, and curricular development should include the following:
   a. A spiral approach to instruction in all clusters.
   b. The use of problem-solving techniques such as: guess and test,

look for patterns, make a chart or table, make a diagram, estimate and approximate, check for reasonableness of results, and determine extraneous or insufficient information.

6. The instruction of computation should not be at the expense of other areas.
7. Instruction should emphasize concepts and understanding rather than rote processes. (p. 28)

California:

- Continue the current emphasis in place value, because this concept is the key to the understanding of arithmetic operations.
- Give students more practice in reading and discussing mathematical problems.
- Develop the vocabulary and mathematical notation needed to discuss mathematical concepts.
- Use open classroom discussions and small group activities to replace some of the individual paper-and-pencil activities.
- Give students concrete experiences to help them discriminate between standard units of length, volume, mass, and temperature and to know when to apply them in the measurement of common objects or quantities.
- At the third grade level, all measurement concepts should be developed using activities with concrete materials.
- In subtraction the most common error made by students was subtracting the smaller digit from the larger digit regardless of the positions of the two digits in the problem. Give instructional emphasis to developing the understanding of the subtraction algorithm, with renaming, through the use of manipulative materials. A better understanding of place value is needed to improve the understanding of this algorithm.
- In application questions the most common error made by students was to add the numbers in the problem even though the operation called for was either subtraction or multiplication. Students should be confronted with many sets of application problems that randomly involve any of the four basic operations and emphasize the selection and use of the correct operation or operations.
- Emphasize the use of multiplication skills in real-life situations.

(p. 57)

An emphasis on the importance of meaningful instruction, promoted through the use of manipulative materials and real-life situations, threads its way through these reports and many others. The way mathematics is taught is as of as much (if not more) concern as what mathematics is taught.

Return to Bright's Conclusions

Early in this report, it was noted that Bright drew five conclusions as a result of his 1978 analysis of assessment data. How well supported is each of these as a result of the data in this report?

1. Performance generally improved across grades: This has been documented in several instances; for instance, see Figures 4, 5, and 6.

2. Levels of performance decrease as items become more complex: This has not been specifically documented, but it has been referred to at several points. Analysis of the data in the Appendix continues to support this conclusion.

3. Performance tends to stabilize: Again, this has been evident from the data in several figures. Thus, addition achievement appears to have stabilized by grade 3 (see Figure 3), while subtraction achievement appears to stabilize by grade 8 (see Figure 4).

4. Stabilization of performance for whole-number computation occurs earlier and at a higher level than for fractional-number computation: The data on Figures 3 through 7 support this conclusion.

5. Once skills are mastered, they are not forgotten: Again, the data summarized on such figures as Figure 3 tend to confirm this conclusion. The need for review at intervals cannot, however, be ignored; it was noted, for instance, that perhaps the lack of curricular emphasis on place value resulted in some of the variability evident in Figure 9.

The End . . . Conclusion

Perhaps the greatest contribution of this report is that it provides a source of recent (albeit not current) data on state assessment results. A great deal more than the casual analysis given in this report can be learned by perusing the materials.

Beyond the compilation of data, this report has presented information on mathematical topics with which students are doing well and those with which they are having difficulty. Some evidence has been presented that the conclusions of Bright continue to be justified. That students are achieving rather well on computation, especially with whole numbers, has been confirmed, while there is an indication that problem solving continues to be of concern.

One other point is clear from perusal of the state reports: some states seem to be attempting to use the assessment program to improve the instructional program. On the other hand, other states are handling the assessment program more in terms of meeting a requirement.

As the report from Iowa indicated, "one could speculate further on the results of state assessment, but the crucial judgments regarding the use of the data must be made by the local school staff." They then presented a list of some questions that should be raised by teachers as a result of the assessment. They are included here, as a concluding step, because they call to attention the fact that the data from any assessment are not an end in themselves.

(1) Was the overall performance of students satisfactory?

(2) Which students did not perform satisfactorialy?

(3) What were their skill deficiencies?

(4) How serious are these deficiencies?

(5) What are the consequences if nothing is done about correcting the deficiencies?

(6) What resources are available to assist with the problem?

(7) How long will it take to resolve the problem?

(8) What action can be taken to prevent similar problems from occurring?

(9) What skill maintenance activities are necessary for all students?

(10) What other objectives should be included in the assessment?

APPENDIX

Data on Mathematical Achievement

from State Reports

Alabama

Basic Competency Testing Program: Grade 3 (Spring 1984)

Competency	Percent at mastery
associate numbers from 0-100 with numeral and word name	94
write in increasing ordinal numbers up to 1000	93
compute with whole numbers - add	80
subtract	63
multiply	85
divide	73
use calendars, blocks	85
read rulers to determine lengths	96
measure capacities	75
read and interpret picto- and bar graph	96
recognize errors in addition and subtraction problems	88
recognize triangle, circle, square, and rectangle	87
identify coins, currency, make change to $1.00	91
identify telephone, zip code, address numbers	88
select operation to solve problem	93

Alabama

Basic Competency Testing Program: Grade 6 (Spring 1984)

Competency	Percent at mastery
read and write money values to $200.00	97
order fractions and decimals	63
add, subtract, multiply, and divide whole numbers	84
add, subtract decimals to thousandths	77
add, subtract, and multiply fractions	58
match simple fractions and decimals	50
find averages of whole numbers	78
use calendars, clocks, determine lapsed time	73
read measure from ruler	57
measure capacities	79
perimeters and areas	90
interpret graphs	96
make approximations by rounding and select reasonable answers	72
find errors in calculation	69
recognize simple plane, solid geometric figures	85
compute wages, determine change, solve consumer problems	86
identify telephone area, zip code, and address numbers	78
determine if sufficient information to solve problem	89

Alabama

Basic Competency Testing Program: Grade 9 (Spring 1984)

Competency	Percent at mastery
amounts of money: read, write	90
compare decimals; compare fractions	60
computation: whole numbers	89
computation: decimals	78
computation: fractions	66
conversions: decimals and percents	47
applications: ratio and percents including discounts and wages	50
applications: fractions and decimals	43
computation: average	64
conversion: units of measure	48
measurement: elapsed time, capacity	71
measurement: perimeter, areas of rectangles	43
interpret graphs, charts, tables	84
measure lengths, solve problems with scale drawings	85
approximations	84
estimate reasonable answers to life problems	80
identify geometric form and concepts	80
determine change; compute cost, cash/credit purchase	74
allocations: time, money	63
write checks and money orders	86
compute miles/gallon, average speed, distance, time	90
compute salaries and wages with deductions	80

Alabama

High School Graduation Examination: Grade 12

Competency	Percent at mastery Oct. 1983	April 1984
read and write: money values, numbers	98	97
compare decimals; compare fractions	78	50
computation: whole numbers	97	93
computation: decimals	96	88
computation: fractions	74	31
conversion: decimals and percents	87	82
application: ratio, percent, discount, taxes, commission	64	26
conversion: fractions and decimals	72	46
averages of whole and decimal numbers	92	81
conversion: units of measure	69	52
solve problems involving time	84	58
measure lengths by using ruler	88	57
capacities	94	89
find perimeters	93	89
find rectangular areas	53	19
interpret: graphs, tables, charts	89	57
interpret scale drawings	91	77
approximate by rounding numbers	96	84
geometric forms and concepts	86	81
determine change; compute cost, cash/credit purchase	91	75
allocate time, money	80	48
complete checks and money orders	97	94
solve rate, time, distance problems	94	78

Alabama - Grade 12 (continued)

Competency	Percent at mastery Oct. 1983	April 1984
compute salaries and wages	89	72
Passed	89	85 (first)
		56 (repeat)

Alabama

California Achievement Tests: Grades 2, 4, 5, 8, 10 (April 1984)

Comparison with national mean grade placement	grade 2	grade 4	grade 5	grade 8	grade 10
percent of students one year or more above	17	31	38	50	50
percent of students at and up to 9 months above	57	33	27	17	9
percent of students one to 9 months below	23	26	23	18	12
percent of students one year or more below	3	10	13	15	29

Arkansas

Minimum Performance Testing Program: Grade 3

Objective	Percent Mastering 1982	1983
Numeration		
count objects to 20	96	96
identify equivalent sets	92	92
identify non-equivalent sets	93	94
identify place value (three digits)	68	68
Whole numbers		
add two 1-digit numbers	96	96
add two 2-digit numbers (no regrouping)	94	94
subtract two 2-digit numbers (no regrouping)	86	88
check subtraction by adding	51	59
identify multiplication symbol	70	70
use multiplication symbol	89	89
identify division symbols	83	84
use division symbols	81	82
Rational Numbers		
recognize one-half of region	90	94
Measurement		
count objects or groups, use terms (wide-narrow, long-short, etc.	96	96
tell time to nearest 5 minutes	67	68
count change under $1	83	84
read ruler to nearest inch	93	96
read scales to nearest pound	87	88
Geometry		
recognize geometric figures.	88	91

Arkansas

Minimum Performance Testing Program: Grade 6

Objective	Percent Mastering 1982	1983
Numeration		
identify place value to six digits	70	73
identify greater/less than, equal to	76	83
round numbers to nearest 1,000	69	73
Whole numbers		
divide dividends to 81 (basic facts)	94	95
divide 3-digit number by 1-digit number	80	85
divide 3-digit number by 2-digit multiple of 10	69	74
add three or more 5-digit numbers	90	93
subtract 5-digit numbers	85	88
multiply 3-digit number by 2-digit number	86	87
Rational Numbers		
identify numerator/denominator	67	76
add decimal fractions through thousandths	85	89
subtract decimal fractions through thousandths	79	83
multiply decimal fractions through thousandths	71	72
Measurement		
read Fahrenheit/Celsius thermometers	68	68
relate freezing/boiling points - C/F	60	64
measure lengths - customary/metric	64	66
Geometry		
identify parts of circle (center, diameter, radius)	73	71
identify parallelograms, others	46	47

Arkansas

Mimimum Performance Testing Program: Grade 8

Objective	Percent Mastering 1982	1983
Numeration		
identify place value (to seven digits)	83	86
round numerals (to seven digits)	72	80
Whole numbers		
add whole numbers	93	94
subtract whole numbers	93	94
multiply 3-digit number by 3-digit number	87	89
divide 5-digit number by 2-digit number	75	79
estimate whole number computations	76	82
solve whole number word problems involving one or two operations	75	83
find greatest common factor	68	69
find least common multiple	75	75
Rational Numbers		
change fraction to equivalent fraction	73	77
order sets of fractions	61	60
add fractions	67	68
subtract fractions	65	65
multiply fractions	84	82
change decimals to fractions	80	79
change fractions to decimals	57	56
add decimals	80	90
subtract decimals	83	83
multiply decimals	69	67

Arkansas - Grade 8 (continued)

Objective	Percent Mastering 1982	1983
solve decimal word problems	74	81
write percent as fraction	65	71
write percent as decimal	77	80
write decimal as percent	76	81
write fraction as percent	58	63
solve percent word problems	56	57
Measurement		
estimate and determine measurements of time, temperature, length, capacity, mass (customary, metric)	73	84
convert units of measure to another within same system	40	44
Geometry		
recognize geometric figures (circles, squares, quadrilaterials, octagons)	65	60
Probability and Statistics		
read and interpret charts/tables/graphs	83	82

California

Survey of Basic Skills: Grade 3

Skill Area	No. of Items	Average percent correct 1979-80	1980-81	1981-82	1982-83
Arithmetic	245	75	75	76	78
Counting and place value	45	79	80	81	82
Skills	30	80	80	82	83
Applications	15	79	79	80	82
Operations	155	73	73	75	76
Basic facts	25	86	86	88	88
Addition	30	83	83	85	86
Subtraction	30	70	71	73	75
Multiplication	30	64	65	67	69
Application	40	66	66	67	68
Basic facts	13	68	68	69	70
Addition/subtraction	15	75	76	77	79
Multiplication	12	51	51	51	52
Nature of numbers and properties	45	76	76	77	78
Properties and relationships	15	76	76	78	77
Money and fractions	15	80	81	82	83
Applications	15	71	72	72	73
Geometry	30	75	75	77	77
Skills	20	76	76	78	78
Applications	10	72	73	74	75

California - Grade 3 (continued)

Skill Area	No. of Items	Average percent correct 1979-80	1980-81	1981-82	1982-83
Measurement	40	73	74	75	75
Linear measures	15	70	71	72	72
Other measures	15	78	79	78	79
Applications	10	71	72	73	74
Patterns and graphs	30	74	75	76	77
Skills	15	64	64	66	66
Applications	15	84	85	86	87
Problem analysis and models	15	70	71	71	73
Problem solving/ applications	(120)	72	72	73	74
Total	360	74	75	76	77

California

Survey of Basic Skills: Grade 6

Skill Area	No. of Items	Average percent correct 1981-82	1982-83
Counting, numeration, and place value	40	65	67
Skills	25	66	68
Counting and numeration	15	67	69
Place value	10	65	68
Applications	15	62	64
Nature of numbers and properties	50	62	62
Skills	35	61	61
Ordering and properties	15	67	67
Classification of numbers	20	57	57
Applications	15	62	62
Operations	145	62	63
Skills	98	66	67
Addition/subtraction of whole numbers	15	79	79
Multiplication of whole numbers	14	79	79
Division of whole numbers	15	72	74
Addition/subtraction of decimals	14	56	57
Multiplication/division of decimals	12	54	58
Operations on fractions	16	54	53
Percents and equivalent fractions/decimals	12	64	64

California - Grade 6 (continued)

Skill Area	No. of Items	Average percent correct 1981-82	1982-83
Applications	47	55	56
One-step involving whole numbers	12	69	69
One-step involving rational numbers	20	53	53
Two (or more) steps	15	48	48
Expressions, equations, and coordinate graphs.	42	63	64
Skills	27	63	63
Expressions and equations	15	66	66
Graphs and function tables	12	58	60
Applications	15	64	65
Geometry	40	63	64
Skills	24	63	64
Shapes and terminology	12	65	65
Relationships	12	61	63
Applications	16	62	63
Measurement	58	61	61
Skills	42	62	62
Metric units	20	59	60
U.S. customary units	10	75	75
Length, area, and volume	12	56	56
Applications	16	58	57
Probability and statistics	23	60	60
Probability	12	54	52
Statistics	11	67	68

California - Grade 6 (continued)

Skill Area	No. of Items	Average percent correct 1981-82	1982-83
Tables, graphs, and integrated applications	30	67	68
Tables and graphs	15	68	69
Integrated applications	15	66	66
Problem solving	52	63	64
Formulation	15	70	70
Analysis and strategy	25	66	66
Interpretation	12	50	50
Solution of problems	(154)	61	61
Total	480	63	63

California

Survey of Basic Skills: Grade 12

Skill Area	No. of Items	Average percent correct 1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83
Arithmetic	98	73	72	72	73	73	75	74	74
Number concepts	28	74	74	74	74	74	75	75	75
Number and numeration	14	71	70	70	70	71	72	72	73
Number theory	8	76	76	76	77	77	78	77	77
Number properties	6	80	79	79	79	79	80	79	79
Whole numbers	22	80	80	80	81	81	82	82	82
Computation	14	81	81	81	82	82	84	84	84
Application	8	79	79	78	78	78	79	78	78
Fractions	26	66	65	64	65	65	66	66	66
Computation	14	70	68	68	69	70	72	72	71
Application	12	61	60	60	60	60	60	60	60
Decimals	22	72	71	72	73	74	76	76	76
Computation	14	74	74	75	76	77	79	79	80
Application	8	68	67	67	68	68	70	70	70
Al ora	32	63	62	62	62	62	64	63	63
Computation	14	66	66	66	66	66	68	68	68
Application	18	60	59	59	59	59	60	60	60
Geometry	24	63	62	62	62	62	62	62	62
Knowledge of facts	12	75	76	76	75	76	76	76	76
Application	12	50	49	48	48	48	49	49	49

