This document provides an overview of the 1980 and 1981 Illinois Inventory of Educational Progress (IIEP) in mathematics. Development of the IIEP is discussed, and results and analyses of the tests administered to students in grades 4, 8, and 11 are presented. Test items are included. Factor analysis identified two factors, "knowledge of mathematical skills and relationships" and "mathematical problem-solving ability." Appendices include answer keys, tables of mathematical items and objectives, and a list of available documents on the IIEP. (MNS)
Illinois Inventory of Educational Progress
1980-81 Illinois Mathematics State Board of Education Results Education

ILLINOIS INVENTORY OF EDUCATIONAL PROGRESS
MATHEMATICS RESULTS FOR 1980 and 1981
FOREWORD

What follows is designed to provide an overview of the 1980 and 1981 Illinois Inventory of Educational Progress (IIEP) in mathematics. The tests have been administered by the Illinois State Board of Education since 1976; however, this analytical report is in a new and more usable format.

Development of the IIEP is discussed, and results and analyses of the tests administered to fourth, eighth, and eleventh grade students are presented. It is hoped that the information contained here will enhance instruction in Illinois schools.

While many state staff members contributed to the preparation of this report, I would like to especially acknowledge the efforts of Dr. Mervin M. Brennan as the main writer. Any questions concerning this report may be addressed to Dr. Brennan or Dr. Thomas Kerins, Manager of the Program Evaluation and Assessment Section of the Department of Planning, Research and Evaluation of the Illinois State Board of Education.

Donald G. Gill  
State Superintendent of Education
PREFACE

Purpose

The Illinois Inventory of Educational Progress (IIEP) is a systematic effort by the Illinois State Board of Education to collect information on the educational achievement of Illinois students in certain areas and to make that information available to educational decision makers.

The three goals of the IIEP are:

1) to make available relevant, reliable, and valid data on the educational attainments of Illinois students;

2) to identify any trends (growth, stability, or decline) in educational attainments which occur over time; and

3) to publish results of the research conducted in connection with the IIEP.

Student Selection

A random sample with two sampling stages is used to select those students attending Illinois public schools who will participate.

First, schools throughout the state are chosen randomly. A sample of fourth, eighth, and eleventh graders is then randomly selected from lists of eligible students submitted by schools for participation. These grade levels are selected to correspond roughly with the end of the primary, elementary, and secondary levels of education.

Since the IIEP is structured toward determining how groups of Illinois students perform on given tasks, no individual student, teacher, school, or district is identified in any reports of the results.

Type of Test

The IIEP employs an objective-referenced approach. An objective-referenced assessment instrument assesses student performance. Desired student performance is expressed in terms of objectives. An objective is a statement of desired student outcomes, for example: "Fourth grade students should be able to recognize geometric shapes such as circles, etc." Student performance is measured by test items designed to determine whether or not certain groups of students are able to do what the objectives state they should be able to do.

Subject Areas

The IIEP has been in existence since 1976. A number of subject areas have been assessed, such as, reading, mathematics, science, citizenship, energy and nutrition, as well as student attitudes about themselves and education in general.

Base line data are collected during the first year that any subject area is assessed. For each succeeding year that a subject area is reassessed, comparisons are made between earlier and later student performance and any growth or decline in achievement is noted.
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OVERVIEW

SUMMARY OF ILLINOIS STUDENT ACHIEVEMENT IN MATHEMATICS

In February, 1983, the Illinois State Board of Education published a report entitled Student Achievement in Illinois: An Analysis of Student Progress. The report describes and synthesizes the results of six different measures of the achievement of Illinois students from 1970-1981; these six tests include the Illinois Inventory of Educational Progress (IIEP), Decade Study test (DST), High School and Beyond test (HSB), Scholastic Aptitude Test (SAT), American College Test (ACT), and National Assessment of Educational Progress (NAEP). The report describes these instruments in terms of the students tested, curricular areas assessed, and overall purpose. It summarizes student progress across years, from basic to advanced skills in reading, language arts, social studies, mathematics and science. Here are some of the findings of that report regarding the mathematics achievement of Illinois students.

- Illinois students of 1981 showed significantly higher mathematics achievement than 1976 students in elementary school mathematics.
- Illinois students of 1981 showed significantly lower mathematics achievement than 1970 students in high school mathematics.
- Mathematics achievement of Illinois high school sophomores was significantly higher than the achievement of sophomores in the South and statistically equivalent to sophomores in the rest of the United States on the High School and Beyond Study Test.
- Mathematics achievement of Illinois high school seniors on the High School and Beyond Study Test was significantly higher than the achievement of seniors in the South, but significantly lower than the achievement of New York seniors. Illinois scores were statistically equivalent to scores of all other groups of seniors across the United States.

Results of Correlational Analysis

- Students who took advanced courses in mathematics tended to achieve higher scores than those who did not.
- Students whose parents showed an active interest in their academic achievement achieved higher scores than those whose parents showed little interest.
- Students who reported low levels of test anxiety tended to achieve higher scores than students who said tests made them quite anxious.
- Males scored significantly higher than females on the high school mathematics tests of the IIEP, ACT, and SAT, but scores for males and females were statistically equivalent on the mathematics subtests of the Decade Study.
- Parental education level was significantly related to student achievement in mathematics.

Copies of "Student Achievement in Illinois: An Analysis of Student Progress" can be obtained from the Illinois State Board of Education.
Summary of the Present Report

A random sample of fourth, eighth, and eleventh grade Illinois students has been tested annually since 1976 by the Illinois State Board of Education. These tests are called the Illinois Inventory of Educational Progress (IIEP). This report of 1980 and 1981 mathematics results presents item results (Chapter 2) and factor analysis results (Chapter 3).

Chapter 2 gives teachers' reports on student opportunity to learn, teachers' estimates of how well students would do, and the actual student achievement. These are given for each item. It is the reader's task to synthesize the data and interpret the meaning of the results.

Chapter 3 presents the factor analysis results with proposed interpretation. Two general mathematics factors were indicated by the test results. The most important factor appeared to be knowledge of mathematical facts and relationships. A second general factor appeared to be mathematical problem solving. It was speculated that mathematics achievement requires two abilities. Cattell (1963) proposed the names crystallized and fluid intelligence for these factors.
In the spring of 1978, a panel of six mathematics educators with elementary, junior high, high school and college teaching and administrative experience was convened to assist Illinois State Board of Education staff in formulating the 1979, 1980, and 1981 mathematics tests for the IIEP. (A roster of panel members appears in Appendix E.) Charged with redrafting the objectives which had been developed for the 1976 IIEP and developing mathematics tests, the group met over a two-year period. Results of their work are displayed in this report.

Additionally, results of a teacher survey that was administered with the previous year's IIEP (1978) were used in developing the 1979, 1980, and 1981 mathematics tests and teacher surveys. Produced by State Board staff, the surveys sought to: (1) validate the tests; (2) supply an additional perspective on the results; and (3) provide a standard of performance, based upon teacher estimates, with which student results could be compared.

Toward that end, one mathematics teacher from each school which participated in the IIEP was asked to do three things for each test item. Teachers were asked to determine (1) whether students had been exposed to the material and (2) whether the item was of an appropriate level of difficulty and (3) to estimate the percentage of students that could be expected to answer each item correctly. A sample of the teacher survey is contained in Appendix C. Results of the teacher survey are given in Chapter 2.

The Tests

The tests are domain and objective-referenced tests, which means simply that the items test the general domain of mathematics and are keyed to curricular objectives.

Mathematics objectives for the 1979 IIEP were developed by the aforementioned panel of educators. The following mathematics topics and abilities reflect those objectives. A list of topics precedes a description of abilities. Some of the topics are self-explanatory; a brief definition is provided for those which are less common. The abilities are skills required for success in mathematics. Each mathematics objective describes an ability with reference to a topic.
Mathematics Topics

1. **NUMERATION CONCEPTS.** This topic refers to the concepts of numeration and place value, and the processes of naming numerals, approximating numbers, and rounding off numbers.

2. **PROPERTIES OF NUMBERS AND OPERATIONS.** This topic refers to characteristics of numbers, operations and comparisons among numbers.

3. **WHOLE NUMBERS.** Whole numbers are the numbers used by children to count. Whole numbers include 0, 1, 2, 3, etc.

4. **FRACTIONS.**

5. **DECIMALS.**

6. **PERCENT.**

7. **INTEGERS.** Integers are positive and negative whole numbers and zero as distinguished from fractions. The numbers -3, -2, -1, 0, +1, +2, +3, etc., are integers.

8. **RATIONALS.** Rationals is an all-inclusive term for topics 3 through 7, both positive and negative. Examples are +2, +1/2, +.50, +50%, -2, -1/2, -.05, and -50%.

9. **REALS.** Reals is an all-inclusive term for topics 3 through 8 and numbers such as 1, 2, etc.

10. **MEASUREMENT.**

11. **ALGEBRA.**

12. **GEOMETRY.**

13. **PROBABILITY AND STATISTICS.**

14. **PERSONAL AND CONSUMER MATHEMATICS.**

Mathematics Abilities

1. **RECALL:** the ability to recall and recognize facts, definitions, and symbols quickly. Perception is the primary mental act used.

2. **COMPUTATION:** the ability to perform computations, procedures, and complex counting where the operations are indicated.

3. **UNDERSTANDING:** the ability to understand concepts, facts, and processes. The mental operations of analysis and synthesis are used to make comparisons and evaluative judgments.

4. **PROBLEM SOLVING:** the ability to solve complex word problems. Several of the following operations must be involved: interpretation of the question, identification of the relevant data from the given information, decisions about which operations need to be performed on the data, correct performance of the operations, and interpretations of the results.
The Matrix of Mathematics Objectives (Table 1) shows the conceptual model of the IIEP mathematics tests. Each cell of the matrix is a specific mathematics objective.
Table 1
MATRICES OF MATHEMATICS OBJECTIVES
MATHEMATICAL TOPICS BY ABILITIES

<table>
<thead>
<tr>
<th>MATHEMATICS ABILITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECALL</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>1. Numeration Concepts</td>
</tr>
<tr>
<td>2. Properties of Numbers and Operations</td>
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<td>3. Whole Numbers</td>
</tr>
<tr>
<td>4. Fractions</td>
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<td>5. Decimals</td>
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<td>6. Percent</td>
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<td>7. Integers</td>
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<tr>
<td>8. Rationals</td>
</tr>
<tr>
<td>9. Reals</td>
</tr>
<tr>
<td>10. Measurement</td>
</tr>
<tr>
<td>11. Algebra</td>
</tr>
<tr>
<td>12. Geometry</td>
</tr>
<tr>
<td>13. Probability and Statistics</td>
</tr>
<tr>
<td>14. Personal and Consumer Mathematics</td>
</tr>
</tbody>
</table>

* The numbers in the upper left of the cells are the objective numbers of the IIEP. There are 56 IIEP mathematics objectives.
Chapter 2
The Test Instruments and Item Results

Tables 2-7 of this section show the 1980 and 1981 (fourth, eighth, and
eleventh grade) tests. Three types of results are displayed; all are given
in percentages for comparison. Student achievement is reported as student
score, abbreviated stu. score. Student opportunity to learn is the
teachers' response as to whether the content of the item had been taught,
abbreviated oppor. learn. Teacher estimates of student achievement are
abbreviated teach. est.

The correct answer keys for the tests are found in Appendix A. The data for
student opportunity to learn and teacher estimates came from the teacher
surveys described in Chapter 1. A sample teacher survey instrument is shown
in Appendix C.

A modified teacher survey was sent to fourth grade teachers in 1981. The
teachers were questioned extensively about a few of the test items. No data
was collected on the teacher survey regarding most of the items. Thus, the
reader will not find data from teachers on student opportunity to learn or
teachers' estimate of student performance for most of the 1981 fourth grade
test items.
# TABLE 2

## GRADE 4

### MATHEMATICS

This section contains mathematics tests. The tape will announce the question part of the items, but will not announce the answer choices. After you listen to the tape while reading the question along with the tape, read the answer choices to yourself silently and mark an X for your choice in the proper box of your answer booklet. **PLEASE USE THE SCRATCH PAPER PROVIDED TO WORK OUT YOUR ANSWERS. DO NOT WRITE ON THE TEST BOOKLET.**

17. 1029 is written as
   - a. ten hundred twenty-nine.
   - b. ten thousand twenty-nine.
   - c. one thousand two hundred nine.

18. Do the following problem: 12 - 7 =
   - a. 4
   - b. 5
   - c. 6
   - d. 7

19. What is the missing number in this pattern?
   - 322, 324, 326, 328, __
   - a. 329
   - b. 330
   - c. 331
   - d. 332

20. The number that is 200 less than 800 is
   - a. 1000
   - b. 600
   - c. 400
   - d. 200

21. What is the difference between +2 and +5?
   - a. 2
   - b. 3
   - c. 7
   - d. 10

22. What is the difference between -5 and +2?
   - a. 2
   - b. 3
   - c. 5
   - d. 7

23. What is the difference between +4 and +7?
   - a. 1
   - b. 2
   - c. 3
   - d. 4

24. Is the following statement true or false?
   - 15 + 3 = 10 + 8
   - a. True
   - b. False

25. If you spent 72 cents how much change should you get back from one dollar?
   - a. 8 cents
   - b. 14 cents
   - c. 16 cents
   - d. 20 cents

26. The figure below is a
   - a. triangle
   - b. cube
   - c. circle
   - d. rectangle

27. How many inches are there in a foot?
   - a. 12 inches
   - b. 24 inches
   - c. 36 inches
   - d. 48 inches

28. Which one of the following sets has the same number of elements (members) as the picture shown below?

---

**Table:**

<table>
<thead>
<tr>
<th>Number</th>
<th>Test Score</th>
<th>Oppor. Learn</th>
<th>Teach. Est.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>92%</td>
<td>97%</td>
<td>81%</td>
</tr>
<tr>
<td>3</td>
<td>86%</td>
<td>95%</td>
<td>73%</td>
</tr>
<tr>
<td>4</td>
<td>98%</td>
<td>97%</td>
<td>94%</td>
</tr>
<tr>
<td>3</td>
<td>74%</td>
<td>89%</td>
<td>80%</td>
</tr>
<tr>
<td>2</td>
<td>55%</td>
<td>91%</td>
<td>86%</td>
</tr>
<tr>
<td>3</td>
<td>95%</td>
<td>100%</td>
<td>89%</td>
</tr>
<tr>
<td>4</td>
<td>60%</td>
<td>57%</td>
<td>66%</td>
</tr>
<tr>
<td>2</td>
<td>92%</td>
<td>94%</td>
<td>86%</td>
</tr>
<tr>
<td>3</td>
<td>95%</td>
<td>94%</td>
<td>84%</td>
</tr>
<tr>
<td>4</td>
<td>60%</td>
<td>57%</td>
<td>66%</td>
</tr>
</tbody>
</table>
29. Do the following problem: \( 48 \div 6 = \)

a. 8  

b. 12  

c. 8  

d. 2  

st. score: 79% 

op. learn: 85% 

teach. est.: 80%

30. What is the next larger odd number after 5?

a. 6  

b. 7  

c. 9  

d. 11  

st. score: 71% 

op. learn: 89% 

teach. est.: 83%

31. Multiply: \( 18 \times 7 = \)

a. 256  

b. 266  

c. 276  

d. 8  

st. score: 70% 

op. learn: 96% 

teach. est.: 75%

32. Since 43 = 4 tens 3 ones and 52 = 5 tens 2 ones, then \( 43 \times 52 = \) tens + ones.

a. 4 tens + 3 ones  

d. 2 tens + 3 ones  

c. 5 tens + 5 ones  

d. 9 tens + 8 ones  

st. score: 66% 

op. learn: 85% 

teach. est.: 60%

33. Look at the drawings below and answer the questions that follow.

13. What fraction of the figures are circles?

a. \( \frac{4}{3} \)  

b. \( \frac{2}{3} \)  

c. \( \frac{3}{4} \)  

d. \( \frac{1}{3} \)  

st. score: 45% 

op. learn: 37% 

teach. est.: 40%

34. What fraction of the figures are geometric shapes?

a. \( \frac{1}{7} \)  

b. \( \frac{7}{7} \)  

c. \( \frac{4}{7} \)  

d. \( \frac{2}{7} \)  

st. score: 26% 

op. learn: 27% 

teach. est.: 31%

35. Four and two-fifths is written as

a. \( \frac{12}{5} \)  

b. \( \frac{4}{5} \)  

c. \( \frac{5}{5} \)  

d. None of these  

st. score: 68% 

op. learn: 27% 

teach. est.: 44%

36. The figure below is divided into equal parts. What fractional part is shaded?

a. \( \frac{1}{4} \)  

b. \( \frac{3}{8} \)  

c. \( \frac{1}{8} \)  

d. \( \frac{1}{10} \)  

st. score: 72% 

op. learn: 42% 

teach. est.: 47%

37. John has 365 stamps in his stamp collection. Greg has 230, Pete has 310 and Bob has 175. The number of stamps the boys have all together is

a. 900 stamps.  

b. 1,000 stamps.  

c. 1,100 stamps.  

d. 2,200 stamps.  

st. score: 66% 

op. learn: 90% 

teach. est.: 70%

38. An angle may be measured in units called

a. centimeters.  

b. degrees.  

c. grams.  

d. inches.  

st. score: 31% 

op. learn: 17% 

teach. est.: 32%

39. Jane and Sue each had 10 cents, Mary had 9 cents. How much money did the girls have all together?

a. 10 + 9 + 10 = 29  

b. 20 - 9 = 11  

c. 9 + 10 = 19  

d. None of these  

st. score: 43% 

op. learn: 96% 

teach. est.: 78%

40. An astronaut is to orbit the earth in a space capsule for seven days. If he drinks three pints of water each day, how many pints of drinking water will be needed for the trip?