California - Grade 12 (continued)

Skill Area	No. of Items	Average percent correct 1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83
Measurement	30	61	60	59	59	59	60	59	59
Knowledge of facts	12	72	71	70	70	70	71	70	69
Application	18	53	52	52	52	52	53	52	52
Probability and statistics	14	57	57	57	57	58	59	59	59
Computation	6	58	58	58	59	60	61	61	61
Application	8	57	56	57	56	57	58	57	57
Problem solving	(62)	62	61	61	61	61	62	61	61
Arithmetic	28	69	67	67	67	68	68	68	68
Graphs	34	56	55	55	55	55	56	56	56
Total	198	67	66	66	67	67	68	68	68

Connecticut

Basic Skills Proficiency Test: Grade 9

Objective/Competency	October 1980	1981	1982	1983
Computation (23 items)	78	78	79	85
add whole number.				
subtract whole numbers				
multiply whole numbers				
divide whole numbers (without remainders)				
add fractions and/or mixed numbers				
subtract fractions and/or mixed numbers				
multiply fractions and/or mixed numbers				
divide fractions and/or mixed numbers				
add decimal numbers				
subtract decimal numbers				
multiply decimal numbers				
divide decimal numbers				
find a percent of a given whole number				
find what percent one whole number is of another whole number				
Concepts (15 items)	71	72	73	74
convert fractions, decimals, and percents to equivalents				
order unit fractions or decimal numbers				
identify the numeric form of given whole number written in words				

Connecticut - Grade 9 (continued)

Objective/Competency	1980	1981	1982	1983
identify place value of digit in given number				
name ratio given two quantities				
recognize given pair of lines as parallel, perpendicular, or intersecting				
identify fractional equivalent of shaded portion of given pictorial representation				
select most appropriate unit of measure for given task				
find perimeter of common geometric figure (triangle, rectangle, square)				
find area of common geometric figure (triangle, rectangle, square, circle)				
Problem Solving (27 items)	73	76	76	85
solve for value of variable in given formula				
solve problem involving whole numbers				
solve problem involving fractions				
solve problem involving decimals				
solve problem involving percents				
read and interpret table, chart, or graph				
read and interpret map drawn to scale				
find equivalent linear measures (English, metric)				
find equivalent measures of weight (mass) and capacity (English, metric)				
solve problem involving time				

Connecticut - Grade 9 (continued)

Objective/Competency	1980	1981	1982	1983
find average of set of whole numbers				
approximate reasonable answer to given problem				
identify correct number sentence to solve problem				
Total (65 items)	74	76	76	82

Delaware

Educational Assessment Program: Grades 1-8, 11

1981-19 : California Achievement Test
1984: Comprehensive Tests of Basic Skills

Grade		Normal Curve Equivalent CAT-1981	1982	1983	CTBS-1984/est. CAT	
1	Total	61	62	62	58	
	Computation			53		
	Concepts/Applications			62		
2	Total	59	60	62	65	
	Computation			64		
	Concepts/Applications			59		
3	Total	58	60	59		
	Computation			60		
	Concepts/Applications			56		
4	Total	57	57	58	61	62
	Computation			63		
	Concepts/Applications			61		
5	Total	56	58	59	58	59
	Computation			60		
	Concepts/Applications			54		
6	Total	57	57	59	58	62
	Computation			60		
	Concepts/Applications			54		
7	Total	56	58	58	56	60
	Computation			56		
	Concepts/Applications			55		
8	Total	55	57	57	55	58
	Computation			56		
	Concepts/Applications			54		
11	Total	54	54	54	53	54
	Computation			54		
	Concepts/Applications			51		

Delaware

Comprehensive Tests of Basic Skills (Spring 1984)

Objective	Grade 1	2	3	4	5	6	7	8	11
	Percent Correct								
Computation									
add whole numbers	77	92	85	84					
add decimals/ fractions				85	65	78	68	79	77
subtract whole numbers	83	88	85	79					
subtract decimals/ fractions				75	72	83	71	81	77
multiply whole numbers			94	89	80	89			
multiply decimals/ fractions					67	79	64	75	78
divide whole numbers			87	82	71	84			
divide decimals/ fractions							55	67	66
integers							46	58	68
algebraic expressions									65
exponents or percents									62
Concepts and Applications									
numeration	83	86	82	73	69	77	61	71	68
number sentences			87	74	66	75	62	74	70
number theory			75	79	70	81	68	75	70
problem solving	73	91	81	73	74	81	67	74	70
measurement		78	8[illegible]	81	60	70	61	69	59
geometry		84	86	68	73	80	83	88	76
measurement/geometry	79								

Florida

State Student Assessment Tests: Grades 3, 5, 8, 10 *

Standards	Grade	Percent Correct 3	5	8	10
Number Concepts					
count quantities		98	98		
read and write numerals		100	96		
round numbers			88	88	81
put numbers in order			91		96
determine equivalent forms of fractions, decimals, and percents		78	94	79	92
Computation with Whole Numbers					
add whole numbers		98	92	97	
subtract whole numbers		89	86	92	
multiply whole numbers			92	89	94
divide whole numbers			70	78	82
Computation with Fractions					
add and subtract fractions			80	71	80
multiply fractions				84	53
Computation with Decimals					
add and subtract decimals				95	
multiply and divide decimals				72	86
find percentages					79
Measurement					
measure time, temperature, distance, capacity, and weight		96	98		
Practical Problems					
identify value of coins and bills		93	98		

* Grades 3, 5, 8 - October 1982; Grade 10 - April 1982

Florida - Grades 3, 5, 8, 10 (continued)

Standards	Grade	Percent correct 3	5	8	10
solve problems involving whole numbers		94	70	87	82
solve problems involving fractions, decimals, and percents					65
solve money problems		66	62	67	
solve measurement problems using metric and customary units				91	
interpret graphs, tables, and maps			68	95	
Mastery of 76% to 100% of Standards:		78	77	70	69

Florida

State Student Assessment Test: Grade 3

Skills	Percent Correct
Number Concepts	
count up to 100 objects	98
read and write numbers less than 100	100
identify halves, thirds, or fourths	78
Computation with Whole Numbers	
add three 1-digit numbers, sums through 18	99
add two 2-digit numbers (no regrouping)	95
subtract basic facts through 18	87
subtract 1-digit from 2-digit numbers with no regrouping	88
subtract 2-digit numbers with no regrouping	80
Measurement	
tell time on hour and half-hour	89
determine length of object	98
Practical Problems	
identify sets of coins equal in value (under 25¢)	93
solve word problems involving addition	95
solve word problems involving subtraction	92
subtract to solve practical money problems (under 50¢)	66

Florida

State Student Assessment Test: Grade 5

Skills	Percent Correct
Number Concepts	
count up to 1,000 objects	98
match numbers 100 to 9,999 to word names	99
read and write money values through $5	84
round whole numbers less than 100 to nearest 10	88
order three numbers less than 1,000	85
identify object's position (11th through 99th)	91
match fractions to pictures showing fractional parts	94
Computation with Whole Numbers	
add four 3-digit numbers with regrouping	86
add 3-digit numbers to 1-, 2-, or 3-digit number	91
subtract two 4-digit numbers without regrouping	89
subtract two 4-digit numbers with one regrouping	79
identify basic multiplication facts	95
multiply 1-digit number and 3-digit number	84
divide 3-digit number by 1-digit number with no remainder	70
Computation with Fractions	
add two fractions with like denominators	82
subtract two proper fractions with like denominators	86
Measurement	
identify months of year in order	95
tell time to hour, half-hour, and quarter-hour	84
measure length, width, or height using centimeters or meters	99

Florida - Grade 5 (continued)

Skills	Percent Correct
Practical Problems	
identify equivalent amounts of money up to $5	98
solve word problems by adding three 3-digit numbers	82
solve word problems by subtracting two 3-digit numbers	56
solve purchase problems involving change from $1	62
find information in bar graphs or pictographs	68

Florida

State Student Assessment Test: Grade 8

Skills	Percent Correct
Number Concepts	
round whole numbers less than 10,000	88
und decimal numbers less than 10 to nearest whole number	82
identify equivalent proper fractions	72
identify improper fraction equal to mixed number	83
identify decimal equal to whole number percent	87
identify decimals or percents equal to proper fractions	56
Computation with Whole Numbers	
add any three 4-digit numbers	97
subtract any two 5-digit numbers	92
multiply 2-digit number by 3-digit number	89
divide 5-digit number by 1-digit number	78
Computation with Fractions	
add two proper fractions with unlike denominators	69
subtract two proper fractions with unlike denominators	72
multiply two proper and/or improper fractions	84
Computation with Whole Numbers and Decimals	
add three numbers, each with fewer than three decimal places	94
subtract two decimal numbers, each with no more than two decimal places	92
multiply whole number and 1- or 2-place decimal number	82
divide decimal (tenths or hundredths) by multiple of 10	67

Florida - Grade 8 (continued)

Skills	Percent Correct
Practical Problems	
solve word problems by multiplying 2-digit and 3-digit numbers	84
change word problem to number sentence	84
solve money problems involving comparison shopping (less than $10)	67
add or subtract to solve linear measurement problems	86
add or subtract to solve weight problems	90
find information in bar graphs or pictographs	95

Florida

State Student Assessment Test: Grade 10

Skills	Percent Correct
Number Concepts	
round numbers with no more than three decimal places	79
round mixed number to nearest whole number	73
order three numbers (through millions)	96
identify improper fraction equal to mixed number	95
identify mixed number equal to improper fraction	95
identify decimal and percent equal to fraction	68
Computation with Whole Numbers	
multiply two 3-digit numbers	94
divide 5-digit number by 2-digit number	82
Computation with Whole and Mixed Numbers	
add two mixed numbers	33
subtract whole number and mixed number	66
subtract two mixed numbers	79
multiply whole number and mixed number	53
Computation with Decimals	
multiply two numbers with no more than two decimal places	91
divide numbers with no more than two decimal places	72
Computation with Percents	
multiply whole number and whole number percent	80
multiply decimal number and whole number percent	73

Florida - Grade 10 (continued)

Skills	Percent Correct
Practical Problems	
solve problems involving averages	82
solve problems using addition or subtraction of fractions with unlike denominators	65
Part II Skills	
determine elapsed time between two events	70
determine equivalent amounts of up to $100 using coins and bills	99
solve problem involving one or two distinct whole number operations	85
solve problem involving decimal fractions or percents and one or two distinct operations	77
solve problem involving comparison shopping	55
solve problem involving rate of interest and estimation of amount of simple interest	88
solve problem involving purchases and a rate of sales tax	89
solve problem involving purchases and a rate of discount given in fraction or percent form	74
solve problem related to length, width, or height using metric or customary units up to kilometers/ miles, conversion within system	66
solve problem involving area of rectangular region using metric or customary units	55
solve problem involving capacity using units in table	73
solve problem involving weight using units in table	54
read and determine relationships described by line graphs, circle graphs, and tables	96

Hawaii

Stanford Achievement Test: Grade 2

	Mean Grade Equivalent		Percent in Stanine					
			1-2-3		4-5-6		7-8-9	
	1981	1982	1981	1982	1981	1982	1981	1982
Concepts	3.3	3.4	21	18	51	51	29	31
Computation	3.2	3.3	14	12	54	53	32	34
Applications	2.8	2.9	30	26	52	54	18	20

Item Groups	Percent Correct 1981	1982
Computation		
Knowledge of primary facts	75	76
Addition algorithms	62	64
Subtraction algorithms	40	41
Concepts		
Number	61	62
Notation	63	64
Operations	59	61
Geometry measurement and graphs	72	72
Applications		
Solution of one-step problem	58	60
Analysis and development of solution design	50	52
Measurement and graphs	56	58

Hawaii

Stanford Achievement Test: Grade 4

	Mean Scores		Percent in Stanine					
			1-2-3		4-5-6		7-8-9	
	1982	1983	1981	1983	1982	1983	1982	1983
Concepts	17	17	20	20	57	56	23	24
Computation	22	22	18	18	49	50	33	32
Applications	17	17	25	24	60	59	15	17

Item Groups	Percent Correct 1982	1983
Computation		
Knowledge of primary facts	64	64
Addition and subtraction algorithms	67	67
Multiplication and division algorithms	39	40
Concepts		
Number	56	56
Notation	55	55
Operations	54	53
Geometry, measurement	51	51
Applications		
Solution of one-step problem	74	75
Analysis and development of solution design	52	54
Measurement and graphs	57	58

Hawaii

Stanford Achievement Test: Grade 6

	Mean Scores		Percent in Stanine					
			1-2-3		4-5-6		7-8-9	
	1982	1983	1982	1983	1982	1983	1982	1983
Concepts	21	20	16	17	52	53	32	30
Computation	27	26	15	16	56	57	29	27
Applications	23	22	24	26	55	54	21	20

Item Groups	Percent Correct 1982	1983
Computation		
Knowledge of primary facts and solution of simple mathematical sentences	64	63
Addition and subtraction algorithms	62	61
Multiplication and division algorithms	53	52
Common fractions	43	41
Concepts		
Number	58	57
Notation	62	61
Operations	65	64
Geometry, measurement	55	55
Applications		
Selection of appropriate operation	76	75
Analysis and development of solution design	56	55
Rate and scale	54	53
Measurement	40	39
Graph reading and interpretation	56	56

Idaho

Proficiency Test: Grades 8, 9 (1984)

Objective	Percent Passing Grade 8 Public	Grade 8 Nonpublic	Grade 9 Public	Grade 9 Nonpublic	Retakes	
add fractions	77	57	58	61	22	13
multiply and divide decimals	84	77	71	59	38	31
add and subtract decimals	54	34	85	72	63	63
multiply fractions	81	69	94	91	86	100
equivalent fractions	85	77	92	94	79	94
decimal to percent equivalents and vice versa	59	63	51	52	25	38
fractions to decimal equivalents	82	67	73	62	43	69
add whole numbers	96	88	98	99	96	100
subtract whole numbers	94	89	98	96	94	100
multiply whole numbers	86	81	96	97	91	100
divide whole numbers	79	67	87	80	71	75
best unit metric	96	90	93	96	85	88
unit conversion measurement	64	51	60	61	34	38
parallel and perpendicular	83	73	71	67	50	63
figures recognition	99	94	93	95	81	94
area and perimeter	59	50	91	88	81	94
whole number application or money problems	87	73	89	90	72	94
averages	56	38	81	81	62	69
f ction application	77	71	67	60	29	50
percent application	48	40	76	79	56	56
proportional parts	79	68	74	68	44	63
time	72	61	91	89	81	94

Idaho - Grades 8, 9 (continued)

Objective	Percent Passing Grade 8 Public	Grade 8 Nonpublic	Grade 9 Public	Grade 9 Nonpublic	Retakes	
checkbook; bank records	78	77	86	77	76	81
wages and money	96	88	85	77	67	69
change from $20, $10, $5	94	88	93	91	82	88
formulas	91	85	71	68	33	38
Total % of students passing	77	60	79	69	40	75

Illinois

Inventory of Educational Progress: Grades 4, 8, 11

Selected Topics	Percent Correct, 1976-1983 Grade 4	Grade 8	Grade 11
Whole Numbers	75	67	86
Mathematical Concepts	64	60	67
Fractions		68	63
Algebra		57	61
Applications	60	54	60
Statistics			59
Measurement	44	44	53
Geometry	35	48	47

Total Scores

Grade	1976	1978	1979	1980	1981	1982	1983
4	55	54	69	68	62	64	67
8	60	58	68	70	69	60	64
11	50	53	59	57	57	55	62