a. 4 pints  

b. 7 pints  

c. 10 pints  

d. 21 pints  

st. score: 41% 

op. learn: 82% 

teach. est.: 65%
41. What digit is in the tens place in 4,263?
   a. 2  
   b. 3  
   c. 4  
   d. 6  

   stu. score: 38%  
   oppor. learn: 100%  
   teach est: 81%

42. In the picture below, if the square on the left is the first square, the square with the X in it is in what position?
   a. Fifth  
   b. Sixth  
   c. Seventh  
   d. Eighth

   stu. score: 88%  
   oppor. learn: 91%  
   teach est: 85%

43. Do the following problem: 6 ÷ 2
   a. 11  
   b. 12  
   c. 13  
   d. 14  
   e. 15

   stu. score: 94%  
   oppor. learn: 90%  
   teach est: 96%

44. Do the following problem: 9 × 3 =
   a. 3  
   b. 6  
   c. 12  
   d. 27

   stu. score: 93%  
   oppor. learn: 100%  
   teach est: 97%

45. What number is 3 more than 999?
   a. 2,997  
   b. 996  
   c. 1,331  
   d. 1,002

   stu. score: 76%  
   oppor. learn: 91%  
   teach est: 84%

46. What number can replace the □ to make the following a true sentence?
   □ + 11 = 17
   a. 6  
   b. 7  
   c. 8  
   d. 9

   stu. score: 88%  
   oppor. learn: 91%  
   teach est: 84%

47. What value of x makes the following true?  
   x + 3 = 7
   a. 12  
   b. 10  
   c. 8  
   d. 4  
   e. 1

   stu. score: 65%  
   oppor. learn: 74%  
   teach est: 74%

48. How many apples did you have at the start if you gave away 9 apples and have 6 apples left?
   a. 9 - 6 = 3  
   b. 9 - 6 = 15  
   c. 6 + 3 = 9

   stu. score: 57%  
   oppor. learn: 96%  
   teach est: 73%

49. A sports car owner says that the car gets 22 miles per gallon of gasoline. How many miles could the car go on seven gallons of gasoline?
   a. 144 miles  
   b. 154 miles  
   c. 164 miles  
   d. 174 miles

   stu. score: 66%  
   oppor. learn: 79%  
   teach est: 63%

50. The figure below is a
   a. triangle  
   b. cube  
   c. circle  
   d. rectangle

   stu. score: 66%  
   oppor. learn: 79%  
   teach est: 61%

51. John has 13 cents. He wants to buy a 25 cent toy. How much more money does he need?
   a. 12 + 13 = 25  
   b. 25 - 12 = 13  
   c. 25 - 13 = 12  
   d. 27

   stu. score: 88%  
   oppor. learn: 99%  
   teach est: 96%

52. 762 =
   a. 7 + 6 + 2  
   b. 7 + 60 + 20  
   c. 700 + 60 + 2  
   d. 70 + 60 + 20

   stu. score: 76%  
   oppor. learn: 91%  
   teach est: 92%

53. In the United States, we usually buy gasoline by the gallon. In France, where the metric system is used, people buy gasoline by the
   a. meter  
   b. liter  
   c. quart  
   d. gram

   stu. score: 39%  
   oppor. learn: 67%  
   teach est: 48%

54. Which is the CLOSEST to the size of one square centimeter?
   a. A tennis court  
   b. Your thumbnail  
   c. A slice of bread  
   d. The cover of a record album

   stu. score: 50%  
   oppor. learn: 44%  
   teach est: 42%

55. Mary earned $1.00 raking leaves. Candy bars cost 15 cents. How many candy bars can she buy with her money?
   a. 3  
   b. 4  
   c. 6  
   d. 7

   stu. score: 50%  
   oppor. learn: 56%  
   teach est: 51%
This section contains mathematics items. The tape will announce the question part of the items, but will not announce the answer choices. After you listen to the tape while reading the question along with the tape, read the answer choices to yourself silently and darken the box for your choice on your answer sheet. PLEASE USE THE SCRATCH PAPER PROVIDED TO WORK OUT YOUR ANSWERS. DO NOT WRITE ON THE TEST BOOKLET.

18. The figure below is a
   a. triangle.  
   b. cube.  
   c. circle.  
   d. rectangle.
   stu. score: 94%

19. Divide 9 3 *
   a. 3  
   b. 6  
   c. 12  
   d. 27
   stu. score: 75%  
   oppor. learn: 91%  
   teach. est.: 90%

20. What digit is in the tens place in 4,263?
   a. 2  
   b. 3  
   c. 4  
   d. 6
   stu. score: 73%  
   oppor. learn: 97%  
   teach. est.: 93%

21. If one-fourth of the dots in the above figure are taken away, how many dots will be left?
   a. 2 dots  
   b. 5 dots  
   c. 6 dots  
   d. 7 dots
   stu. score: 21%  
   oppor. learn: 91%  
   teach. est.: 93%

22. How many tens are there in 79?
   a. 7  
   b. 9  
   c. 70  
   d. 90
   stu. score: 57%  
   oppor. learn: 81%  
   teach. est.: 77%

23. What is the next larger odd number after 5?
   a. 6  
   b. 7  
   c. 8  
   d. 9
   stu. score: 57%  
   oppor. learn: 81%  
   teach. est.: 77%

24. What is another name for two hundred thirteen?
   a. 203  
   b. 2,310  
   c. 2,130  
   d. 213
   stu. score: 82%  
   oppor. learn: 42%  
   teach. est.: 32%
32. Which set below has fewer members than the set of stars?

a. 0 0 0
b. 6 6 6

33. Add: 7 + 7 =

a. 14 b. 15 c. 7 d. 8

34. Solve: $13.84 + 5.62$

a. $19.46$ b. $19.46$ c. $18.46$ d. $19.46$

35. Mrs. Sanchez paid for $7.27 worth of groceries with a ten-dollar bill. How much change should she receive?

a. $2.77$ b. $2.87$ c. $5.77$ d. $5.87

36. The figure below is a

a. triangle. b. cube. c. circle. d. rectangle.

37. Find the difference: $34.21 - 6.17$

a. $28.04$ b. $28.04$ c. $28.04$ d. $28.04$

38. A sports car owner says that the car gets 22 miles per gallon of gasoline. How many miles could the car go on seven gallons of gasoline?

a. 154 miles b. 154 miles c. 154 miles d. 154 miles

39. In the table below, which shape is in row B, column 3?

<p>| | | |</p>
<table>
<thead>
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<tbody>
<tr>
<td>A</td>
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<tr>
<td></td>
<td>B</td>
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<td></td>
<td></td>
<td>C</td>
</tr>
</tbody>
</table>

a. A square b. A circle c. A triangle d. A star

40. Add: $\frac{5}{8} + \frac{2}{8}$

a. $\frac{7}{8}$ b. $\frac{7}{8}$ c. $\frac{7}{8}$ d. $\frac{7}{8}$
41. In which of these numbers does the digit 9 represent the greatest value?
   a. 7,968
   b. 9,002
   c. 10.39
   d. 14.239

42. How many units shorter is PENCIL B than PENCIL A?
   a. 5
   b. 3
   c. 10
   d. 13

43. Which of the shapes below could you cut out, fold on the dotted lines, and have the sides match?
   a. A only
   b. B only
   c. B & C only
   d. B, C, & D only
   e. All of them

44. The spinner was divided into 15 sections of equal size. Five of these sections were white, two were blue, four were red and four were black. What is the most likely color for the spinner to stop on?
   a. White
   b. Blue
   c. Red
   d. Black

45. What should replace the □ in \( \frac{2}{3} + \frac{1}{3} = \) ?
   a. 1
   b. 3
   c. 7
   d. 14

46. How many ounces are there in two pounds?
   a. 8 ounces
   b. 16 ounces
   c. 20 ounces
   d. 32 ounces

47. Nancy saved $3.00 a week for 6 weeks. She still needs $2.00 to buy the radio she picked out. How much does the radio cost?
   a. $5.00
   b. $15.00
   c. $16.00
   d. $20.00

48. Add: \( 2.7 \)

   a. 10.54
   b. 10.44
   c. 6.93
   d. 1.044

49. Mark bought a basketball that cost $6.98 plus tax. If the sales tax on an $18.98 purchase is 45¢, how much change should he receive from a ten-dollar bill?
   a. 47¢
   b. 57¢
   c. 67¢
   d. 84¢
DIRECTIONS. The questions below should be answered by referring to the chart showing basketball games won by Central High School.