Indiana

Test Results Summary by Level*

Level	Stanines	Percent in stanines 1980-81	1981-82
Primary	1 2 3	15	15
	4 5 6	56	56
	7 8 9	29	29
Intermediate	1 2 3	13	13
	4 5 6	58	58
	7 8 9	29	29
Junior/Middle	1 2 3	14	13
	4 5 6	57	57
	7 8 9	29	30
High school	1 2 3	17	16
	4 5 6	57	56
	7 8 9	26	28
Overall	1 2 3	15	13
	4 5 6	57	57
	7 8 9	28	30

* varied tests administered - CAT, CTBS, ITBS, MAT, STEP, SRA, SAT, TAP

Iowa

Assessment Test: Grade 5 (1975-76)

Objective	Percent Correct
Number and Numeration	
read numerals through 100,000	93
write numeral from word - up to 100,000	82
give place value for digit - up to 100,000	89
order three numbers from smallest to largest	85
write numeral from expanded notation - up to 10,000	87
write expanded notation from numeral - up to 10,000	88
round number less than 10,000 to nearest 10, 100, or 1,000	70
distinguish between even and odd numbers less than 50	89
Computation - Addition and Subtraction	
find sum - 2 or 3 addends, no more than 4-digit numbers, without regrouping	92
find sum - 2 or 3 addends, no more than 4-digit numbers, with regrouping	91
find sum - 2 or 3 addends, no more than 4-digit numbers, with regrouping, in columns	91
estimate sum of two 2-digit numbers by rounding to nearest 10	84
estimate sum of two 3-digit numbers by rounding to nearest 100	68
subtract - up to 4-digit numbers, without regrouping	91
subtract 4-digit numbers with regrouping in one column, with no zero in minuend	82
subtract 4-digit numbers with regrouping in one column, with zero in minuend	79

Iowa - Grade 5 (continued)

Objective	Percent Correct
subtract 4-digit numbers with regrouping in two or more columns, no zero in minuend	81
subtract 4-digit numbers with regrouping in two or more columns, with zeros in minuend	65
recognize identify element for addition	95
recognize subtraction as inverse of addition	71
match mathematical sentence with problem solution	82
match mathematical sentence to problem	80
Computation - Multiplication and Division	
identify multiplication as repeated addition	88
demonstrate knowledge of multiplication facts	83
multiply 3-digit number by 1-digit number with regrouping	80
multiply 2-digit number by multiple of 10	54
multiply 3-digit number by 10 or 100	66
multiply 2-digit number by 2-digit number	48
divide 3-digit number by 1-digit number, with no zeros in quotient, no remainder	66
divide 3-digit number by 1-digit number, with no zeros in quotient, with remainder	54
divide 2- or 3-digit number by multiple of 10, without remainder	44
divide 2- or 3-digit number by multiple of 10, with remainder	46
match mathematical sentence to problem	66 61
recognize identity element for multiplication	94
recognize effect of 0 in multiplication	82

Iowa - Grade 5 (continued)

Objective	Percent Correct
Measurement	
read time to nearest minute	68
determine value of coins and bills - up to $20	79
select appropriate change - from $10	49
select items to purchase for specified amount	70
measure to nearest ½ inch	81
measure to nearest centimeter	94
read thermometer to nearest degree	47
select unit of linear measure for situation	70
estimate length to nearest inch	65
estimate length to nearest centimeter	45
Fractions	
name fraction for shaded or circled portion of region or set	70
divide region into halves, thirds, fourths	74
identify pair of equivalent fractions from drawing	61
identify larger/smaller of two fractions, like denominators	70
add two fractions, like denominators	44
subtract fractions, like denominators	47
Geometry	
identify circle, rectangle, square, triangle, cube, sphere	76
identify similar plane figures	89
identify congruent plane figures	78
identify whether point lies in interior, exterior, or on simple closed plane curve	62

Iowa - Grade 5 (continued)

Objective	Percent Correct
find perimeter of polygon	78
count unit squares to find area of polygon	68

Iowa

Assessment Test: Grade 8 (1975-76)

Objective	Percent Correct
Number and Numeration	
notation and value	76
word form	83
rounding	55
exponents	87
Whole Numbers	
addition	82
subtraction	79
multiplication	72
division	66
estimation	44
problem solving	54
Statistics	
averages	57
Scale Drawing	
measurement	79
Graphing	
tables and interpretation	56
Measurement	
estimation	71
segments	63
calibration	64
English, metric units	66
perimeter, area, volume	46

Kansas - Grade 6 (continued)

Competency	Percent Answering Correctly at least 1 of 3	2 of 3	3 of 3
Solve one-step word problem using addition (no more than three numbers less than 10,000)	97	90	68
Solve one-step word problem using subtraction (3- or 4-digit number from 3-, 4-, or 5-digit number, with regrouping)	93	82	59
Solve one-step problem using multiplication (two numbers less than 100)	88	75	55
Solve problem using division (3-digit number by 2-digit number with no remainder)	89	73	52

Percent meeting or exceeding minimum standard: 62

Iowa - Grade 8 (continued)

Objective	Percent Correct
betweeness	44
rounding	51
renamed as fraction	62
addition	59
subtraction	57
multiplication	68
division	46
problem solving	61
Ratio	
equivalent	70
problem solving	59
Percent	
as fractions	64
as decimals	47
as mixed numbers	31
problem solving	30
Geometry	
concepts	53
Simple Algebra	
formulas	29
Integers	
concepts	80
addition	56
problem solving	51

Iowa

Iowa Tests of Basic Skills: Grades 3-8 (1955-77)*

	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
1955	31	41	48	60	68	76
1960	34	43	51	63	74	83
1965	35	45	55	65	75	85
1966	35	45	55	65	74	83
1967	35	44	54	64	74	82
1968	35	45	54	64	72	82
1969	35	44	53	62	71	81
1970	35	44	53	62	71	80
1971	35	44	52	62	71	80
1972	35	44	53	62	71	80
1973	35	44	52	61	70	79
1974	35	44	52	60	69	78
1975	35	44	51	60	68	77
1976	35	44	51	60	67	78
1977	35	44	52	60	68	77

* in terms of 1965 "Base Year" Iowa Grade Equivalents

Kansas

Minimum Competency Test: Grade 2 (1982-83)

Competency	Percent Answering Correctly 1 of 3	at least 2 of 3	3 of 3*
Identify next number in sequence (skip-counting by 2s, 5s, 10s)	99	97	88
Identify standard numeral for number (2-digit number, modeled)	97	89	76
Identify sum (basic fact)	100	99	92
Identify sum (no more than two digits, no regrouping)	99	98	89
Identify sum (no more than two digits, with regrouping)	86	79	62
Identify difference (basic fact)	100	98	86
Identify difference (1- or 2-digit number from 2-digit number)	98	95	83
Identify time shown on clock (hour or half-hour)	98	91	73
Interpret data on bar graph	99	98	89
Identify squares, circles, triangles, and rectangles	100	99	84
Identify shaded part as one-half, one-third, or one-fourth	89	82	74
Identify coin/value in cents	99	95	88
Identify value of coins to $1.00	96	82	55
Identify solution to word problem (sum less than 100, no regrouping)	98	95	81
Identify solution to word problem (subtract, two numbers less than 100, no regrouping)	94	79	56

Percent meeting or exceeding minimum standard: 90

* Expected performance underlined

Kansas

Minimum Competency Test: Grade 4 (1982-83)

Competency	Percent Answering Correctly at least 1 of 3	2 of 3	3 of 3
Identify word name for whole number between 99 and 10,000	97	92	79
Order three whole numbers less than 1,000	95	82	64
Identify place value of digit in 4-digit number	96	90	81
Add column of three numbers (three or fewer digits, with regrouping)	99	93	76
Solve problem with subtraction (whole numbers less than 1,000, regrouping)	94	88	69
Solve problem using multiplication basic facts	99	98	91
Multiply 2-digit number by 1-digit number with regrouping	97	91	75
Identify correct quotient to division basic fact	98	95	81
Identify time to minute on clock	96	89	69
Interpret data on bar graph	97	91	63
Interpret data on line graph	94	72	36
Identify figure that has same size and shape	99	97	88
Identify fraction that describes shaded part of region	95	86	48
Identify total cost of items (up to $10)	96	86	56
Identify correct amount of change (up to $5)	89	76	57
Recognize approximation of 3-digit number to nearest hundred or ten	95	74	34
Identify length of object to nearest centimeter	97	90	75
Solve problem using addition or subtraction (3-digits or fewer, regrouping)	96	84	58

Kansas - Grade 4 (continued)

Competency	Percent Answering Correctly at least 1 of 3	2 of 3	3 of 3
Solve problem using multiplication (1- or 2-digit number by 1-digit number, with regrouping)	86	73	57
Solve problem using division fact	78	60	35

Percent meeting or exceeding minimum standard: 79

Kansas

Minimum Competency Test: Grade 6 (1982-83)

Competency	Percent Answering Correctly at least 1 of 3	2 of 3	3 of 3
Identify place value to tenths and hundredths	69	61	48
Add three numbers greater than 100 and less than 10,000 with regrouping	100	98	86
Subtract 3- or 4-digit number from 3-, 4-, or 5-digit number with regrouping	97	92	76
Multiply 3-digit number and 2-digit number with regrouping	96	90	77
Divide 3-digit number and 2-digit number with regrouping	97	87	63
Interpret data on circle, pictorial, and/or bar graph	97	84	50
Interpret data from line graph	96	80	44
Identify average (three to five numbers, two digits or fewer, whole number result)	69	58	43
Identify approximate size of area of quadrilateral or triangle on graph paper	92	70	56
Calculate perimeter of polygon	93	68	22
Multiply two fractions	94	85	61
Find unit cost of items	95	87	72
Approximate by rounding a given 4-digit number to nearest thousand, hundred, or ten	96	83	60
Identify length of object to nearest millimeter	76	70	59
Add two decimal numbers less than ten (one to three places, with regrouping)	95	85	60
Subtract 1- or 2-place decimal number from large 1- or 2-place decimal number less than 100, with regrouping	94	67	56

Kansas - Grade 6 (continued)

Competency	Percent Answering Correctly 1 of 3	at least 2 of 3	3 of 3
Solve one-step word problem using addition (no more than three numbers less than 10,000)	97	90	68
Solve one-step word problem using subtraction (3- or 4-digit number from 3-, 4-, or 5-digit number, with regrouping)	93	82	59
Solve one-step problem using multiplication (two numbers less than 100)	88	75	55
Solve problem using division (3-digit number by 2-digit number with no remainder)	89	73	52

Percent meeting or exceeding minimum standard: 62

Kansas

Minimum Competency Test: Grade 8 (1982-83)

Competency	Percent 1 of 3	Answering Correctly at least 2 of 3	3 of 3
Subtract 3- or 4-digit number from 4-, 5-, or 6-digit number, with regrouping	99	97	85
Compute product (3-digit number with regrouping)	99	97	89
Compute quotient and remainder (4-digit number by 2-digit number)	97	88	63
Determine average	83	76	63
Compute area or perimeter of rectangle	88	56	35
Add two fractions or mixed numbers (unlike denominators)	84	76	69
Subtract two fractions or mixed numbers (unlike denominators)	88	79	64
Divide two fractions or mixed numbers	88	74	59
Identify cost of set of items	96	84	55
Determine amount of take-home pay	94	85	70
Identify most economical buy	79	49	23
Determine wage for stated period of time	96	87	60
Round number to designated place value between thousands and thousandths	93	76	44
Identify correct amount of change (from $20)	88	70	44
Estimate distance between points on map (given scale)	96	80	48
Identify difference between two mixed decimal fractions up to thousandths	93	80	67
Identify correct decimal placement in product	96	88	26
Identify correct decimal placement in quotient	92	70	38

Kansas - Grade 8 (continued)

Competency	Percent Answering Correctly at least 1 of 3	2 of 3	3 of 3
Identify percent equivalent to given 1- or 2-place decimal number	90	83	66
State relationship between two quantities or items as a fraction, decimal, or percent	90	62	27

Percent meeting or exceeding minimum standard: 68

Kansas

Minimum Competency Test: Grade 11 (1982-83)

Competency	Percent Answering Correctly at least 1 of 3	2 of 3	3 of 3
Read and interpret data from line, bar, or circle graphs	99	93	66
Determine average	95	90	75
Determine amount of covering for specified area of rectangular solid	87	67	38
Identify most economical buy	91	66	28
Determine amount of take-home pay	97	86	57
Indicate average monthly payment	87	78	63
Identify cost of materials	98	91	66
Identify amount to save for purchase	98	93	77
Reconcile checking or savings account	95	80	40
Determine least combination of money for change (up to $100)	92	79	52
Determine fractional amount allocated for item	96	79	46
Identify sales slip for items purchased	96	85	68
Identify monetary or percent saved with discount	92	77	44
Compute simple interest	91	75	57
Determine quantity needed in metric units	96	84	58
Estimate distance between two points on scale drawing	96	83	56
Apply formula for determining area, perimeter, volume, or other parameter	88	63	34
Calculate missing terms in given proportion	98	90	66
Determine measurement of object given instrument	99	95	75

Kansas - Grade 11 (continued)

Competency	Percent Answering Correctly at least 1 of 3	2 of 3	3 of 3
Identify missing quantity in rate problem	99	92	70

Percent meeting or exceeding minimum standard: 76

Louisiana

State Assessment Test: Grade 7

Objective	Percent Correct 1982	1983	1984
Numeration	64	67	69
place value	59	61	64
rounding numbers	69	72	74
Whole number operations	84	85	87
addition and subtraction	89	90	91
division	79	81	82
Fractions and operations	70	71	74
rename fractions	70	72	74
add fractions	75	76	78
subtract fraction	71	73	76
multiply fractions	63	65	67
Decimals/decimal operations	75	77	79
add and subtract decimals	85	87	88
multiply decimals	66	68	70
Percent-ratio-proportion	50	52	55
Changing percents and decimals	52	54	58
changing fractions and percents	55	57	60
percent of a number	42	44	47
Relations and functions	78	80	82
graphs	78	80	82
Measurement and estimation	80	82	84
time and temperature	80	82	84
Geome .ry	57	59	6[illegible]
perimeter and area	57	59	[illegible]

Louisiana - Grade 7 (continued)

Objective	Percent Correct 1982	1983	1984
Problem solving	57	58	60
two-step word problems	59	60	62
money	61	63	65
averages	50	51	54
Total	66	68	70

Louisiana

State Assessment Test: Grade 10

Objective	Percent Correct 1982	1983	1984
Numeration	78	80	82
rounding numbers	78	80	82
Whole number operations	86	87	87
add and subtract integers	90	91	91
multiply and divide integers	82	83	84
Fractions and operation	65	67	67
add and subtract fractions	66	67	68
multiply fractions	66	68	69
divide fractions	63	65	65
Decimals/Decimal operations	76	78	79
convert fractions and decimals	68	71	73
add and subtract decimals	71	92	92
multiply decimals	77	79	80
divide decimals	68	71	71
Percent-ratio-proportion	62	63	64
fractions and decimals to percent	69	69	70
percent to a number	55	56	58
Relations and functions	75	77	78
graphs	85	87	88
equations	65	67	68
Measurement and estimation	63	63	63
addition and subtraction	76	76	77
convert liquid and mass measures	51	50	50

Louisiana - Grade 10 (continued)

Objective	Percentage Correct 1982	1983	1984
Geometry	66	66	67
spatial figures, volume	77	77	78
perimeter and area	54	54	55
Problem solving	62	61	62
banking and commission	62	61	62
budgeting and planning	63	61	63
Total	70	71	72

Massachusetts

Secondary Level Minimum Standards

(Tested by Massachusetts Test of Basic Skills - last administered, January 1979)

Number and Numeration Concepts

Recognize number symbols (17, eighteen), whole numbers (34), fractions (½), decimals (3.75), and powers of 10 (10^2)

Identify odd and even numbers

Put numbers in numerical order

Recognize equivalent fractions [$\frac{2}{4} = \frac{1}{2}$]

Arithmetic Computation

Add, subtract, multiply, and divide whole numbers (4069 + 81 + 123, 254 x 17, 16300 ÷ 100)

Add and subtract mixed numbers (2½ - 1¼)

Multiply whole numbers or money by fractions (halves, quarters, thirds)

Add, subtract, multiply, and divide decimal numbers like money

Change a fraction to a decimal (¼ to .25)

Find a percent of a number in situations such as simple interest, discounts, commissions, and taxes

Use ratio and proportion (mixtures, recipes, scale drawings)

Use simple formulas (A = l x w)

Estimation and Approximation

Round off numbers to a specified place

Approximate the answer to a computation problem (including discounts and percentages)

Estimate length, weight/mass, capacity, time, temperature, area, and volume

Estimate with money

Massachusetts (continued)

Measurement and Geometry

Choose an appropriate unit of measurement in the U.S. customary system (for example: feet, pounds, and gallons)

Choose an appropriate unit of measurement in the metric system (for example: meters, kilograms, and liters)

Choose an appropriate measurement instrument involving both U.S. customary and metric units

Convert common measurements within the same system

Read a scale drawing

Use a map to compute highway distances

Relate total cost and cost per unit

Compute by using temperature

Compute by using time

Identify right angles and parallel, perpendicular, and intersecting lines like those in a street map

Recognize that an object has the shape of a square, rectangle, triangle, or parallelogram

Identify the radius, diameter, and center of a circle

Recognize that an object has the shape of a cube, cylinder, or sphere

Find the perimeter of a triangle, square, and rectangle

Find the area of a triangle, square, and rectangle

Find the volume of a cube or other rectangular solid

Graphs and Tables

Read a table

Interpret a bar graph

Interpret a circle graph

Interpret a line graph

Massachusetts (continued)

Prediction of Events and Statistics

Understand probabilities like those used in weather forecasting or lotteries (the chance something will or will not happen)

Find and use averages (mean and median) for a group of numbers

Minnesota

Educational Assessment Tests: Grades 4, 8, 11 (1982-83)

Cluster	Grade	Percent Correct 4	8	11
Basic arithmetic		89	94	95
Whole number computation		74	87	86
Fractions		53	64	77
Decimals and percent			59	68
Integers				71
Terms, symbols		85	70	
Estimation and approximation			54	70
Geometric properties		70	64	65
Geometric applications		62	53	50
Algebraic expressions			69	75
Algebraic applications			56	48
Graphs, charts			71	68
Common measures		76	82	81
Metric measures		50	71	65
Number properties		84	83	70
Basic problem solving		64	67	69
Advanced problem solving		67	62	58
Consumer problem solving				64
Statistics and probability			68	73
Trigonometry				21

Minnesota

Educational Assessment Test: Grade 4

Cluster	Percent Correct 1978-79	1982-83*
Whole number computation	59	63
Terms, symbols	83	85
Introduction to fractions	52	49
Geometric properties	86	86
Geometric applications	72	76
Common measures	79	76
Metric measures	71	69
Number properties	85	84
Basic problem solving	70	68
Advanced problem solving	68	72
Total	78	79

* 80 items common to both assessments

Minnesota

Educational Assessment Test: Grade 8

Cluster	Percent Correct 1978-79	1982-83*
Basic arithmetic	74	78
Whole number computation	85	85
Fractions	50	49
Decimals and percents	60	66
Terms, symbols	79	83
Estimation and approximation	47	55
Algebraic expressions	73	74
Algebraic applications	22	29
Geometric properties	73	78
Geometric applications	58	57
Graphs, charts	66	70
Common measures	81	83
Metric measures	69	73
Number properties	74	80
Advanced problem solving	55	61
Statistics and probability	59	64
Total	65	69

* 64 items common to both assessments

Minnesota

Educational Assessment Test: Grade 11

Cluster	Percent Correct 1978-79	1982-83*
Whole number computation	87	86
Fractions	68	69
Algebraic expressions	79	81
Algebraic applications	41	45
Geometric properties	68	71
Geometric applications	55	57
Graphs, charts	73	73
Common measures	93	92
Metric measures	64	67
Number properties	67	71
Basic problem solving	57	70
Advanced problem solving	61	61
Consumer problem solving	62	66
Statistics and probability	59	59
Trigonometry	18	24
Total	65	67

* 86 items common to both assessments

Mississippi

California Achievement Test: Grades 4, 6, 8

	Percentile Ranking						
Grade 4	1977	1978	1979	1980	1981	1982	1983
Computation	43	43	50	53	55	58	61
Concepts and Applications	37	37	37	41	44	46	49
Grade 6							
Computation		29	34	54	56	60	62
Concepts and Applications		27	35	42	44	48	50
Grade 8							
Computation	33	33	36	47	49	51	54
Concepts and Applications	30	30	32	40	42	45	48

Montana

School Testing Service - Consumer Mathematics: Grades 6, 11

Topic of problem	Percent Correct Grade 6	Grade 11
comparison shopping	84	95
price of multiple quantity	95	
price of multiple quantity	87	
proportion of time	79	93
salary after deductions	69	
wages due	31	61
change from $5.00	77	89
miles to gallon	53	79
comparison pricing	56	75
buying paint to cover area	36	40
comparison shopping	71	83
sum/length of use	55	86
saving money to make purchase	43	66
profit or loss	27	57
tiles needed to cover area	14	30
comparison shopping	62	
comparison pricing	47	83
comparison pricing	40	72
miles to gallon, cost	33	70
credit		46
percent of discount		46
sales tax		72
commission		44

Montana (continued)

Topic of problem	Percent Correct Grade 6	Grade 11
finance charge		42
take-home pay		39
car payments		33
bank statement		82
discount		72
saving for expenses		47
interest		20
percentage		51

Nevada

Stanford Achievement Test: Grades 3, 6

	Percentage minimally proficient				6th ed.	7th ed.
	1979	1980	1981	1982	1983	1983
Grade 3	97	97	97	97	95	89
Grade 6	97	97	98	99	92	88

	Mean stanine scores			
Grade 3	6.0	5.9	5.9	6.1
Grade 6	5.7	5.7	5.8	5.9

Nevada

High School Proficiency Examinations: Grade 9

Competency	Spring	Percent scoring 4 or better of 6 on subtests 1979	1980	1981	1982	1983
add money		99	99	99	98	98
add fractions		82	83	83	83	82
subtract money		98	98	97	97	97
subtract fractions		88	88	86	87	87
multiply money		98	98	97	97	97
multiply fractions		89	89	89	90	90
divide money		92	92	93	93	92
use percent		77	76	75	77	76
perimeter/area		66	67	65	67	66
translate words/numbers		98	97	97	97	97
make change		89	88	89	90	89
time/date		95	95	89	91	90
measurement		94	93	86	87	86
compare numbers		88	87	79	80	79
tables/graphs		94	94	93	94	94
Total		86	86	81	83	82

Nevada

High School Proficiency Examinations: Grade 11

Competency	Percent scoring 4 or better of 6 on subtests Fall 1980	1981	1982	1983
add money	99	99	99	96
add fractions	77	83	85	98
subtract money	97	98	99	94
subtract fractions	83	89	89	84
multiply money	96	98	100	96
multiply fractions	90	91	89	86
divide money	93	94	96	89
use percent	80	84	71	67
perimeter/area	57	79	69	52
translate words/numbers	98	98	99	98
make change	94	96	96	90
time/date	89	96	97	98
measurement	96	95	97	94
compare numbers	79	93	94	88
tables/graphs	96	97	99	98
Total	83	91	91	91

Nevada

Minimum Competencies

Add money: add a group of not more than four numbers (not to exceed six digits in money notation in both vertical and horizontal form. Application level.

Add fractions: add two fractions with unlike denominators (denominators 2, 3, 4, 5, 8, and 10). Application level.

add two mixed numbers with unlike denominators (denominators 2, 3, 4, 5, 8, and 10). Application level.

Subtract money: subtract numbers (not to exceed six digits) in money notation in both vertical and horizontal form. Application level.

Subtract fractions: subtract two fractions with unlike denominators (denominators 2, 3, 4, 5, 8, and 10). Application level.

subtract two mixed numbers with unlike denominators -- no regrouping (denominators 2, 3, 4, 5, 8, and 10). Application level.

subtract a fraction (denominators 2, 3, 4, 5, 8, and 10) from a 1-digit whole number. Application level.

Multiply money: multiply a number (not to exceed six digits) in money notation by a 2-digit whole number in both vertical and horizontal form. Application level.

Multiply fractions: multiply two fractions with unlike denominators (denominators 2, 3, 4, 5, 8, and 10). Application level.

multiply a whole number (not to exceed two digits) by a fraction (denominators 2, 3, 4, 5, 8, 10). Application level.

Divide money: divide a number (not to exceed six digits) in money notation by a whole number (not to exceed two digits). Application level.

Use percent: estimate within 10% the sale price of an item (original cost not to exceed four digits in whole dollars) at a commercial percent and fractional discounts. Application level.

computer the simple interest (using whole number -- rates not to exceed 20%) on a number (not to exceed four digits in whole dollars). Application level.

find perimeter and area: find the perimeter of a rectangle with like units in English or metric systems. Application level.

Nevada (continued)

find the area of a rectangle with like units in English or metric systems. Application level.

translate words/numbers: represent in numerals a written whole number (not to exceed five digits). Comprehension level.

represent in numberals a number written in money notation (not to exceed six digits). Comprehension level.

express in words a number in money notation (not to exceed six digits). Comprehension level.

Make change: for a given purchase, determine the change in the least number of illustrated U.S. coins and bills from a given amount of money (not to exceed $20.00). Analysis level.

Identify time and date: using picutres of dial and digital clocks, given the starting time and ending time, determine elapsed time. Application level.

using pictures of dial and digital clocks, given the starting time and elapsed time, determine the ending time. Application level.

using a twelve-month calendar, given an elapsed number of days (not to exceed 15) determine the new date by month, day, and year. Application level.

Use units of measure: identify appropriate English or metric unit of common measure for length, weight, liquid volume, or temperature. Knowledge level.

rename, within the English or metric system, the common units of length, weight, liquid volume, or time. Application level.

measure length with an appropriate English or metric rule. Application level.

Compare numbers: determine the larger of two fractions with unlike denominators (denominators 2, 3, 4, 5, 8, and 10 and numerators not to exceed 10). Analysis level.

determine the larger of two decimals (not to exceed two decimal places). Analysis level.

Use tables and graphs: given a Nevada State Sales Tax Table, determine the tax on an item costing less than $5.00. Comprehension level.

given a circle or bar graph, identify the largest and/or smallest quantity. Analysis level.

New Hampshire

Educational Assessment: Grade 5 (1980)

Outcome	Percent Correct
Number recognition	
identify numeral from word name	94 93
Computation	
add three 3-digit numbers	91
subtract 2-digit number from 2-digit number	83
subtract 3-digit number from 3-digit number	71
multiply - basic fact	96
multiply 2-digit number by 1-digit number	81
multiply 3-digit number by 2-digit number	63
divide 2-digit number by 1-digit number	59
divide 3-digit number by 2-digit number	47
Word problems	
make change from $1.00	76
read table, add four 2-digit numbers	66
multiply 2-digit number by 1-digit number	85
multiply 4-digit number by 1-digit number	17
subtract 3-digit number from 3-digit number	59
multiply - basic fact	55
divide 2-digit number by 1-digit number	59
divide 3-digit number by 2-digit number	51
Rounding and estimation	
round to nearer 10	63
round to nearer 100	66

New Hampshire - Grade 5 (continued)

Outcome	Percent Correct
identify measure to nearer centimeter	27 27
round to nearer hundred, estimate sum	38
identify estimate of product	43
Adding and subtracting money	
add dollars and cents	90
subtract dollars and centers	83
make change	76
Knowledge of least and greatest	
identify least - 4-digit numbers	93
identify greatest - 3-digit numbers	96
Knowledge of mathematical symbols	
identify multiplication sign	95
identify less than sign	45
identify greater than sign	47
Metric measurement	
identify unit - meters	58

New Hampshire

Educational Assessment: Grade 9 (1980)

Outcome	Percent Correct
Computation	
add four addends, less than $10	90+
subtract 3-digit integer from 4-digit integer	90+
multiply 3-digit number by 2-digit number	75-
add five 1-, 2-, and 3-digit numbers	80+
subtract mixed decimal from whole number	66-
add two mixed numbers	66-
add two fractions, unlike denominators	75+
multiply mixed numbers	24
subtract negative integer from positive integer	39
identify percent one number is of another	60
Calculators and computers	
choose correct outcome for computer program	53
Alertness to reasonable results	
identify best estimate of sum of five numbers	81
estimate amount spent - millions	57
Charts and graphs	
read graph	84
read graph, subtract	51
Using math to predict	
determine chance of selecting given item	64 41
compute mean (average)	76 72
select median	44
select range	90

New Hampshire - Grade 9 (continued)

Outcome	Percent Correct
Geometry and measurement	
identify gram as appropriate measure	85
identify angle as appropriate measure	80
select ratio describing scale	65
determine difference in two thermometer readings	55
identify perimeter	67
	39
identify area	64
compute area	60
	51
	27
estimate area	48
identify area	59
Problem solving and applications	
percentage	32
	41
	22
	20
ratio	57
	29
	33
	80
	37
fractions	28
	38
geometric concepts	58
measurement - area	67
	42
measurement - volume	26

New Hampshire

Educational Assessment: Grade 12 (1980)

Outcome	Percent Correct
Computation	
add four decimal numbers	86
add two fractions, unlike denominators	66-
identify fractional equivalent of decimal	38
change fraction to decimal	66-
convert fraction to percent	50
Charts and graphs	
read line graph	80 89 36
read circle graph	81
Using mathematics to predict	
determine chance of selecting given item	75 50-
Problem solving and applications	
balance checkbook	83
compute down payment	81
compute gross pay	67
determine lowest price per ounce	45
compute cost per mile	33
determine percent	54 43
Alertness to reasonable results	
round decimal number to nearer 10	37
estimate earnings/expenses	68 53

New Hampshire - Grade 12 (continued)

Outcome	Percent Correct
Calculators and computers	
read flow chart	72
Geometry and measurement	
compute area of rectangle	67+ 67+
compute area of triangle	40+ 66-
compute diameter/radius	66- 66-
determine similarity/congruency of triangles	40 40
apply formula for area of cylinder	40

New Jersey

Minimum Basic Skills Test: Grades 9, 10 (1982-83)

Cluster/Skill	Percent Correct Grade 9	Grade 10
Computation	87	78
add multiple places without regrouping	98	96
	98	96
add multiple places with regrouping	95	93
	93	91
subtract multiple places without regrouping	97	96
	98	96
subtract multiple places with regrouping	94	89
	94	89
subtract with more than one consecutive zero	84	80
multiplication	95	91
multiplication with zero	92	87
	96	94
divide with 1-digit divisor without remainder	96	92
divide with 2-digit divisor without remainder	80	68
divide with 1- and 2-digit divisor with remainder	80	69
	95	92
add/subtract fractions, vertical	87	71
	96	92
add/subtract mixed fractions	61	41
	61	40
	84	68
	89	72
multiply/divide whole number by fraction	72	54
	58	38

New Jersey - Grades 9, 10 (continued)