50. How many games did Central High School win in 1970?
   a. 6
   b. 7
   c. 8
   d. 9
   stu. score: 87%

51. How many games did Central High School win during its best year?
   a. 14
   b. 13
   c. 12
   d. 11
   stu. score: 78%

52. How many more games did Central High School win in 1973 than it won in 1968?
   a. 13
   b. 12
   c. 11
   d. 10
   stu. score: 57%

53. One of the following is not a square. Which one?
   a. □
   b. □
   c. □
   d. □
   stu. score: 65%

54. What is the product of \( \frac{1}{3} \) of 27?
   a. 8
   b. 9
   c. 10
   d. 12
   stu. score: 34%

55. What is the price of 9 tickets at $5.95 each?
   a. $43.55
   b. $53.55
   c. $52.65
   d. $53.55
   stu. score: 50%
17. Which number is the SMALLEST?
   a. 2.002
   b. 0.202
   c. 0.22
   d. 0.022

18. \( \frac{1}{2} \) is equivalent to what percent?
   a. 15%
   b. 50%
   c. 100%
   d. 15%

19. Subtract 4.78 from 17.3.
   a. 12.63
   b. 12.72
   c. 11.92
   d. 11.73
   e. 12.91

20. \( 1 \frac{1}{2} - \frac{1}{3} \cdot \frac{1}{2} \)
   a. \( \frac{1}{3} \)
   b. \( \frac{3}{10} \)
   c. \( \frac{1}{10} \)
   d. \( 1 \frac{1}{2} \)
   e. \( 1 \frac{1}{3} \)

21. \( -2 \times 12 = \)
   a. 24
   b. -24
   c. 14
   d. 6

22. Angle A is what kind of an angle?
   a. Acute
   b. Right
   c. Obtuse

23. In the United States, we usually buy gasoline by the gallon. In France, where the metric system is used, people buy gasoline by the
   a. meter.
   b. liter.
   c. quart.
   d. gram.

24. In the United States, we usually buy potatoes by the pound. In Germany, where the metric system is used, people buy potatoes by the
   a. meter.
   b. liter.
   c. pound.
   d. kilogram.

25. A car takes 15 minutes to travel ten kilometers. What is the speed of the car?
   a. 30 kilometers per hour
   b. 40 kilometers per hour
   c. 50 kilometers per hour
   d. 90 kilometers per hour
   e. 150 kilometers per hour

26. Choose the verbal statement that represents the meaning of this formula:
   \[ 4x - 12 = 200 \]
   a. If a certain number is subtracted from 12 then multiplied by 4, the result is 200.
   b. If a certain number is multiplied by 4 and then decreased by 12, the result is 200.
   c. If a certain number is multiplied by 4 and then subtracted from 12, the result is 200.

27. If \( x \) is replaced by 3, then the value of \( x^2 - 1 \) is
   a. 8
   b. 11
   c. 5
   d. 2

28. In a given triangle, the measures of two of the angles are 35 degrees and 75 degrees. The measure of the third angle is
   a. 40 degrees.
   b. 55 degrees.
   c. 70 degrees.
   d. 95 degrees.
   e. 110 degrees.

29. Which of the following is true?
   a. \( 8 \times 7 \)
   b. \( 1 \times 0 \)
   c. \( -1 \times 0 \)
   d. \( -5 > -4 \)
   e. \( -7 > 6 \)

30. \( a^3 = \)
   a. 12
   b. 24
   c. 48
   d. 64
31. $\frac{1}{2} \div \frac{1}{4}$
   a. $\frac{1}{2}$
   b. $\frac{1}{4}$
   c. $\frac{1}{8}$
   d. $\frac{1}{6}$
   stu. score: 74%
   oppor. learn: 98%
   teach. est.: 83%

32. $11.09 - 8.33$
   a. 2.06
   b. 2.56
   c. 3.06
   d. 3.56
   e. 3.53
   stu. score: 89%
   oppor. learn: 100%
   teach. est.: 83%

33. $-27 \times 3$
   a. $-9$
   b. 3
   c. 9
   d. -3
   stu. score: 65%
   oppor. learn: 81%
   teach. est.: 71%

34. An angle may be measured in units called
   a. centimeters
   b. degrees
   c. grams
   d. inches
   stu. score: 78%
   oppor. learn: 90%
   teach. est.: 79%

35. Which illustration below shows that the ratio of the number of squares to the number of circles is 1:2?
   a. $\square$ $\square$ $\bigcirc$
   b. $\square$ $\square$ $\bigcirc$ $\bigcirc$
   c. $\square$ $\bigcirc$
   d. $\square$
   stu. score: 85%
   oppor. learn: 69%
   teach. est.: 67%

36. 2 meters + 3 millimeters
   a. 2.0000 meters
   b. 2.003 meters
   c. 2.006 meters
   d. 2.3 meters
   e. 2.5 meters
   stu. score: 43%
   oppor. learn: 66%
   teach. est.: 50%

37. All centimeter piece is cut from a stick one meter long. What is the length of the remaining piece?
   a. 85 cm
   b. 115 cm
   c. 185 cm
   d. 1015 cm
   e. 9985 cm
   stu. score: 63%
   oppor. learn: 78%
   teach. est.: 57%

38. Solve the following equation:
   $3x - 3 = 12$
   a. 15
   b. 3
   c. 9
   d. 2
   stu. score: 57%
   oppor. learn: 57%
   teach. est.: 55%

39. Which of the following represents the expression, "the sum of a number and 3 times that number is less than 30"?
   a. $x + 3x < 30$
   b. $3x - x < 30$
   c. $x + 3x < 30$
   d. $x + 3x < 30$
   stu. score: 63%
   oppor. learn: 52%
   teach. est.: 52%

40. What is the altitude of the triangle below?
   a. AB
   b. AC
   c. AD
   d. BC
   stu. score: 74%
   oppor. learn: 58%
   teach. est.: 63%

41. John's parents bought a refrigerator for $5175. If they pay $20 per month for two years, how much more than $375 will
   the refrigerator cost them?
   a. $595
   b. $105
   c. $200
   d. $375
   stu. score: 65%
   oppor. learn: 76%
   teach. est.: 58%

42. What is the perimeter of the triangle ABC below?
   a. 22 inches
   b. 18 inches
   c. 14 inches
   d. 28 inches
   stu. score: 58%
   oppor. learn: 79%
   teach. est.: 68%

43. Which set of the following diagrams illustrates the statement, "Set S is a subset of Set T"?
   a. S
   b. S
   c. S
   d. S
   stu. score: 58%
   oppor. learn: 41%
   teach. est.: 48%
44. \(3(2 + 7) = \)
   - a. 6
   - b. 12
   - c. 23
   - d. 27

45. What is the SMALLEST positive number that can be divided by 6, 9, and 12 without a remainder?
   - a. 18
   - b. 24
   - c. 36
   - d. 72

46. Which one of the following equals \(\frac{3}{4} \times 5\)?
   - a. 4 \(\frac{1}{2}\)
   - b. 9 \(\frac{3}{4}\)
   - c. 47 \(\frac{1}{2}\)
   - d. 47 - \(\frac{3}{4}\)

47. Divide. \(16.4 + .04 = \)
   - a. 165
   - b. 131.42
   - c. 410
   - d. 450

48. Which of the following is NOT true?
   - a. \(\frac{.65 \times .65}{100} = \)
   - b. \(\frac{1}{10} + .1 = \)
   - c. \(\frac{1}{10} + .1 = \)
   - d. \(\frac{3}{20} + .03 = \)

49. The number of centimeters in one meter is
   - a. \(\frac{1}{1000}\)
   - b. 10
   - c. 100
   - d. 1000

50. Which one of the metric units below is equivalent to .01 kilograms?
   - a. 7 hectograms
   - b. 7 grams
   - c. 70 grams
   - d. 7000 milligrams

51. Solve the missing value in this proportion and choose the correct response.
   \[\frac{12 - 18}{26 - n} = \]
   - a. 39
   - b. 32
   - c. 13
   - d. 38

52. Let \(a \times b = a(x + b)\), then \(2 \times 3 = \)
   - a. \(2(2 + 3)\)
   - b. \(3(2 + 3)\)
   - c. \((2 + 3)(2 + 3)\)
   - d. \(3(2 + 2)\)

53. Which line segment is a diameter of the circle with the center N?
   - a. NP
   - b. NO
   - c. EG
   - d. HK

54. Which polygon has an area of 12 square centimeters?
   - a. 3cm
   - b. 3cm
   - c. 3cm
   - d. 2cm

55. A sports car owner says the car gets 22 miles per gallon of gasoline. How many miles could the car go on seven gallons of gasoline?
   - a. 154 miles
   - b. 144 miles
   - c. 124 miles
   - d. 124 miles
THE ILLINOIS INVENTORY OF EDUCATIONAL PROGRESS
1981

MATHEMATICS

This section contains mathematics items. The tape will announce the question part of the items, but will not announce the answer choices. After you listen to the tape while reading the question along with the tape, read the answer choices to yourself silently and darken the box for your choice on your answer sheet

PLEASE USE THE SCRATCH PAPER PROVIDED TO WORK OUT YOUR ANSWERS.