Cluster/Skill	Percent Correct Grade 9	Grade 10
multiply whole number by mixed number	75	55
multiply/divide, proper fractions	94	90
	75	60
add decimals	97	95
	91	84
subtract decimals	80	63
	93	87
multiply decimals	88	80
multiply decimals with zero	65	39
	73	49
divide decimal with whole number	80	65
divide decimal by decimal	58	33
divide decimals - answer less than 1	80	65
divide decimal by multiple of 10	61	47
percent of number	63	53
	60	44
number when percent known	41	25
Number Concepts	89	77
two equivalent fractions	78	58
	76	56
compare simple fractions	74	57
change mixed number to improper fraction	91	82
change fraction to decimal	52	34
change decimal to fraction	84	71
change percent to decimal	92	85
change decimal to percent	89	83

New Jersey - Grades 9, 10 (continued)

Cluster/Skill	Percent Correct Grade 9	Grade 10
rounding whole numbers	80	64
rounding decimal less than or greater than 1	71	52
	71	48
properties: odd/even	89	71
concept of exponents	92	82
property of 1 and 0 in addition/ multiplication	94	87
	97	94
	83	69
Measurement and Geometry	82	70
length	72	54
	94	87
square with formula	63	36
rectangle with formula	87	77
triangle with formula	69	45
circle with formula	50	30
area - no formula	86	74
temperature	81	68
equivalent - linear metric	55	40
volume with formula	92	82
metric units	82	63
equivalent - mass	64	45
time	69	61
perimeter of irregular polygon	90	83
parallel/perpendicular lines	41	29
right angles	58	42

New Jersey - Grades 9, 10 (continued)

Cluster/Skill	Percent Correct Grade 9	Grade 10
identify parts of circle	79	67
	78	60
circle: radius/diameter	75	62
Problem Solving	80	68
read table/chart/graph	99	98
	87	79
	97	93
interpret table/chart/graph	97	94
	67	46
	72	49
reading maps: location	96	92
sales tax	63	45
simple interest	58	42
discount	49	30
change from $5 bill	93	89
measures of quantity	90	80
average: arithmetic mean	85	65
ratio - proportion	71	54
applications of basic arithmetic	86	72
	68	47
estimation of mileage	77	56
estimation	73	60
approximation	70	59

New Jersey

Minimum Basic Skills Test: Grades 9, 10

	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83
Grade 9						
Mean	76	77	79	81	83	84
Percent meeting or exceeding state standard	75	77	81	85	88	89
Grade 10						
Mean						72
Percent meeting or exceeding state standard						67

New Jersey

Minimum Basic Skills Test: Grade 9

Cluster	Average Percent Correct 1978	1979	1980	1981	1982	1983
Computation (41 items)	78	80	82	85	87	87
Number Concepts (16 items)	78	80	85	86	89	89
Measurement/Geometry (19 items)	71	72	74	77	81	82
Problem Solving (19 items)	71	73	73	77	80	80

New Mexico

Comprehensive Test of Basic Skills: Grade 3 (March 1984)

Objective	
Computation	82
Add whole numbers	80
add two 2-digit numbers	87
add two 3-digit numbers	91
	91
	80
	77
	72
add column to three 3-digit numbers	64
	79
Subtract whole numbers	80
subtract 1-digit from 2-digit number	89
subtract two 2-digit numbers	86
	91
	88
	66
	59
subtract two 3-digit numbers	86
	86
subtract two 4-digit numbers	71
Multiply whole numbers	90
multiply two 1-digit numbers	95
	96
	94
	94
	91
multiply by 0	93
multiply multiple of 10 by 1-digit number	90
	90
	79
multiply 2-digit by 1-digit number	73

New Mexico - Grade 3 (continued)

Objective	
Divide whole numbers	78
divide 2-digit by 1-digit number	77
	84
	74
	82
	68
divide two 1-digit numbers	80
Money	86
	78
	56
Concepts/Applications	75
Numeration	74
expanded notation, 4-digit number	90
	89
	58
number before	78
word names to 1000	74
round to nearest 10	72
	69
place value, four places	69
place value, five places	72
expanded notation, count hundreds, tens, ones	65
Number Sentences	82
missing sign	93
missing factor	96
missing addend	90
solve for unknown	62
sentence for array	70

New Mexico - Grade 3 (continued)

Objective	
Number Theory	64
identity element, addition	90
inverse property, addition, subtraction	89
commutative property, addition	54
even number	50
associative property, addition	37
Problem Solving	76
operation needed	88
picture graph	95 96
appropriate sentence	86

New Mexico

Comprehensive Test of Basic Skills: Grade 5 (March 1984)

Objective	Score
Computation	65
Add Decimals/Fractions	61
add two decimal numbers	83 56 47
add whole numbers and decimal	64
add two decimal fractions	55
add two mixed numbers	70 67
add two like fractions	48
Subtract decimals/fractions	65
subtract with money	80
subtract two decimal numbers	65 76
subtract decimal fraction from decimal number	72
subtract two mixed numbers	68 63 34
Multiply whole numbers	75
multiply 2-digit by 1-digit number	88
multiply multiple of 100 by 1-digit number	88
multiply two multiples of 10	77
multiply two 2-digit numbers	67
multiply 3-digit number by multiply of 10	53

New Mexico - Grade 5 (continued)

Objective	Score
Multiply decimals/fractions	64
multiply with money	86 71
multiply decimal number by whole number	68
multiply two decimals	29
multiply mixed number by whole number	64
Divide whole numbers	64
divide two 1-digit numbers	80
divide 3-digit number by multiple of 10	71
divide 4-digit number by 1-digit number	75
divide 5-digit number by 1-digit number	54
divide 4-digit number by multiple of 10	68
divide two 2-digit numbers	53
divide 4-digit number by 2-digit number	51
Concepts/Applications	62
Numeration	61
recognize integer	77
compare decimals	86
compare unlike fractions	52
place value, nine places	66 57
fractional part of set	34
estimate sum	60
expanded notation, 5-digit number	50
place value, periods	66
round to nearest tenth	61

New Mexico - Grade 5 (continued)

Objective	Score
recognize mixed number	67
recognize decimals	57
Number sentences	59
missing factor	58
solve for unknown	76 78
missing sign	49
function table	62
solve inequality	30
Number theory	62
inverse property, multiplication, division	72
identity element, multiplication	86
divisibility by 4	73
equivalent form, fractions	42
equivalent form, whole number/fraction	37
Problem solving	69
line graph	89
essential data	73
one-step, estimate	76
two-step, whole numbers	57 55
picture graph	69
one-step, estimate	75
logical reasoning	64
one-step, decimals	64

New Mexico - Grade 5 (continued)

Objective	Score
Measurement	57
appropriate unit, capacity	75
convert kiloliters to liters	78
perimeter, triangle	80
compare liter and centiliter	53
compare ounces and pounds	47
area, parallelogram	58
convert centimeters to meters	36
convert yards, feet, inches to inches	38
compare centigrams and grams	52
Geometry	65
pyramid	81
intersection	63
perpendicular lines	66
parallel lines	51

New Mexico

Comprehensive Test of Basic Skills: Grade 8 (March 1984

Objective	Score
Computation	69
Add decimals/fractions	73
add two decimal fractions	76 79
add two mixed numbers	59 65 75
add two unlike fractions	68
add decimal number and decimal fraction	81
add decimal fraction and whole number	80
Subtract decimals/fractions	74
subtract two decimal fractions	77 80
subtract two mixed numbers	75 74
subtract decimal fraction from decimal number	76
subtract two unlike fractions	66
subtract two decimal numbers	78
subtract mixed number from whole number	65
Multiply decimals/fractions	68
multiply decimal fraction by whole number	74
multiply two unlike fractions	71
multiply two decimal fractions	82 64 69
multiply mixed number by whole number	48

New Mexico - Grade 8 (continued)

Objective	Score
Divide decimals/fractions	62
divide decimal number by whole number	73 84
divide mixed number by fraction	59
divide two decimal fractions	51 48
divide fraction by mixed number	54
Integers	55
add positive number and negative number	55
subtract negative number from negative number	61
multiply negative by negative by positive numbers	37
divide negative number by positive number	66
Concepts/Application	69
Numeration	67
recognize mixed number	83
exponent notation, equivalent form	86
integer on number line	81
scientific notation, equivalent form	68
order of integers	62
square root	63
compare integers	59
order of fractions	34
Number sentences	68
function table	82
solve for unknown	85 51

New Mexico - Grade 8 (continued)

Objective	Score
solve proportion	77
evaluate inequality	62
value of function	53
Number theory	68
equivalent form, fractions	84
divisibility by 4	88
reciprocal	76
prime factors	72
common factors	51
least common multiple	65
equivalent form, decimal/fraction	43
Problem solving	69
essential data	72
logical reasoning	86
double bar graph	87
one-step, decimals	79
two-step, money	57
Venn diagram	84
one-step, money	78
average	45
logical reasoning	75
circle graph	51
two-step, fractions	41

New Mexico - Grade 8 (continued)

Objective	Score
Measurement	64
convert liters to kiloliters	86
convert centimeters to millimeters	78
use of protractor	93
convert inches to feet	67
compare liters and kiloliters	68
convert pounds and ounces to ounces	41
convert gallons to quarts	43
volume, rectangular prism	44
circumference	54
Geometry	83
name coordinates on grid.	93
congruent figures	71
name point on grid	92
	74

North Carolina

Diagnostic Mathematics Inventory: Grade 1 (Spring 1983)

Cluster	Percent Correct
Preoperational concepts	91
Counting	84
Matching	97
Add whole numbers - single digits	92
Add whole numbers - multiple digits	55
Subtract whole numbers	74
Missing addends	68
Sequences and inequalities	54
Measurement	69
Plane figures	94
Inverse and place value	49

North Carolina

Diagnostic Mathematics Inventory: Grade 2 (Spring 1983)

Cluster	Percent Correct
Preoperational concepts, counting and matching	83
Addition of whole numbers without regrouping	97
Addition of whole numbers with regrouping	50
Subtraction of whole numbers without regrouping	92
Subtraction of whole numbers with regrouping	42
Multiplication of whole numbers	61
Fractions	52
Sequences	78
Missing addends and factors	44
Inverse relations, inequality, number theory	21
Linear measure	76
Money	89
Time	68
Plane figures	90
Problem solving	88

North Carolina

California Achievement Tests: Grades 3, 6, 9 (Spring 1983)

	Percentile
Grade 3	
Computation	69
Concepts/Applications	58
Grade 6	
Computation	67
Concepts/Applications	59
Grade 9	
Computation	59
Concepts/Applications	53

North Dakota

Mathematics Assessment: Grade 4 (1979)

Objective	Percent Correct
Recall basic facts of addition	96
Recall basic facts of subtraction	95
Recall basic facts of multiplication	96
Recall basic facts of division	85
Identify by written word the counting numbers to 100	96
Identify by numerical symbol the counting numbers to 1,000	96
Recognize examples of even and odd numbers	94
Identify position of item in set of objects (ordinals)	95
Recognize examples of geometric shapes	92
Identify geometric concepts: point, line, curve, cube	94
Identify coin and give its value	96
Recognize appropriate units of measure	90
Convert units of measurement within a system	51
Recognize proper use of symbols: ( ), =, > , <	74
Add two whole numbers, with or without regrouping	94
Add three whole numbers, with or without regrouping	91
Add decimals	74
Find difference between two numbers less than 1,000	87
Name product of 2-digit number and 1-digit number	91
Name quotient and remainder of 2-digit dividend less than 50 and 1-digit divisor	98
Round to nearest hundred and nearest ten	64
Count by 2s and 3s	91
Measure given line segments to nearest unit	96

North Dakota - Grade 4 (continued)

Objective	Percent Correct
Tell time	92
Read temperature on thermometer	91
Indicate value of coins in cents	91
Recognize data on graph	70
Change verbal statement to mathematical sentence	81
Give sum of any number and zero as the given number	93
Give product of any number and 1 as the given number	98
Recognize where to use $<$, $=$, or $>$	87
Assign correct place value to digits in numeral	82
Rewrite number in expanded notation	83
Match number sentences with set combination drawings (addition)	97
Match number sentences with set and subset removal drawings (subtraction)	85
Indicate that repeated addition can be done by multiplication	90
Find fractional part of number	76
Identify fractional part of drawing	75
Match number sentences with subtraction arrows on number line	18
Select appropriate metric unit for length	73
Select appropriate metric unit for mass	44
Determine time elapsed	72
Estimate answer to problem	89
Arrange counting numbers from smallest to largest	92
Find solution to problem	60
Determine distance traveled from odometer readings	73

North Dakota - Grade 4 (continued)

Objective	Percent Correct
Identify extraneous data	57
Identify data needed to solve problem	83
Arrange fractions from smallest to largest	61
Find perimeter of rectangles, triangles, other polygons	60
Find total cost of several items	96
Make change from a dollar	77
Make change from an amount less than a dollar	94

North Dakota

Mathematics Assessment: Grade 6 (1975)

Objective	Percent Correct
Addition of whole numbers	
add five 2- or 3-digit numbers with regrouping	85
recognize commutative property	77
recognize zero as identity element	83
Addition of fractions	
add two mixed numbers with like denominators	71
add two or three fractions with like denominators	75
add two mixed numbers with unlike denominators	49
add two or three proper fractions with unlike denominators	52
Addition of decimals	
add two or three mixed decimals with two decimal places	91
add two or three decimals with regrouping	63
Subtraction of whole numbers	
subtract 3- or 4-digit number from 4-digit number without regrouping	93
subtract 3-digit number from 4-digit number with regrouping	85
Subtraction of fractions	
subtract two mixed numbers with like denominators	65
subtract two proper fractions with unlike denominators	58
Subtraction of decimals	
subtract two decimals with two or three places without regrouping	88
subtract two decimals with two or three places with regrouping	90

North Dakota - Grade 6 (continued)

Objective	Percent Correct
subtract two expressed amounts of money each less than $100	86
Multiplication of whole numbers	
multiply 3- or 4-digit number by 1-digit number	90
multiply 3- or 4-digit number by multiple of 10	86
recognize associative property	66
multiply 2- or 3-digit number by 2-digit number	87
Multiplication of fractions	
multiply proper fraction by proper fraction	72
multiply whole number by proper fraction	57
multiply proper fraction by mixed number	49
Multiplication of decimals	
multiply 2- or 3-digit mixed decimal by 1- or 2-digit whole number	79
determine given percent of a number	59
Division of whole numbers	
divide 2- or 3-digit number by 1-digit number with no remainder	91
divide 2- or 3-digit number by 1-digit number with remainder	90
divide 3- or 4-digit number by 2-digit number with remainder	81
Division of fractions	
divide proper fraction by proper fraction	42
divide whole number by proper fraction	36
divide proper fraction by whole number	56

North Dakota - Grade 6 (continued)

Objective	Percent Correct
Division of decimals	
divide 2- or 3-digit mixed decimal by 1- or 2-digit whole number	76
div'de 2- or 3-digit mixed decimal by 1-digit decimal	46
General operations	
identify fraction represented on diagram	79
name value of indicated digit in decimal	56
change decimal to fraction (tenths, hundredths)	85
identify expressions of greater than, less than, equal to	85
redefine an improper fraction as a mixed number and vice versa	51
write fraction with denominator of power of ten as a decimal	68
reduce fraction to lowest terms	60
number operations with parenthesis	86
select square, rectangle, trapezoid, or rhombus	66
select line segment, plane, line, or ray	55
estimate length of segment (nearest centimeter)	43
identify appropriate English unit approximation for kilometer, meter, liter, or kilogram	37
convert metric length to kilometers, meters, centimeters, or millimeters	41
convert metric weight (mass) to kilograms, grams, or milligrams	29

North Dakota

Mathematics Assessment: Grade 8 (1979)