DO NOT WRITE ON THE TEST BOOKLET.

TABLE 5

GRADE 8

25. John's parents bought a refrigerator for $375. If they pay $520 per month for two years, how much more than $375 will the refrigerator cost them?

a. $15
b. $41
C. 3
D. $375

26. Solve the following equation: 3x - x = 12

a. 15
b. 6
C. 3
D. 9

27. The figure below illustrates which of the following?

a. 24.863
b. 25.503
c. 25.843
d. 28.863

28. In decimal form, 3% may be written as

a. 0.03
b. 0.3
c. 3.0
d. 30.0

29. Angle A is what kind of angle?

a. Acute
b. Right
c. Obtuse

30. What is .731 written as a fraction?

a. 7311
b. 7311000
c. 731100
d. 73110
31. Which of the shapes below could you cut out, fold on the dotted lines, and have the sides match?

A. 

B. 

C. 

D. 

32. If you spend 45 minutes watching one TV program, 30 minutes watching another, and an hour watching a third program, what is your total viewing time?

a. 2 hours
b. 2 hours 15 minutes
c. 2 hours 30 minutes
d. 2 hours 45 minutes

33. What should replace the □ in the number sentence?

□ - □ = 36?

a. 1
b. 6
C. 16
d. 36

34. .27 .3

a. .9
b. 3
c. .9
d. -1

35. There were 8 girls and 4 boys in the class. The ratio of girls to boys is

a. 2 to 1
b. 3 to 2
c. 2 to 3
d. 1 to 3

36. In the statement, “Today 20% of the students were absent from school,” which one of the following statements best describes the meaning of the symbol %?

a. 20 students were not in school.
b. 20 students out of every 100 students were absent.
c. There were 20 more students in school than were absent.
d. More than 20 students were absent.

37. How many fewer objects (x's) are there inside the ( ) than inside the [ ]

a. 0
b. 3
c. 4
d. 5

38. Which of the following is a multiple of 6?

39. What should replace the □ in the number sentence

□ ÷ □ = 3

a. .3
b. 3
c. .9
d. -1

40. Diane wanted to wallpaper one wall of her room. If the room is 8 feet high and 15 feet long and if a roll of wallpaper contains 32 square feet of paper, how many rolls of paper does she need to complete the job?

a. 1 roll
b. 2 rolls
c. 3 rolls
d. 4 rolls

41. Ruth has savings of $17.25. She wants to buy the following things:

skirt $9.00
belt $3.00
book $2.50
records $4.98

How much more money does she need before she can buy all of these items? (Do not include sales tax in your answer.)

a. $1.70
b. $2.00
c. $2.13
d. $2.23

stu. score: 86%

oppor. learn: 85%
teach. est.: 86%
42. The area of the triangle shown below can be found using the formula $A = \frac{1}{2}bh$. What is the area of the triangle?

![Triangle Diagram]

- a. 10 square feet  
- b. 24 square feet  
- c. 48 square feet  
- d. 96 square feet

43. Find the INCORRECT statement about the table.
   a. In 1972 two of the cars got the same mileage.
   b. The gas mileage of the Chief is getting better every year.
   c. The Bomb could get the best mileage in 1974.
   
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<tbody>
<tr>
<td>Ranger</td>
<td>15</td>
<td>16.5</td>
<td>18</td>
<td>18</td>
<td>17</td>
</tr>
<tr>
<td>Chief</td>
<td>20</td>
<td>17</td>
<td>17</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Bomb</td>
<td>13</td>
<td>15</td>
<td>17.6</td>
<td>18</td>
<td>20.2</td>
</tr>
</tbody>
</table>

44. What is the difference? $9.67 - 5 = n$

   - a. 9.62  
   - b. 9.17  
   - c. 4.67  
   - d. 5.67

45. What is three hundred seventy-one thousands written as a decimal?

   - a. 0.0371  
   - b. 0.071  
   - c. 370.100  
   - d. 371.000

46. Which fraction below has a numerator of 3?

   - a. $\frac{1}{3}$  
   - b. $\frac{3}{3}$  
   - c. $\frac{1}{2}$  
   - d. $\frac{2}{3}$

47. If the sales tax is 5%, how much sales tax is there on a $7.25 meal in a restaurant?

   - a. 8c  
   - b. 11c  
   - c. 26c  
   - d. 36c

48. A pair of shoes costs $8.75, and the sales tax is 5%, what is the total cost of the shoes?

   - a. $8.79  
   - b. $9.07  
   - c. $9.19  
   - d. $9.35

49. There are 13 boys and 15 girls in a group. What fractional part of the group is boys?

   - a. 13  
   - b. 12  
   - c. 13  
   - d. 15

50. Approximately what is the difference between the highest and lowest temperatures recorded on September 1st?

   - a. 50 degrees  
   - b. 40 degrees  
   - c. 20 degrees  
   - d. 0 degrees
51. At what time was the temperature approximately 65 degrees?
   a. 11:00 a.m. and 2:00 p.m.
   b. 8:00 a.m. and 8:00 p.m.
   c. Midnight September 1st and Midnight September 2nd
   d. 4:00 a.m. and 8:00 p.m.

   stu. score: 57%
   oppor. learn: 50%
   teach. est.: 62%

52. In what period did the temperature change the most?
   a. From Midnight September 1st to 4:00 a.m.
   b. From 8:00 a.m. to noon
   c. From noon to 4:00 p.m.
   d. From 8:00 p.m. to Midnight September 2nd

   stu. score: 77%
   oppor. learn: 47%
   teach. est.: 64%

53. Approximately what was the difference in temperature between Midnight September 1st and Midnight September 2nd?
   a. 0 degrees
   b. 2 degrees
   c. 5 degrees
   d. 10 degrees

   stu. score: 82%
   oppor. learn: 51%
   teach. est.: 67%

54. Solve: \(-2x + 12 = 0\)
   a. 24
   b. -24
   c. 14
   d. 6

   stu. score: 70%
   oppor. learn: 60%
   teach. est.: 62%

55. Which one of the following is NOT an equivalent expression for \(3:4\)?
   a. \(\frac{3}{4}\)
   b. 0.75
   c. The ratio of 3 to 4.
   d. \(\frac{4}{3}\)

   stu. score: 67%
   oppor. learn: 63%
   teach. est.: 61%

56. The ninth grade class had its meeting in the school auditorium. The auditorium had 10 rows of seats with 21 seats in each row. If 45 seats were empty after all the students were seated, how many students attended the meeting?
   a. 420
   b. 255
   c. 210
   d. 165

   stu. score: 78%
   oppor. learn: 80%
   teach. est.: 63%

57. Clyde ate \(\frac{1}{2}\) of a pizza and Jim ate \(\frac{3}{4}\) of it. How much more did Clyde eat than Jim?
   a. \(\frac{1}{6}\)
   b. \(\frac{1}{3}\)
   c. \(\frac{1}{4}\)
   d. 3

   stu. score: 52%
   oppor. learn: 82%
   teach. est.: 61%

58. The length of a box was measured and found to be nine centimeters to the nearest centimeter. Which of these could have been the length of the box measured more accurately?
   a. 10 cm
   b. 9.9 cm
   c. 9.6 cm
   d. 9.62 cm
   e. 8.6 cm

   stu. score: 44%
   oppor. learn: 44%
   teach. est.: 51%

59. \(x^3 + x^2\)
   a. \(3x^2\)
   b. \(3x^2 + x\)
   c. \(x^4\)
   d. 21x + x

   stu. score: 63%
   oppor. learn: 22%
   teach. est.: 39%
This section contains mathematics items. The tape will announce the question part of the items, but will not announce the answer choices. After you listen to the tape while reading the question along with the tape, read the answer choices to yourself silently and mark an X for your choice in the proper box of your answer booklet. PLEASE USE THE SCRATCH PAPER PROVIDED TO WORK OUT YOUR ANSWERS. DO NOT WRITE ON THE TEST BOOKLET.

17. Tom bought a bicycle last year for $70. This year the same model is selling for $70 more. What is the price of the bicycle this year?
   a. $77
   b. $80
   c. $82
   d. $87

18.\[ \frac{2}{3} \]
   a. 6 percent
   b. 15 percent
   c. 23 percent
   d. 30 percent
   e. 60 percent

19. Which fraction is the GREATEST?
   a. \( \frac{5}{3} \)
   b. \( \frac{3}{4} \)
   c. \( \frac{1}{3} \)
   d. \( \frac{2}{5} \)

20. Television sets are on sale at two stores. One offers a 10 percent discount while the other offers 15 percent. What is the difference in dollars in the sale price at the two stores of a TV set that is regularly priced at $100?
   a. $5
   b. $12
   c. $13
   d. $25

21. If \( x \) is replaced by 3, then the value of \( x^2 - 1 \) is
   a. 8
   b. 13
   c. 5
   d. 2

22. Solve the following equation:
   \[ 3x - 1 = 12 \]
   a. 15
   b. 5
   c. 3
   d. 9

23. Which is true?
   a. All rectangles are squares.
   b. All squares are rectangles.
   c. No squares are rectangles.
   d. No rectangles are squares.