Objective	Percent Correct
Recall basic facts of addition, subtraction, multiplication, and division	94
Recognize examples of terms	82
Identify value of digits of number in base 10	83
Read and write Roman numerals	89
Recognize examples of geometric terms	92
Select correct geometric term from definition	76
Identify metric units in terms of length, mass, and capacity	83
Identify values associated with metric prefixes	33
Identify meaning of area and volume	55
Identify quantitative relationships among units of measurement	97
Recognize and use symbols =, < , and >	85
Demonstrate computation skills in addition and subtraction of whole numbers	96
Demonstrate computation skills in addition and subtraction of decimals	94
Demonstrate computation skills in addition and subtraction of fractions and mixed numbers	91
Demonstrate computation skills in addition and subtraction of integers	60
Demonstrate computation skills in multiplication of whole numbers	97
Demonstrate computation skills in multiplication of decimals	89
Demonstrate computation skills in multiplying fractions and mixed numbers	82
Demonstrate computation skills in multiplying integers	76

North Dakota - Grade 8 (continued)

Objective	Percent Correct
Demonstrate computation skills in division of whole numbers	88
Demonstrate computation skills in dividing decimals	85
Change decimal to equivalent percent and vice versa	85
Arrange decimals and whole numbers in order	90
Round numbers to nearest ten, hundred, thousand, or million	86
Round decimal numbers to nearest tenth, hundredth, or thousandth	78
Determine G.C.F., L.C.M. of whole numbers with one or two digits	80
Solve percentage problems	54
Find rational number solutions for simple linear equations	84
Solve for fourth value in proportion	56
Measure lengths, temperatures, angles, and weights	94
Convert measurements on map scale drawing to actual distances	78
Convert commonly used units of measurement within system	64
Determine elapsed time	49
Determine probability of equally likely events	64
Read and interpret graphs	91
Plot given ordered pairs as points on a coordinate plane	49
Plot points and intervals on number line	92
Match number sentences with subtraction arrows on number line	56
Change expanded form of numeral to standard form	91

North Dakota - Grade 8 (continued)

Objective	Percent Correct
Identify fractional part of set	91
Match number sentences with set and subset removal drawing (subtraction)	93
Read flow chart of everyday occurrences	68
Find answer to verbal problems	96
Recognize best estimate of results of problem	71
Collect data to find generalization	56
Compute perimeter and area	67
Compute volumes of cubes and rectangular prisms	77
Compute areas, given formulas and measurements	63
Determine sizes of angles, given two intersecting lines and size of one angle	85
Find length of one side of square, given perimeter	82
Solve problem based on relationship which can be expressed by an equation	71
Determine cost per unit	68
Determine discount on sale items	49
Determine savings on volume buying	29
Make change	96
Find interest paid	81
Read and interpret table of data	74
Determine sales tax by using tax tables	83
Solve problems requiring analysis	79

North Dakota

Mathematics Assessment: Grade 11 (1978)

Objective	Percent Correct
Knowledge of basic addition, subtraction, multiplication, and division	97
Knowledge of percent and ratio	55
Knowledge of simple algebraic terms	69
Knowledge of union, intersection, absolute value	61
Knowledge of f(x), log x, exp x, exponential notation, Cartesian product	32
Knowledge of terms: variables, coordinate, etc.	52
Knowledge of terms: function, inverse	35
Knowledge of terms: parallel, similar, ray, etc.	72
Knowledge of terms: elementary anal tic geometry -- slope, etc.	44
Knowledge of terms: trigonometry -- sine, cosine, right triangles, etc.	19
Knowledge of terms: elementary probability and statistics	34
Knowledge of trigonometry functions: 30-60-90° triangles, etc.	23
Knowledge of geometric facts	34
Knowledge of laws for exponents and logarithms	46
Identify graphs; parabola, hyperbola, ellipse	36
Knowledge of scientific notation	73
Knowledge of metric system	79
Knowledge of necessary and sufficient conditions, converse, etc.	43
Computation with approximate data	68
Computation: use of for operations in whole, fractional, and decimal numbers	76

North Dakota - Grade 11 (continued)

Objective	Percent Correct
Manipulation of algebraic expressions (first degree polynomials	45
Manipulation of algebraic expressions: combining like terms, etc.	45
Conversion relations in measurement (with system being used)	54
Solving simultaneous equations (linear)	36
Finding square root	82
Interpolation and extrapolation with table	64
Synthetic division	4
Expanding binomial	27
Reading graphs	88
Using formulas (areas of triangles, circles, perimeter of polygons, etc.)	73
Solving equations and inequalities in one variable	62
Solving equations and inequalities of quadratics	31
Making graph of function (linear)	34
Making graph of frunction (quadratic and higher)	15
Finding equation of graph (linear)	12
Finding equation of graph (quadratic and higher)	3
Demonstrating properties of a mathematical system	71
Interpreting statistical data: mean, median, mode	17
Translating verbal statement into mathematical sentence	55
Illustrating geometric theorem by making sketches	52
Solution of triangles using trigonometric ratios	19
Solving verbal problems (simple linear equations in one variable)	39

North Dakota - Grade 11 (continued)

Objective	Percent Correct
Interpreting tables and graphs	66
Applying formulas	58
Computing with complex numbers	36
Locating flaw in geometric proof	20
Locating flaw in algebraic proof	12
Solving time problems: time elapsed	75
Solving time zone problems	35
Estimation	62
Solving consumer problems: budgets, taxes, insurance, etc.	74
Geometric experiments: drawing figures, measurements, models, etc.	42
Recognizing pattersn and making generalizations about configurations	48
Solving novel problems, puzzles, and recreations	29
Comparative buying	56
Discovering fallacies in consumer ads (statistical data and charts)	54
Problem solving: counterexamples	73
Problem solving: use of a similar case	13
Problem solving: assume you know the answer	83
Problem solving: analysis of problems	93

North Dakota

Achievement of 17-Year-Olds

Cluster	Percent Correct
Computation with whole numbers	89
Concepts and computation with common fractions	61
Concepts and computation with decimals	62
Consumer problems	77
Properties of numbers	59
Recognition of geometric figures and relations between figures	68
Applications of geometric properties	46
Algebraic expression	57
Algebraic applications	41
Interpreting graphs, tables, and maps	73
Basic problem solving	74
Advanced problem solving	43
Measurement systems	69
Statistics and probability	24
Sets	46
Trigonometry	20
Time	67

North Dakota

Clusters of Content

Computation with whole numbers

Basic facts and addition, subtraction, multiplication, division, and taking square roots

Concepts and computation with common fractions

Concepts of ratio and equivalent fractions; addition, subtraction, multiplication, and division with common fractions

Concepts and computation with decimals

Addition, subtraction, multiplication, and division with decimals; conversion of decimals to percent and common fractions

Properties of numbers

Odd and even numbers, positive and negative numbers, rational numbers, and real numbers; factors, exponents, and properties of number systems

Recognition of geometric figures and relations between figures

Recognition of angles, polygons, ellipses and parabola; congruence and similarity relations for triangles

Applications of geometric properties

Basic knowledge of area, perimeter, volume, and other properties of geometric figures applied to specific situations

Algebraic expressions

knowledge necessary to manipulate algebraic expressions and solve equations

Algebraic applications

Methods of algebra used in situations requiring solutions of algebraic equations

Interpreting graphs, tables, and maps

Picture graphs and other representations of data presented for interpretation and determination of accurate conclusions

Basic problem solving

verbally stated problems that can be translated into equation form and then solved by means of simple arithmetic computations

Clusters of Content (continued)

Advanced problem solving

Recognition and use of heuristics of problem solving and applying these to problem situations

Measurement systems

use of common units of measurement (customary and metric)

Statistics and probability

Basic notions of the probability of an event; concepts of mean, mode, and median

Sets

General concepts of sets and subsets as well as basic operations on sets

Trigonometry

Basic knowledge and applications of sine, cosine, tangent, and cotangent functions

Consumer Problems

Concepts of interest, installment buying, balancing checking accounts, and comparative buying

Time

Problems relating to time zones, train schedules, and elapsed time

Ohio

Needs Assessment: Grade 4 (1978)

Objective	Percent Correct
Add two or more whole numbers (two 3-digit addends with two renamings)	95 92 92
Subtract two whole numbers (3-digits, with renaming)	75 74 66
Multiply two whole numbers (3-digit by 1-digit without renaming)	88 92 86
Divide whole numbers (3-digit by 1-digit, with no remainder, without renaming)	75 72 70
Recognize numeral for up to 1,000 objects	92
Arrange five whole numbers than than 1,000 in order from highest to lowest and vice versa	64 69
Identify ordinal position of objects in line	92 87
Round number (less than 1,000) to nearer 10 or 100	49
Add simple fractions (with like denominators)	49 45
Subtract two fractions (with like denominators)	57 56
Identify place value of digit (up to four digits)	83 74
Identify shaded portion of a whole representing the fractional part	80
Identify fraction shown by fractional parts of regions or sets	68
Identify circle, triangle, rectangle, or square	78

Ohio - Grade 4 (continued)

Objective	Percent Correct
Express numbers in words or vice versa	92 90
Select appropriate metric unit	40 49
Select appropriate English unit	87 83
Determine length, width or height of object by reading ruler	72 41
Indicate meanings of $=, \neq, >, <$	66 71
Tell time to hour, half-hour, and quarter-hour	66 52
State value of set of currency or coins	91 92
Select correct combination of coins for purchase	87
Determine change from $1	67 66
Solve one-step word problems involving the four operations with whole numbers	62 80
Solve simple equations involving the four operations	89 87
Select next number when given number pattern	85
Read calendar	74 93
Add two numbers expressed as money	84 85
Subtract two numbers expressed as money	57 65
Recognize commutativity	70
Use simple reasoning to answer practical question	19 60
Total	73

Ohio

Needs Assessment: Grade 8 (April 1977)

Objective	Percent Correct
Whole Numbers	80
add whole numbers	97
subtract whole numbers	95
multiply whole numbers	93
divide whole numbers	81
solve written problems involving whole numbers	87
average set of whole numbers	55
solve simple number sentences	61
use properties of signed numbers	57
identify correct expressions illustrating commutative or associative properties	47
solve problems involving zero properties	86
Decimals	62
solve problems involving decimals	97
subtract decimals	64
multiply decimals	37
divide decimals	65
convert decimals to fractions vice versa	54
identify place value of a digit	55
Fractions and/or Mixed Numbers	76
add fractions	74
subtract fractions	67
multiply fractions	81
convert mixed number to improper fraction or vice versa	84

Ohio - Grade 8 (continued)

Objective	Percent Correct
Measurement	55
read measurements from instrument	69
use map scale to determine distance	54
solve written problems involving time, rate, and distance	32
solve written problems involving time	72
solve problems involving conversion of units	50
solve problems involving conversion of units within metric system	37
measure angles with protractor	61
interpret directional compass to describe locations of points on map	49
Geometry	47
recognize simple plane and 3-dimensional figures	71
recognize types of lines	88
determine diameter, radius, perimeter of simple plane figures	32
determine area of circle, triangle, or rectangle	29
determine volume of rectangular solid	45
Graphic and Tabular Data	73
use table of information	88
use graphs of information	65
Percents	61
determine what percent of a whole number another number is	59
determine a specified percent of a given number	63
Personal Finance	75
calculate sales tax	55

Ohio - Grade 8 (continued)

Objective	Percent Correct
calculate cost	88
determine unit price or best buy	73
recognize value of coins and make change	86
determine number of items purchasable with given amount of money	70
Proportion or Ratio	63
solve problems involving proportion or ratio	63
Probability	60
solve problems involving probability	60
Logical Thinking	63
use logical thinking to solve written or illustrated problem	63
Total	67

Ohio

Needs Assessment: Grade 12 (1978)

Objective	Percent Correct
Add two or more whole numbers (four 4-digit addends with renaming)	92 95
Subtract two whole numbers (4-digits, with renaming)	84 96
Multiply two whole numbers (4-digit by 3-digit)	93 93
Divide whole numbers (5-digit by 3-digit)	77 94
Solve written problems involving whole number operations	88 94 92
Identify place value of digit (up to seven digits or four decimal places)	86 31
Use simple reasoning to answer practical question	78 73
Use commutative or associative properties of addition or multiplication of whole numbers	97
Add two or more numbers in decimal form (up to four decimal places)	90 94
Subtract two numbers in decimal form (up to four decimal places)	80 92
Multiply two numbers in decimal form (up to three decimal places)	83 84
Divide two numbers in decimal form (up to three decimal placed in dividend and two in divisor)	72 63
Solve written problems involving operations with decimal numbers	86

Ohio - Grade 12 (continued)

Objective	Project Correct
Add two or more fractions, simplify	70 73
Subtract two fractions	76
Multiply two fractions	74 72
Solve simple number sentences involving the four operations	91
Convert a mixed number to an improper fraction and vice versa	94
Solve written problems involving fractions	71
Convert fraction to decimal and vice versa	52 68
Determine what percent one number is of another	47
Determine specified percent of a given number	45 77
Solve written problems involving percents	55 73
Determine ratios	73
Determine length of object	88 72
Read and interpret amount indicated on dial or scale	82 95
Solve written problems involving money	75 83
Calculate reduced price	67
Solve written problems involving time	84 86
Solve written problems involving time, rate, and distance	82 86
Convert measure from specified unit to another within the same system	90 70

Ohio - Grade 12 (continued)

Objective	Percent Correct
Recognize and/or use symbols for common metric or customary units	75 90
Identify lines as parallel, intersecting, perpendicular, vertical, or horizontal	58
Identify circles, triangle, square, rectangle, quadrilateral, parallelogram, pentagon, hexagon, or octagon	91
Compute sales tax	69
Determine perimeter, area, or volume	30 41
Use formula in practical application	74
Use table of information	82 91
Interpret and use graphs (picture, bar, circle, broken line)	82 95
Determine unit price	92 87
Understand monetary value and be able to use common currency units	89 90
Total	78

Oregon

Assessment Test: Grade 4 (March 1982)

Skill	Percent Correct
Addition of multiple places without regrouping	91 93
Addition of multiple places with regrouping	80 90
Subtraction of multiple places without regrouping	92 95
Subtraction of multiple places with regrouping	71 82 79
Multiplication of 1-, 2-, 3-digit numbers by 1-digit numbers	97 77 70 73
Multiplication with zero	95 45
Division involving single-digit divisors without remainder	51 34
Division involving 1-, 2-digit divisors without remainder	70 54 53
Addition in word problems	45 84 36
Subtraction in word problems	85 63
Division in word problems	81 59 55 46
Approximate answers in word problems	38 39

Oregon - Grade 4 (continued)

Skill	Percent Correct
Identification of correct operation in word problems	46
	56
	77
	69
Addition of multiple places in decimals	74
Addition with decimals in word problems	80
	68
	83
Subtraction with decimals in word problems	80
Multiplication with decimals in word problems	53
Division with decimals in word problems	44
Multiple decimal operations in word problems	45
Money units	82
	84
Problem solving: guess and check	22
Problem solving: look for a pattern	29
	31
Problem solving: translation	33
Problem solving: estimating	59
	36
	35
	70
Problem solving: relevant data	94
	68
	44
	32
Total	63

Oregon

Assessment Test: Grade 7 (March 1982)

Skill	Percent Correct
Addition of multiple digits in horizontal format with regrouping	93 95
Addition of multiple digits in vertical format with regrouping	93 95
Subtraction: multiple digits with regrouping (non-zero)	95
Subtraction of multiple digits with regrouping (zero)	90 90
Multiplication of multiple-digit numbers	85
Multiplication involving zero	91 90
Division with multiple-digit numbers	86
Division involving zero	78 85
Subtraction word problems with units	66
Multiplication word problems	84 80
Division word problems with units	84
Multiple operations in word problems	48 87 77 47
Approximate answers in word problems	50 61
Identifying correct operations in word problems	52 82 68 42
Addition, subtraction of fractions with like denominators	77 89

Oregon - Grade 7 (continued)