24. If the measure of Angle F is 50° and the measure of Angle G is 105°, what is the measure of Angle E?
   a. 25°
   b. 35°
   c. 55°
   d. 180°

25. Which is true?
   a. All rectangles are squares.
   b. All squares are rectangles.
   c. No squares are rectangles.
   d. No rectangles are squares.

26. What is the SMALLEST number that can be divided by 3, 6, and 9 without a remainder?
   a. 9
   b. 12
   c. 18
   d. 36

27. The solution set of the equation \( x^2 - 9 \) is
   a. \( \{3\} \)
   b. \( \{-3\} \)
   c. \( \{x = 3\} \)
   d. \( \{-3, 3\} \)

28. A door-to-door salesperson receives 20 percent of the retail value of his/her sales as commission. How much commission does he/she earn on a sale of $100?
   a. $20
   b. $100
   c. $150
   d. $200
31. Herbie earned $15 one week mowing lawns. Which problem below must be solved before you can find out how much Herbie earns each hour?
   a. If Herbie worked 2 hours on Monday and 3 hours on Wednesday, how many hours did he work altogether?
   b. If Herbie paid $1.00 to have his lawn mower fixed and 50¢ for gas, how much did he spend?
   c. If Herbie earned more this week than he did last week, how much did he earn during the two weeks?
   d. If Herbie spent 15¢ on ice cream cones for each of his six friends, how much did he spend?

32. Which one of the following gives ALL of the factors of 12?
   a. (1, 3, 6)
   b. (1, 12)
   c. (2, 4, 6, 8, 10, 12)
   d. (12, 24, 36...)
   e. (1, 2, 3, 4, 6, 12)

33. Which of these symbols =, >, < correctly completes the following sentence?
   4 + 3 ___ 3 + 5
   a. >
   b. =
   c. <

34. \(\frac{7}{9}\) as a decimal is
   a. .777...
   b. .7777...
   c. .777...
   d. .6666...

35. Do the following problem: \(3 \frac{1}{2} \div 2 =
   a. 1 \frac{1}{2}
   b. 1 \frac{1}{2}
   c. 1 \frac{1}{2}
   d. 2 \frac{1}{2}

36. Which of the following is the best estimate of the number of television sets in the United States if you know:
   1. There are approximately 225 million people in the United States.
   2. There is one TV set for every 2.5 people in the United States.
   a. 1 million
   b. 10 million
   c. 100 million
   d. 10 billion

37. Which is the closest to the size of one cm²?
   a. A tennis court
   b. Your thumbnail
   c. A slice of bread
   d. The cover of a record album

38. Which one of the following equals \(\frac{27}{3}\)?
   a. 4 \(\frac{2}{3}\)
   b. 9 \(\frac{1}{3}\)
   c. 47 \(\frac{1}{3}\)
   d. 47 - \(\frac{1}{3}\)

39. If \(a + 3 = b\) and \(3 + c = b\), then
   a. \(a = c\)
   b. \(a < c\)
   c. \(a > c\)
   d. There is not enough information to determine the relation between \(a\) and \(b\).

40. If \(n\) is an odd number, what can you say about \(n + 1\)?
   a. It is always odd.
   b. It is always even.
   c. It is even or odd depending upon what \(n\) is.

41. There are 13 boys and 15 girls in the group. What fractional part of the group is boys?
   a. \(\frac{13}{28}\)
   b. \(\frac{16}{28}\)
   c. \(\frac{15}{28}\)
   d. \(\frac{13}{28}\)

42. Mr. Johnson wants to buy carpeting for his living room. The room is square and has a perimeter of 56 feet. What is the area of the room in square feet?
   a. 144 square feet
   b. 168 square feet
   c. 182 square feet
   d. 196 square feet

43. John's parents bought a refrigerator for $375. If they pay $20 per month for two years, how much more than $375 will the refrigerator cost them?
   a. $95
   b. $105
   c. $200
   d. $375

44. \((4x + 2)(x - 5) =
   a. 4x² + 2x - 10
   b. 4x² - 10x - 10
   c. 4x² - 10
   d. 4x² + 2x - 3
45. At four o'clock, the size of the angle between the minute hand and the hour hand of a clock is
   a. 45 degrees.
   b. 60 degrees.
   c. 90 degrees.
   d. 120 degrees.
   e. 150 degrees.
   stu. score: [51%]
   oppor. learn: [95%]
   teach. est.: [54%]

46. A car takes 15 minutes to travel ten kilometers. What is the speed of the car?
   a. 30 kilometers per hour
   b. 40 kilometers per hour
   c. 60 kilometers per hour
   d. 90 kilometers per hour
   e. 150 kilometers per hour
   stu. score: [71%]
   oppor. learn: [87%]
   teach. est.: [56%]

47. In the United States, we usually buy gasoline by the gallon. In France, where the metric system is used, people buy gasoline by the
   a. meter.
   b. liter.
   c. quart.
   d. gram.
   stu. score: [90%]
   oppor. learn: [82%]
   teach. est.: [68%]

48. In the United States, we usually buy potatoes by the pound. In Germany, where the metric system is used, people buy potatoes by the
   a. meter.
   b. liter.
   c. pound.
   d. kilogram.
   stu. score: [87%]
   oppor. learn: [80%]
   teach. est.: [68%]

49. Add: $14.2 + 3.8 + 43 + .07 =$
   a. 55.41
   b. 61.07
   c. 59.07
   d. 81.52
   stu. score: [91%]
   oppor. learn: [100%]
   teach. est.: [77%]

50. Do the following division: $127 \div 44$
   a. 821
   b. 822
   c. 314
   d. 922
   stu. score: [90%]
   oppor. learn: [100%]
   teach. est.: [80%]

51. Fred decided to take a trip to his grandmother's house on his mini-bike. It costs Fred 3 cents to run his mini-bike one mile. We want to know how much Fred's trip will cost. What else do we still need to know?
   a. How much the mini-bike cost when it was new.
   b. How many miles Fred can go on one gallon of gas.
   c. How many miles it is to Fred's grandmother's house.
   d. How large a mini-bike Fred has.
   stu. score: [93%]
   oppor. learn: [87%]
   teach. est.: [56%]

52. Do the following problem: $344 \div 223$
   a. 123
   b. 125
   c. 126
   d. 132
   stu. score: [90%]
   oppor. learn: [100%]
   teach. est.: [61%]
This section contains mathematics items. The tape will announce the question part of the items, but will not announce the answer choices. After you listen to the tape while reading the question along with the tape, read the answer choices to yourself silently and darken the box for your choice on your answer sheet. PLEASE USE THE SCRATCH PAPER PROVIDED TO WORK OUT YOUR ANSWERS. DO NOT WRITE ON THE TEST BOOKLET.

11. Which fraction below has a numerator of 3?
   a. \( \frac{3}{7} \)
   b. \( 3\frac{1}{5} \)
   c. \( \frac{2}{3} \)
   d. \( 2\frac{1}{3} \)

12. Which figure below is not a parallelogram?

   [Diagram of figures A, B, C, D]

   a. A
   b. B
   c. C
   d. D

24. The ninth grade class had its meeting in the school auditorium. The auditorium had 10 rows of seats with 21 seats in each row. If 45 seats were empty after all the students were seated, how many students attended the meeting?
   a. 429
   b. 255
   c. 210
   d. 165

25. What is the volume of the rectangular solid?

   [Diagram of a rectangular solid with dimensions 2 feet by 2 feet by 5 feet]

   a. 10 cubic feet
   b. 25 cubic feet
   c. 30 cubic feet
   d. 40 cubic feet

26. Bob saved $10.00 for 1 year. The interest rate was 6% per year. How much interest did he earn?
   a. $0.60
   b. $0.65
   c. $0.70
   d. $0.75

27. The figure below illustrates which of the following?

   [Diagram of a circle divided into sections]

   a. \( \frac{2}{3} \)
   b. \( \frac{1}{3} \)
   c. \( \frac{2}{6} \)
   d. \( \frac{4}{9} \)
30. Which of the shapes below could you cut out, fold on the dotted lines, and have the sides match?

A. 
B. 
C. 
D.

a. A only  
   stu. score:  64%  
   oppor. learn:  43%  
   teach. est.:  74%  

b. C only  
   stu. score:  75%  
   oppor. learn:  81%  
   teach. est.:  67%  

c. B and D only  
   stu. score:  72%  
   oppor. learn:  79%  
   teach. est.:  70%  

d. B, C, and D only  
   stu. score:  74%  
   oppor. learn:  90%  
   teach. est.:  74%  

e. All of them  
   stu. score:  75%  
   oppor. learn:  83%  
   teach. est.:  67%

31. Television sets are on sale at two stores. One offers a 10 percent discount while the other offers 15 percent. What is the difference in dollars in the sale price at the two stores of a TV set that is regularly priced at $100?

   a. $ 95  
   stu. score:  81%  
   oppor. learn:  93%  
   teach. est.:  65%  

   b. $100  
   stu. score:  86%  
   oppor. learn:  95%  
   teach. est.:  70%  

   c. $105  
   stu. score:  79%  
   oppor. learn:  81%  
   teach. est.:  70%  

   d. $120  
   stu. score:  79%  
   oppor. learn:  81%  
   teach. est.:  70%

32. John's expenses for operating his mini-bike are shown in the figure below.

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Repairs</th>
<th>Insurance</th>
<th>License</th>
</tr>
</thead>
<tbody>
<tr>
<td>50c</td>
<td>40c</td>
<td>15c</td>
<td>12c</td>
</tr>
</tbody>
</table>

How many cents of each dollar of operating costs went for insurance?

   a. 3  
   stu. score:  92%  
   oppor. learn:  72%  
   teach. est.:  90%  

   b. 69  
   stu. score:  98%  
   oppor. learn:  72%  
   teach. est.:  90%  

   c. 28  
   stu. score:  98%  
   oppor. learn:  72%  
   teach. est.:  90%  

   d. 50  
   stu. score:  98%  
   oppor. learn:  72%  
   teach. est.:  90%

33. For which item did John spend $28 out of each dollar?

   a. Fuel  
   stu. score:  98%  
   oppor. learn:  72%  
   teach. est.:  90%  

   b. Repairs  
   stu. score:  98%  
   oppor. learn:  72%  
   teach. est.:  90%  

   c. Insurance  
   stu. score:  98%  
   oppor. learn:  72%  
   teach. est.:  90%  

   d. License  
   stu. score:  98%  
   oppor. learn:  72%  
   teach. est.:  90%

34. What is the value of $x^2 + 3y$ when $x = 2$, $y = 4$?

   a. 7  
   stu. score:  75%  
   oppor. learn:  81%  
   teach. est.:  67%  

   b. 18  
   stu. score:  75%  
   oppor. learn:  81%  
   teach. est.:  67%  

   c. 20  
   stu. score:  75%  
   oppor. learn:  81%  
   teach. est.:  67%  

   d. 70  
   stu. score:  75%  
   oppor. learn:  81%  
   teach. est.:  67%

35. What is the perimeter of the triangle ABC below?

   a. 20"  
   stu. score:  73%  
   oppor. learn:  90%  
   teach. est.:  74%  

   b. 16"  
   stu. score:  73%  
   oppor. learn:  90%  
   teach. est.:  74%  

   c. 15"  
   stu. score:  73%  
   oppor. learn:  90%  
   teach. est.:  74%  

   d. 24"  
   stu. score:  73%  
   oppor. learn:  90%  
   teach. est.:  74%

36. What is .731 written as a fraction?

   a. 731  
   100  
   stu. score:  74%  
   oppor. learn:  94%  
   teach. est.:  77%  

   b. 731  
   1000  
   stu. score:  74%  
   oppor. learn:  94%  
   teach. est.:  77%  

   c. 731  
   100  
   stu. score:  74%  
   oppor. learn:  94%  
   teach. est.:  77%  

   d. 731  
   1000  
   stu. score:  74%  
   oppor. learn:  94%  
   teach. est.:  77%

37. John's parents bought a refrigerator for $375. If they pay $20 per month for two years, how much more than $375 will the refrigerator cost them?

   a. $95  
   stu. score:  79%  
   oppor. learn:  81%  
   teach. est.:  70%  

   b. $100  
   stu. score:  79%  
   oppor. learn:  81%  
   teach. est.:  70%  

   c. $105  
   stu. score:  79%  
   oppor. learn:  81%  
   teach. est.:  70%  

   d. $120  
   stu. score:  79%  
   oppor. learn:  81%  
   teach. est.:  70%

38. Which one of the formulas expresses the relationship between $x$ and $y$ in the following table?

<table>
<thead>
<tr>
<th>x</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>7</td>
<td>10</td>
<td>13</td>
<td>16</td>
</tr>
</tbody>
</table>

   a. $y = x + 5$  
   stu. score:  56%  
   oppor. learn:  55%  
   teach. est.:  55%  

   b. $y = 3x + 1$  
   stu. score:  56%  
   oppor. learn:  55%  
   teach. est.:  55%  

   c. $x = y - 5$  
   stu. score:  56%  
   oppor. learn:  55%  
   teach. est.:  55%  

   d. $x = y + 1$  
   stu. score:  56%  
   oppor. learn:  55%  
   teach. est.:  55%

39. Mr. Johnson wants to buy carpeting for his living room. The room is square and has a perimeter of 56 feet. What is the area of the room in square feet?

   a. 144 square feet  
   stu. score:  41%  
   oppor. learn:  28%  
   teach. est.:  51%  

   b. 169 square feet  
   stu. score:  41%  
   oppor. learn:  28%  
   teach. est.:  51%  

   c. 182 square feet  
   stu. score:  41%  
   oppor. learn:  28%  
   teach. est.:  51%  

   d. 196 square feet  
   stu. score:  41%  
   oppor. learn:  28%  
   teach. est.:  51%
In answering the questions below and on the next page, refer to the chart showing a record of temperature for one day in Meadsville.

**RECORD OF TEMPERATURE FOR ONE DAY IN MEADSVILLE**

<table>
<thead>
<tr>
<th>Time</th>
<th>Temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:00 a.m.</td>
<td>40</td>
</tr>
<tr>
<td>7:00 a.m.</td>
<td>60</td>
</tr>
<tr>
<td>1:00 p.m.</td>
<td>80</td>
</tr>
<tr>
<td>7:00 p.m.</td>
<td>30</td>
</tr>
</tbody>
</table>

40. Approximately how much is the difference between the highest and lowest temperatures recorded in Meadsville?
   a. 10°F
   b. 20°F
   c. 30°F
   d. 40°F

41. At what time was the temperature approximately 65 degrees?
   a. 11:00 a.m. and 2:00 p.m.
   b. 11:00 a.m. and 1:00 p.m.
   c. Midnight September 1st and Midnight September 2nd
   d. 4:00 a.m. and 1:00 p.m.

42. In what period did the temperature change the most?
   a. From Midnight September 1st to 4:00 a.m.
   b. From 1:00 a.m. to noon
   c. From noon to 4:00 p.m.
   d. From 8:00 p.m. to Midnight September 2nd

43. Approximately, what was the difference in temperature between Midnight September 1st and Midnight September 2nd?
   a. 0 degrees
   b. 2 degrees
   c. 5 degrees
   d. 10 degrees

44. \((4x + 2)(x - 5)\)
   a. \(4x^2 + 2x - 5\)
   b. \(4x^2 - 10x - 10\)
   c. \(4x - 10\)
   d. \(4x + 2x - 3\)

45. Find the INCORRECT statement about the table.
   a. In 1972 the cars got the same mileage.
   b. The gas mileage of the Chief is getting better every year.
   c. The Durab could have the best mileage in 1974.
   d. The Rambler got better mileage in 1971 than in 1970.

46. What is the difference? \(9.67 - 5 - x\)
   a. 9.62
   b. 9.17
   c. 4.67
   d. 5.67

47. Mr. Vega has just received a 6% salary raise on his annual salary of $16,000. How much is his annual salary now?
   a. $16,640.00
   b. $16,800.00
   c. $16,960.00
   d. $17,120.00

48. In the drawing below, line segments AB and CD are parallel. What is the length of line segment CD?

   a. 1 inch
   b. 2 inches
   c. 3 inches
   d. 4 inches

49. What is the difference? \(9.67 - 5 - x\)

   a. 9.62
   b. 9.17
   c. 4.67
   d. 5.67
49. The solution set of the equation $x^2 = 9$ is
   a. $(3)$
   b. $(-3)$
   c. $(x = 3)$
   d. $(-x = 3)$
   [stu. score: 39%, oppor. learn: 73%, teach. est.: 64%]

50. If you spend 45 minutes watching one TV program, 30 minutes watching another, and an hour watching a third program, what is your total viewing time?
   a. 2 hours
   b. 2 hours 15 minutes
   c. 2 hours 10 minutes
   d. 2 hours 45 minutes
   [stu. score: 52%, oppor. learn: 68%, teach. est.: 68%]

51. You are given the following problem.
   Thirty-two boys each carried 10 pounds of equipment on a camp-out trip. How many pounds of equipment were there in all?
   Which of the arithmetic sentences below best represents this problem?
   a. $10 \times 32 = P$
   b. $32 \times 10 = P$
   c. $10 \times 32 = P$
   d. $32 \times 10 = P$
   [stu. score: 89%, oppor. learn: 89%, teach. est.: 74%]

52. A door-to-door salesperson receives 20 percent of the retail value of the sales as commission. What must the total retail sales be to earn a commission of $560?  
   a. $1,700$
   b. $2,700$
   c. $2,500$
   d. $3,000$
   [stu. score: 56%, oppor. learn: 64%, teach. est.: 55%]

53. Solve the following.  $5x - 3x = 27$
   a. $167.710$
   b. $194.031$
   c. $230.304$
   d. $167.034$
   [stu. score: 79%, oppor. learn: 96%, teach. est.: 96%]

54. $\frac{1}{2} + \frac{3}{4}$
   a. $\frac{1}{2}$
   b. $\frac{2}{3}$
   c. $\frac{4}{5}$
   d. $\frac{5}{6}$
   [stu. score: 57%, oppor. learn: 96%, teach. est.: 77%]

55. If the sales tax is 5%, how much sales tax is there on a $7.25 meal in a restaurant?
   a. $0.36$
   b. $0.41$
   c. $0.26$
   d. $0.36$
   [stu. score: 80%, oppor. learn: 86%, teach. est.: 73%]

56. In the two formulas below let $R = 3$ and $S = 7$. After computing the values of $M$ and $P$, select the true statement.
   