Skill	Percent correct
Addition, subtraction of fractions with unlike denominators	52 52
Subtraction involving whole numbers and mixed numbers	39
Multiplication of fractions with changing	54
Division of fractions with changing	50
Addition of fractions in word problems	47
Multiplication of fractions in word problems	41
Addition of multiple places in decimals, with regrouping	90 84
Subtraction of multiple places in decimals, with regrouping	78 88
Multiplication of decimals	90 62
Division of decimals	56
Multiple operations with decimals in word problems	73 69 73 78 80
Approximate answers with decimals in word problems	82
Problem solving: guess and check	39 52
Problem solving: look for a pattern	55 60
Problem solving: translation	53 59
Problem solving: estimating	60 55
Problem solving: relevant data	58 40
Total	70

Oregon

Assessment Test: Grade 11 (March 1982)

Skill	Percent Correct
Multiplication of multiple-digit numbers	81
Multiplication involving zero	90 91
Division with 2-digit divisors	94 88
Division with 1-, 2-, 3-digit divisors involving 0	87 91 78
Addition in word problems	95 72
Multiplication in word problems	93 52
Division in word problems	77 28
Multiple operations in word problems	90 59 68 55 70
Multiple operations in word problems: averages	81 84
Approximate answers in word problems	64
Identify correct operations in word problems	75
Addition of integers with same sign	72
Division of fractions with changing	63
Division of fractions in word problems	44
Multiple operations with fractions in word problems	47
Equivalent fractions	83 28
Multiplication of multiple-digit decimals	78
Multiplication with decimals, involving zero	83 91

Oregon - Grade 11 (continued)

Skill	Percent Correct
Division of multiple-digit decimals	70
Addition with decimals in word problems	57
Subtraction with decimals in word problems	90
Multiplication or division with decimals in word problems	50 93
Multiple operations with decimals in word problems	86 69 83 77 67
Approximate answers in word problems	42
Percent one number is of another	88 39
Percent one number is of another in word problems	91
Percent of a number	78 65 62 52
Percent of a number in word problems	92 61 69
Multiple operations with percents in word problems	53
Problem-solving skills	68 35 55 35
Total	70

Pennsylvania

Educational Quality Assessment: Grade 5 (1983)

Concept	Percent Correct
Subraction with common fraction notation, like denominators	72
Multi-digits used in addition with renaming	90
English units for yards or less	55
Division - known factor (divisor), less than 10, product (dividend) not renamed; no remainder	85
Expanded notation for whole numbers	93
Factors and primes	57
Time	49
Multi-digits used in subtraction with renaming	76
Ordering non-negative rational numbers: greater than, less than, equal to, not equal to, between	43
Related lines: intersecting, parallel, skew, oblique	79
Estimation	57
Least common multiple	50
Metric units for meters or less	30
Subtraction with decimal fraction notation	83
Ordering whole numbers	78
Place value - three or more digits	84
Circles	40
Liquids in metric units	21
Division (as above)	79
Frequency tables, charts, graphs (bar, line, circle, dot, picture, etc.)	50
Multiplication with common fraction notation	63
Perimeter or circumference of simple closed curves	92

Pennsylvania - Grade 5 (continued)

Concept	Percent Correct
Mathematical sentences (equations)	73
Odd and even numbers	72
Operations related to denominate numbers (feet/inches)	26
Multi-digits used in addition with renaming	85
Division by multiples of 10	69
Rounding numbers	90
Subtraction with common fraction notation, unlike denominators	22
Liquids in English and nonstandard units	37
Square units of measure in English and nonstandard units	15
Greatest common factor	66
Reasoning	76
Multi-digits used in multiplication with renaming	91
Equivalent common fraction notation	61
Quadrilaterals	85
Ratio	79
Liquids in metric units	80
Division by 10 or greater numbers	44
Addition with common fraction notation, like denominators	50
Circles	45
Multi-digits used in subtraction with renaming	84
Metric units for meters or less	52
Weight in English and non-standard units	36
Proportion (including rate pairs)	88
Multiples of .. as a factor	93

Pennsylvania - Grade 5 (continued)

Concept	Percent Correct
Subtraction with decimal fraction notation	85
Equations - linear in one variable	36
Division (as above)	67
Area of plane figures	27
Division (as above)	69
Multiplication with common fraction notation	69
Estimation	53
Weight in metric units	35
Whole numbers as related to set of non-negative fractions	41
Time; operations related to denominate numbers	69
Multiples	74
Other names for a number	83
Addition with common fraction notation, unlike denominators	17
Line segments	55

Pennsylvania

Educational Quality Assessment: Grade 8 (1983)

Concepts	Percent Correct
Multi-digits used in multiplication with renaming	81
Addition with exact decimal fraction notation	82
Two sequential operations	73
Equivalent mixed numeral notation	87
Multiplication with common fraction notation	76
Triangles	42
Metric units for meters or less	59
Decimal fractions	57
Relations and functions	28
Powers and roots	23
Perimeter or circumference of simple closed curves	40
Least common multiple	23
Weight in metric units	38
Computation related to percent	45
Frequency tables, charts, graphs (bar, line, circle, dot, picture, etc.)	50
Multi-digits used in multiplication with renaming	72
Multiplication with decimal fraction notation	74
Two sequential operations	59
Subtraction with common fraction notation, like denominators	68
Computation related to percent; multi-digits used in addition and subtraction with renaming	42
Equivalent decimal fraction notation with terminating decimals	73
Quadrilaterals	50

Pennsylvania - Grade 8 (continued)

Concept	Percent Correct
Exponential notation	48
Addition computation	59
Area of plane figures	33
Frequency tables, charts, graphs (bar, line, circle, dot, picture, etc.)	66
Multiples	52
Weight in metric un ts	39
Proportion (including rate pairs)	68
Logic in depth	35
Ordering non-negative ration numbers	64
Reasoning	73
Greatest common factor	84
Division by 10 or greater numbers	70
Subtraction with common fraction notation, unlike denominators	54
Distance in metric units for lengths longer than a meter	32
Equivalent percent notation	53
Division with decimal fraction notation	60
Circles	20
Kinds of angles	60
Equivalent common fraction notation	25
Volume of solids	41
Frequency tables, charts, graphs (bar, line, circle, dot, picture, etc.)	47
Odd and even numbers	33
Ratio	45

Pennsylvania - Grade 8 (continued)

Concept	Percent Correct
Division by multiples of 10	76
Equivalent common fraction notation	59
Subtraction with decimal fraction notation	63
Weight in English and non-standard units	32
Rounding numbers	55
Ordering integers	58
Similarity: scale drawing	72
Addition with common fraction notation, unlike fractions	55
Polygons: general properties	56
Estimation	51
Operations related to denominate numbers (feet/inches)	47
Measures of central tendency: average, mean, mode, median	18
General number sequences and patterns	64
Factors and primes	41
Computation related to percent	53

Pennsylvania

Educational Quality Assessment: Grade 11 (1983)

Concept	Percent Correct
Multi-digits used in addition with renaming	80
Multi-digits used in addition with renaming: money	86
Conversion to other standard units measuring several kinds of non-geometric quantities	53
Two sequential operations with whole numbers	87
Equivalent mixed numeral notation	74
Decimal fractions	51
Metric units for meters or less with estimation	43
Metric geometry, similarity: scale drawing	72
Non-negative rational numbers: identity element in multiplication	33
Division with decimal fraction notation	45
General number sequences and patterns: arithmetic progressions	74
Area of plane figures	22
Computation related to percent	57
Formal concepts - probability	30
Flow charts - logic	79
Multi-digits used in multiplication with renaming	88
Subtraction with common fraction notation, like denominators	86
Odd and even numbers	69
Raising to powers and finding roots; two sequential operations with whole numbers	54
Equivalent decimal fraction notation with terminating decimals	66

Pennsylvania - Grade 11 (continued)

Concept	Percent Correct
Exponential notation	60
Distance in metric units for lengths longer than a meter	57
Similarity in metric geometry	41
Multiplication with common fraction notation	73
Perimeter or circumference of simple closed curves	41
Proportion	39
Greatest possible error of measurement	54
Graphs with ordered pairs on a coordinate plane	49
Reasoning	68
Equations: linear in one variable	59
Division by 10 or greater whole numbers	73
Addition computation of integers	77
Unique factorization (prime)	63
Ordering non-negative rational numbers	59
Equivalent percent notation	58
Geometry - related lines: intersecting, parallel, skew, oblique	88
Liquid measure in English and non-standard units	43
Triangles	34
Multiplication with decimal fraction notation	66
Subtraction with common fraction notation, unlike denominators	56
Proportion	46
Metric geometry: surface area of solids	28
Graphs with ordered pairs on coordinate plane with estimation	70

Pennsylvania - Grade 11 (continued)

Concept	Percent Correct
Equations: linear in one variable	54
Logic in depth	42
Two sequential operations with whole numbers	64
Kinds of angles	70
Multiples	73
Addition with common fraction notation, unlike denominators	53
Rounding numbers in base ten	74
Real numbers: powers and roots	44
Measurement operations related to denominate numbers	50
Ordering integers	74
Division with common fraction notation	57
Volume of solids in metric geometry	47
Ratio; proportion	22
Subtraction with decimal fraction notation	75
Measures of central tendency: average, mean, mode, median	26
Equations: linear in one variable	57
Estimation	41

Texas

Assessment of Basic Skills Tests: Grade 3

Objective	Percent Mastering 1981	1982	1983
Read and write 4-digit whole numbers (word, numerical form)	84	86	88
Arrange three whole numbers from greatest to least and vice versa (up to three digits)	61	59	71
Find sum of 1- 2-, or 3-digit numbers, with two or three addends, with or without regrouping	83	88	90
Subtract numbers having as many as three digits, with or without regrouping	69	73	76
Solve word problems involving addition or subtraction of whole numbers	80	85	88
Complete number pattern involving multiples of 2, 3, 4, 5, and 10	80	83	83
Find product of two 1-digit numbers with one factor less than 6	89	93	94
Use pictorial models to identify halves, thirds, or fourths	79	83	88
State value (up to $5) of given set of coins and bills	84	90	92
Select unit of measurement needed to determine weight/mass, liquid volume, length, and time	47	57	64

Texas

Assessment of Basic Skills Tests: Grade 5

Objective	Percent Mastering 1980	1981	1982	1983
Identify by name geometric terms and figures	45	64	63	72
Demonstrate ability to interpret place value	45	43	59	67
Add column of numbers with regrouping	86	89	90	94
Perform subtraction using whole numbers with regrouping	76	80	81	85
Multiply whole number less than 1000 by whole number less than 100 where regrouping is necessary	71	76	81	84
Find quotient with or without remainders	71	76	76	80
Solve word problems involving addition and/or subtraction using whole numbers and/or decimals involving money	77	85	83	82
Solve word problems involving multiplication and division of whole numbers	55	59	61	65
Select unit of measurement needed to determine weight/mass, liquid volume, length, temperature, and time	85	89	89	88
Read and interpret mathematical information displayed on graphs	82	88	91	96
Use pictorial models to identify equivalent fractional parts of objects or sets of objects	44	52	53	71
Arrange group of whole numbers from largest to smallest or vice versa	70	78	82	85

Texas

Assessment of Basic Skills Tests: Grade 9

Objective	Percent Mastering 1980	1981	1982	1983
Add and subtract whole numbers where regrouping is required	93	94	95	96
Multiply and divide whole numbers	82	87	90	90
Solve problems using the basic operations	61	63	67	69
Add, subtract, and multiply fractions and mixed numbers	60	59	64	63
Add or subtract, multiply and divide decimal fractions	75	75	80	84
Solve problems involving income, banking, cost comparisons, and taxes	44	48	51	48
Determine total dollar amounts and/or correct change from specified amount	77	82	89	88
Use the basic operations to solve problems involving measures	70	69	76	79
Solve problems involving ratios, proportions, and percents	50	51	45	58
Use maps to determine approximate distances or locations	76	79	84	86
Read and interpret mathematical information from chart or graph	87	94	92	92
Total	70	72	77	79

Texas

Assessment of Basic Skills Tests: Grade 10

Objective	Percent Mastering 1981	1982	1983
Add and subtract whole numbers where reprouping is required	80	91	92
Multiply and divide whole numbers	70	81	81
Solve problems using the basic operations	37	45	46
Add, subtract, and multiply fractions and mixed numbers	32	41	38
Add or subtract, multiply and divide decimal fractions	53	67	71
Solve problems involving income, banking, cost comparisons, ard taxes	28	32	29
Determine total dollar amounts and/or correct change from specified amount	65	82	80
Use the basic operations to solve problems involving measures	49	60	59
Solve problems involving ratios, proportions, and percents	28	27	40
Use maps to determine approximate distances or locations	59	73	74
Read and interpret mathematical information from chart or graph	79	86	85
Total	46	57	56

Texas

Assessment of Basic Skills Tests: Grade 11

Objective	Percent Mastering 1982	1983
Add and subtract whole numbers where regrouping is required	91	93
Multiply and divide whole numbers	80	80
Solve problems using the basic operations	48	49
Add, subtract, and multiply fractions and mixed numbers	37	35
Add or subtract, multiply and divide decimal fractions	66	70
Solve problems involving income, banking, cost comparisons, and taxes	38	35
Determine total dollar amounts and/or correct change from specified amount	84	81
Use the basic operations to solve problems involving measures	61	61
Solve problems involving ratios, proportions, and percents	31	45
Use maps to determine approximate distances or locations	73	74
Read and interpret mathematical information from chart or graph	87	87
Total	57	57

Texas

Assessment of Basic Skills Tests: Grade 12

Objectives	Percent Mastering 1983
Add and subtract whole numbers where regrouping is required	93
Multiply and divide whole numbers	79
Solve problems using the basic operations	53
Add, subtract, and multiply fractions and mixed numbers	32
Add or subtract, multiply and divide decimal fractions	69
Solve problems involving income, banking, cost comparisons, and taxes	40
Determine total dollar amounts and/or correct change from specified amount	83
Use the basic operations to solve problems involving measures	63
Solve problems involving ratios, proportions, and percents	49
Use maps to determine approximate distances or locations	73
Read and interpret mathematical information from chart or graph	88
Total	58

Virginia

Science Research Associates Test: Grades 4, 8, 11

	Percentile Ranks		
	1981-82	1982-1983	1983-84
Grade 4	53	56	59
Grade 8	64	66	68
Grade 11	58	60	62

Washington

California Achievemer Test: Grade 4 (Fall 1^ 3)

Objective	Percent Correct
Computation	46
Addition	65
add three 2-digit numbers	81
add 3-digit and 2-digit numbers, no regrouping	86
add 3-digit and 2-digit number, no regrouping	75
add two 3-digit numbers	67
add two 4-digit numbers	61
add three 4-digit numbers	82
add column, up to 4-digit numbers	49
add horizontally, up to 3-digit numbers	56
add like fractions	14
add decimal number and decimal fraction	57
Subtraction	52
subtract two 2-digit numbers	58
subtract 2-digit number from 3-digit number, no regrouping	52
subtract two 3-digit numbers	55
subtract 3-digit number from 4-digit number	27
subtract two 4-digit numbers	32
subtract two 5-digit numbers, no regrouping	50
subtract like fractions	62
subtract whole number from mixed number	69
subtract decimal fractions	38
subtract decimal numbers, no regrouping	78

Washington - Grade 4 (continued)

Objective	Percent Correct
Multiplication	38
multiply two 1-digit numbers	62
multiply multiple of 10 by 1-digit number	63
multiply 2-digit by 1-digit numbers	58
multiply 3-digit by 1-digit numbers	53
multiply 4-digit by 1-digit number, no regrouping	58
multiply multiple of 10 by 2-digit numbers	13
multiply two 2-digit numbers, no regrouping	9
multiple multiple of 100 by multiple of 10	42
multiply 3-digit by 2-digit numbers	11
multiply multiple of 100 by 3-digit number	13
Division	27
divide 2-digit number by 1-digit number	36
divide 2-digit by 1-digit number	36
divide 2-digit by 1-digit number, no remainder	47
divide 3-digit by 1-digit number, no remainder	32
divide 3-digit by 1-digit number	19
divide 4-digit by 1-digit number, no remainder	46
divide two 2-digit numbers, no remainder	10
divide 3-digit number by multiple of 10, no remainder	16
divide multiple of 100 by multiple of 10	18
divide 4-digit by 1-digit number	12

Washington - Grade 4 (continued)

Objective	Percent Correct
Concepts and Applications	55
Numeration	61
point on number line, mixed number	88
value of digit in thousand's place	85
greatest value, four digits	72
estimate to nearest hundred	29
expanded notation, four digits	31
Number Theory	51
rename hundreds and ones	77
sequence, subtract fours	65
factor of 8 and 10	55
odd numbers	37
equivalent fractions, figure half shaded	22
Number Sentences	38
identify division sentence	84
identify true sentence	26
sign to make sentence true, division	45
box as placeholder, multiplication	19
box as placeholder, addition/multiplication	18
Number Properties	68
commutative property, multiplication	63
associative property, addition	62
identity element, addition	87
fact family, division/multiplication	59

Washington - Grade 4 (continued)

Objective	Percent Correct
Common Scales	62
money, total value	70
money, add quarter	65
time, add time to clock	56
calendar, date on day	91
calender, day on date	56
read thermometer, subtract temperatures	34
Geometry	56
plane figures, triangles	60
solid figures, cone	82
point on line	54
line segment	49
parallel lines	34
Measurement	46
mass, convert grams to kilograms	54
mass, read scale	44
length, convert meters to kilometers	31
operations, add liters	76
operations, add kilometers	47
area, rectangle	23
Graphs	68
picture graph	77
picture graph	63
bar graph	67
bar graph	65

Washington - Grade 4 (continued)

Objective	Percent Corrent
Story Problems	53
whole numbers, subtract	66
whole numbers, divide	53
whole numbers, add/multiply	41
needed operations	62
needed operations	43

Washington

California Achievement Test: Grade 8 (Spring 1979)

Objective	Procent Correct
Computation	69
Addition	76
5-digit + 4-digit	84
5-digit + 4-digit, horizontal	83
unlike fractions	65
whole number + mixed number	95
mixed numbers	73
decimal numbers, horizontal	77
decimal numbers + decimal fraction, horizontal, no regrouping	78
whole number + decimal number + decimal fraction	90
money, horizontal	79
negative integer + positive integer	41
Subtraction	69
two 4-digit	87
two 5-digit, horizontal	89
unlike fractions	61
whole number - mixed number	45
mixed numbers, no regrouping	66
decimal numbers, horizontal, no regrouping	88
whole number - decimal fraction, horizontal	61
decimal number - decimal fraction	86
money, horizontal	81
positive integer - negative integer	27

Washington - Grade 8 (continued)

Objective	Percent Correct
Multiplication	68
4-digit x 1-digit	86
3-digit x 2-digit, horizontal	75
whole number x fraction	59
unlike fractions	63
fraction x mixed number	53
mixed numbers	47
whole number x decimal fraction	69
decimal fractions, horizontal	74
decimal fraction x decimal number	68
negative integer x positive integer	82
Division	62
3-digit / 1-digit, no remainder	88
4-digit / 2-digit, no remainder	81
whole number / mixed number	51
mixed number / fraction	38
mixed numbers	72
decimal numbers	61 53
whole number / decimal fraction	43
decimal number / decimal fraction	44
positive integer / negative integer	87
Concepts and Applications	65
Numeration	74
exponents, number squared	93
exponents, equivalent notation	49

Washington - Grade 8 (continued)

Objective	Percent Correct
digit in hundredth's place	81
expanded notation, 3-digit	76
expanded notation, 3-digit	75
estimate total cost	75
square root	76
square root	74
point on number line, integers	68
Number Theory/Sentences	68
sequence, subtract twos	87
sequence, consecutive numbers and squares	66
greatest common factor	82
least common denominator	43
prime numbers	59
prime numbers	59
decimal greater than and less then two numbers	76
Geometry	76
plane figures, polygon -- greatest area	86
plane figures, hexagon	65
point on circle	64
angle measurement, protractor	74
similar triangles	76
parallel avenues	87
Measurement	63
convert cubic cm to cubic mm	81
capacity, convert liters to kl	49

Washington - Grade 8 (continued)

Objective	Percent Correct
mass, multiply/convert grams	47
operations, read map/multiply cm	64
operations, divide liters	56
operations, read ruler/subtract	59
operations, solve proportion -- kg	46
perimeter, irregular polygon	83
area, parallelogram	70
volume, cylinder	74
Functions and Graphs	61
function with three variables	59
function with two variables	39
ordered pairs	69
ordered pairs	69
bar graph	75
bar graph	52
Story Problems	47
needed operation	51
needed information	25
sum of fractional parts	40
percentage	82
percent, installment payments	25
decimals, add	53
logical deduction	55

Washington

California Achievement Test: Grade 11 (Spring 1981)

Objective	Percent Correct
Computation	70
Addition	77
unlike fractions	78
mixed numbers	56
decimal fractions, horizontal	82
decimal numbers, horizontal	88
whole number + decimal number, horizontal	95
whole number + decimal number + decimal fraction	92
mixed number + decimal number	77
money	85
two positive integers + negative integer	76
fractional algebraic expressions	43
Subtraction	71
unlike fractions	70
mixed numbers	44
decimal fractions, horizontal	87
whole number - decimal number, horizontal	84
decimal number - decimal fraction, horizontal	76
decimal number - whole number	95
mixed number - decimal number	68
money	83
positive integer - negative integer	59
fractional algebraic expressions	43

Washington - Grade 11 (continued)

Objective	Percent Correct
Multiplication	71
fraction x whole number	79
unlike fractions	74
whole number x decimal fraction	83
decimal fractions	67
decimal numbers, horizontal	88
decimal number x decimal fraction	88
mixed number x decimal number	49
two negative integers	71
fractional algebraic expressions	55
algebraic expressions	56
Division	62
fraction / whole number	51
mixed number / fraction	46
mixed numbers	54
decimal fractions	79
decimal numbers	78
whole number / decimal fraction	67
decimal fraction / whole number	59
decimal number / decimal fraction	74
two negative integers	64
algebraic expressions	53
Concepts and Applications	67
Numeration	73
greatest value, decimal numbers	89
greatest value, hundredth's place	39

Washington - Grade 11 (continued)

Objective	Percent Correct
exponents, equivalent notation	91
round to nearest tenth	89
square root	79
scientific notation	71
expanded notation, 4-digit	50
Number Theory	66
composite number, set intersection	82
decimal to fraction	84
least common denominator	81
factors, algebraic expression	33
algebraic expression from factors	33
sequence, positive/negative fractions	84
Number Sentences, Properties	64
solve inequality, number line	52
solve for unknown	57
solve for unknown	63
box as placeholder, integers	62
associate property, multiplication	89
distributive property, multiplication	54
identity element, multiplication of fractions	71
Geometry	64
bases of solid figure	79
intersection of planes	73
perpendicular rays	67
measure angle in parallelogram	32
similar rectangles	69

Washington - Grade 11 (continued)

Objective	Percent Correct
Measurement	66
length, add/convert centimeters	85
mass, convert kg to grams	60
capacity, convert/divide liter	57
operations, divide kilometers	65
area, formula for triangle	66
area, parallelogram	60
Functions and Graphs	75
function with three variables	61
function with three variables	73
ordered pairs	95
ordered pairs	94
bar graph	83
circle graph	44
Story Problems	63
fractions, divide by mixed number	43
set up and solve proportion	63
rate of discount	51
commission	62
discount price	49
logical deduction	86
logical deduction	61
probability of simple event	88

West Virginia

Comprehensive Tests of Basic Skills: Grades 3, 6, 9, 11

	Percentiles			
	1976-77	1977-78	1978-79	1979-80
Grade 3	46	49	52	55
Grade 6	47	49	50	52
Grade 9	46	47	47	48
Grade 11	44	43	44	45

Wisconsin

Pupil Assessment Program: Grade 4

Competency	Percent Correct* 1976	1977	1978	1979	1980	1982
Computation						
add whole numbers with and without regrouping	92	87	93	94	91	90
subtract whole numbers without regrouping	92	90	94	93	87	88
subtract whole numbers with regrouping	77	80	84	83	77	78
multiply whole numbers with basic facts	95	94	90	95	93	93
multiply whole numbers beyond facts, no regrouping			84	89	83	85
multiply whole numbers beyond facts, regrouping				88	81	86
divide whole numbers with basic facts	84	80	74	89	87	84
divide whole numbers without regrouping or remainder				72	71	68
recognize common equivalent fractions						15
Money Applications						
solve simple pictorial problems to find total costs and coins	80	87	83	86	85	85
solve multi-step pictorial problems to find total cost, tax, change, earnings	89	93	90	62	68	67
solve simple problems (no picture) to find total cost, change, and earnings	86	84	87	80	83	82

* Approximated in some instances, especially for 1976-1978 (fewer questions)

Wisconsin - Grade 4 (continued)

Competency	Percent Correct 1976	1977	1978	1979	1980	1982
solve multi-step problems (no picture) to find total cost, earnings, and change				53	53	52
Measurement Applications						
solve simple, pictorial problems to find total weight, perimeter; read graph or ruler		88	89	87	91	90
solve multi-step pictorial problems to find total miles, area, difference in temperature	69	79	78	77	74	73
solve simple problems (no picture) to find total time, length, capacity	77	73	76	72	72	72
solve multi-step problems (no picture) to find total time, units, weight	75	87	86	56	55	53
identify uses and limitations of computers						35

Wisconsin

Pupil Assessment Program: Grade 8

Competency	Percent Correct* 1976	1977	1978	1979	1980	1982
add and subtract whole numbers	90	89	90	92	85	86
multiply and divide whole numbers	85	87	88	90	85	87
find percent of whole number	40	44	30	52	53	56
find percent one number is of another	62	67	64	70	63	64
find percent-fraction-decimal equivalents				78	67	71
add terminating decimals	83	83	84	89	82	86
subtract terminating decimals with regrouping	88	85	77	80	76	78
multiply decimals with regrouping	81	82	85	86	78	79
divide decimals with terminating quotients	73	73	73	76	74	76
use ratio and proportion to solve equivalent fractions	80	83	81	87	74	75
add and subtract fractions with like denominators	85	77	66	70	73	74
add and subtract fractions with unlike denominators	70	66	58	68	69	70
multiply fractions using horizontal form	89	79	73	73	71	71
divide using fractions				66	66	67

* Approximated in some instances, especially for 1976-1978 (fewer questions)

Wisconsin - Grade 8 (continued)

Competency	Percent Correct 1976	1977	1978	1979	1980	1982
Money Applications						
solve problems related to purchases	81	77	75	70	77	78
solve problems dealing with earnings and savings	73	73	73	74	78	80
solve problems dealing with basic expenses	58	64	61	63	67	69
Measurement Applications						
solve problems dealing with length or area	56	66	63	56	58	57
solve problems dealing with weight or volume		75	63	49	60	60
solve problems dealing with rates				45	50	50
read and interpret graphs, maps, and tables	86	83	81	82	80	81
identify uses and limitations of computers						55
give output for simple algorithm, explain						19

Wisconsin

Pupil Assessment Program: Grade 12

Competency	Percent Correct* 1976	1977	1978	1979	1980	1982
add and subtract whole numbers	94	93	93	92	90	89
multiply and divide whole numbers	88	90	89	90	88	87
find percent of whole number	53	61	55	67	68	67
find percent one number is of another	79	83	82	74	75	77
find percent-fraction-decimal equivalents				85	75	77
add terminating decimals	80	87	85	89	87	88
subtract terminating decimals with regrouping	93	91	83	84	81	82
multiply decimals with regrouping	85	89	89	90	86	85
divide decimals with terminating quotients		77	74	76	77	79
use ratio and proportion to solve equivalent fractions	91	90	87	91	82	81
add and subtract fractions with like denominators		90	82	81	83	81
add and subtract fractions with unlike denominators	81	78	75	72	74	74
multiply fractions using horizontal form	86	73	71	73	75	74
divide using fractions				71	72	72

* Approximated in some instances, especially for 1976-1978 (fewer questions)

Wisconsin - Grade 12 (continued)

Competency	Percent Correct 1976	1977	1978	1979	1980	1982
Money Applications						
solve problems related to purchases	86	87	86	79	86	87
solve problems dealing with earnings and savings	89	88	88	84	90	90
solve problems dealing with basic expenses	78	82	63	77	82	82
Measurement Applications						
solve problems dealing with length or area	79	80	80	68	74	71
solve problems dealing with weight and/or volume		90	82	66	77	77
solve problems dealing with rates				64	66	66
read and interpret graphs, maps, and tables	94	90	89	87	89	88
identify uses and limitations of computers						65
give output for simple algorithm, explain						24

Wyoming

Educational Needs Assessment Project Test: Grade 12 (1977)

Objective	Percent Correct
Add 4-digit and 5-digit number, with regrouping	95
Subtract 3-digit number from 4-digit number, with regrouping	92
Multiply 3-digit number by 2-digit number	74
Divide 4-digit number by 2-digit number	84
Add two fractions, unlike denominators	80
Subtract two fractions, unlike denominators	82
Multiply two fractions, unlike denominators	73
Divide two fractions, unlike denominators	66
Add two mixed numbers	86
Subtract two mixed numbers	73
Add three decimal numbers	87
Subtract two decimal numbers	77
Multiply two decimal numbers	81
Divide two decimal numbers	52
Find equivalent fraction	82
Find average of three 2-digit numbers	82
Find sale price of item discounted (percent)	67
Identify place value of digit (hundred thousands)	83
Identify numeral equivalent to word name (ten thousands)	92
Identify order of two whole numbers (hundred thousands)	97
Identify equivalent form of fraction	84
Identify order of two fractions	69
Interpret pictorial representation of fraction	90
Identify whole number approximation of fraction greater than 1	56

Wyoming - Grade 12 (continued)

Objective	Percent Correct
Identify whole number approximation of mixed number	65
Identify numeral equivalent to word name for decimal	52
Identify appropriate approximation of decimal number rounded to fewer decimal places	58
Convert decimal to percent	80
Convert percent to decimal	60
Convert fraction to percent	69
Convert mixed number percent to decimal	42
Convert fraction to decimal	64
Identify order of two decimals	73
Identify word name of numeral (millions)	90
Identify place value of digit in decimal (thousandths)	73
Identify word name of decimal	81
Identify efficient procedure for obtaining reasonable estimates (addition problems)	83
Identify measure of real objects from scale drawings	75
Compute perimeter of pentagon	87
Compute perimeter of rectangle	77
Identify best buy	73
Determine interest on installment purchases	48
Identify reasonable estimates of measure (length, English)	87
Identify reasonable estimates of measure (mass, English)	90
Identify reasonable estimates of measure (volume, English)	23
Identify reasonable estimates of measure (temperature, English)	30

Wyoming - Grade 12 (continued)

Objective	Percent Correct
Identify problems having insufficient data	62
Identify relevant data in problem	59
Interpret certain facts from graph	76
Identify reasonable estimates of measure (length, metric)	60
Identify reasonable estimates of measure (mass, metric)	55
Identify reasonable estimates of measure (volume, metric)	49
Identify reasonable estimates of measure (temperature, metric)	38
Compute area of triangle	40
Compute volume of cube	74
Demonstrate making change from $10	88

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