   $M = 2R$  
   $P = R + S$
   a. $M = 50$
   b. $M$ is larger than $P$
   c. $M = P$
   d. $P = 21$
   [stu. score: 57%, oppor. learn: 69%, teach. est.: 61%]

57. If the measure of Angle $F$ is 50° and the measure of Angle $G$ is 105°, what is the measure of Angle $E$?
   a. 25°
   b. 35°
   c. 55°
   d. 180°
   [stu. score: 55%, oppor. learn: 81%, teach. est.: 67%]
Chapter 3

Factor Analysis Results, Discussion, and Conclusion

Factor Analysis Results

The 1980 and 1981 data were subjected to a statistical analysis procedure called factor analysis, a mathematical procedure which determines underlying unities in a test. These underlying unities are referred to by various names such as underlying variables, academic abilities, learning constructs, psychological components, fundamental properties, and most commonly as factors. A description of factor analysis is given in Appendix D.

The tests (fourth, eighth, and eleventh grades) were general mathematics tests, covering 23, 31, and 24 cells (i.e. objectives) respectively over the two years. Untested cells were judged by the mathematics advisory committee and State Board staff to be inappropriate for the purposes of the IIEP tests. All student abilities were tested both years at all grade levels, and all appropriate mathematical topics were tested one or both years. One purpose of the 1980 and 1981 assessments was to test the hypothesis that the data would identify a "knowledge of mathematical facts and relationships" factor and a "mathematical problem-solving ability" factor. That is, each test was designed to measure both general knowledge of mathematics and the ability to do mathematical problem solving. It was hypothesized that each test would contain a general mathematics factor and that a problem-solving factor would be indicated by any test which identified a second general factor.

All six tests showed a "knowledge of mathematical facts and relationships" factor, and two of the six contained a second general factor which indicated "mathematical problem-solving ability." Mathematical problem-solving ability was the second factor in the 1981 fourth grade test and in the 1981 eleventh grade test. Tables 8 to 15 show the factor analysis results for the six tests.
Table 8

Factor Analysis Results for the 1980 Fourth Grade Test

**FACTOR I**

**KNOWLEDGE OF MATHEMATICAL FACTS AND RELATIONSHIPS**

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>FACTOR LOADING</th>
<th>% CORRECT</th>
<th>ABILITY</th>
<th>TOPIC</th>
<th>OBJECTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td>.47</td>
<td>50%</td>
<td>1</td>
<td>10</td>
<td>37</td>
</tr>
<tr>
<td>36</td>
<td>.47</td>
<td>72%</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>25</td>
<td>.42</td>
<td>86%</td>
<td>2</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>50</td>
<td>.42</td>
<td>88%</td>
<td>1</td>
<td>12</td>
<td>45</td>
</tr>
<tr>
<td>35</td>
<td>.41</td>
<td>68%</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>24</td>
<td>.41</td>
<td>70%</td>
<td>2</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>37</td>
<td>.40</td>
<td>66%</td>
<td>2</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>53</td>
<td>.39</td>
<td>39%</td>
<td>1</td>
<td>10</td>
<td>37</td>
</tr>
<tr>
<td>45</td>
<td>.37</td>
<td>78%</td>
<td>2</td>
<td>3</td>
<td>10</td>
</tr>
</tbody>
</table>

Factor I for the 1980 Fourth grade test had an eigenvalue of 5.85 and accounted for 13% of the variance in overall test scores.

---

Table 9

Factor Analysis Results for the 1981 Fourth Grade Test

**FACTOR I**

**KNOWLEDGE OF MATHEMATICAL FACTS AND RELATIONSHIPS**

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>FACTOR LOADING</th>
<th>% CORRECT</th>
<th>ABILITY</th>
<th>TOPIC</th>
<th>OBJECTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>.59</td>
<td>94%</td>
<td>1</td>
<td>12</td>
<td>45</td>
</tr>
<tr>
<td>20</td>
<td>.46</td>
<td>73%</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>.44</td>
<td>75%</td>
<td>1</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>24</td>
<td>.40</td>
<td>82%</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Factor I for the 1981 fourth grade test had an eigenvalue of 6.33 and accounted for 14% of the variance in the overall test scores.
### Table 10

Factor Analysis Results for the 1981 Fourth Grade Test

**FACTOR II**
MATHEMATICAL PROBLEM-SOLVING ABILITY

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>FACTOR LOADING</th>
<th>% CORRECT</th>
<th>ABILITY</th>
<th>TOPIC #</th>
<th>OBJECTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>.53</td>
<td>21%</td>
<td>3</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>47</td>
<td>.47</td>
<td>35%</td>
<td>4</td>
<td>14</td>
<td>56</td>
</tr>
<tr>
<td>49</td>
<td>.45</td>
<td>32%</td>
<td>4</td>
<td>14</td>
<td>56</td>
</tr>
<tr>
<td>54</td>
<td>.43</td>
<td>34%</td>
<td>2</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>29</td>
<td>.37</td>
<td>42%</td>
<td>4</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>42</td>
<td>.36</td>
<td>73%</td>
<td>3</td>
<td>10</td>
<td>39</td>
</tr>
<tr>
<td>31</td>
<td>.35</td>
<td>57%</td>
<td>3</td>
<td>14</td>
<td>55</td>
</tr>
<tr>
<td>38</td>
<td>.33</td>
<td>58%</td>
<td>4</td>
<td>14</td>
<td>46</td>
</tr>
<tr>
<td>52</td>
<td>.33</td>
<td>57%</td>
<td>2</td>
<td>13</td>
<td>50</td>
</tr>
<tr>
<td>46</td>
<td>.32</td>
<td>26%</td>
<td>3</td>
<td>10</td>
<td>39</td>
</tr>
</tbody>
</table>

Factor II for the 1981 fourth grade test had an eigenvalue of 1.99 and accounted for 4% of the variance in the overall test scores.

### Table 11

Factor Analysis Results for the 1980 Eighth Grade Test

**FACTOR I**
KNOWLEDGE OF MATHEMATICAL FACTS AND RELATIONSHIPS

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>FACTOR LOADING</th>
<th>% CORRECT</th>
<th>ABILITY</th>
<th>TOPIC</th>
<th>OBJECTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>.60</td>
<td>42%</td>
<td>2</td>
<td>12</td>
<td>46</td>
</tr>
<tr>
<td>29</td>
<td>.59</td>
<td>66%</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>22</td>
<td>.30</td>
<td>67%</td>
<td>1</td>
<td>12</td>
<td>45</td>
</tr>
<tr>
<td>39</td>
<td>.24</td>
<td>63%</td>
<td>1</td>
<td>11</td>
<td>41</td>
</tr>
</tbody>
</table>

Factor I for the 1980 eighth grade test had an eigenvalue of 9.23 and accounted for 19% of the variance of the overall test scores.
Table 12
Factor Analysis Results
for the 1981 Eighth Grade Test

FACTOR I
KNOWLEDGE OF MATHEMATICAL FACTS AND RELATIONSHIPS

<table>
<thead>
<tr>
<th>ITEM</th>
<th>FACTOR LOAD</th>
<th>% CORRECT</th>
<th>ABILITY</th>
<th>TOPIC</th>
<th>OBJECTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>#</td>
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<td>#</td>
<td>#</td>
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</tr>
<tr>
<td>42</td>
<td>.53</td>
<td>46%</td>
<td>2</td>
<td>12</td>
<td>46</td>
</tr>
<tr>
<td>28</td>
<td>.50</td>
<td>50%</td>
<td>1</td>
<td>12</td>
<td>45</td>
</tr>
<tr>
<td>40</td>
<td>.45</td>
<td>44%</td>
<td>4</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>29</td>
<td>.38</td>
<td>61%</td>
<td>1</td>
<td>12</td>
<td>45</td>
</tr>
<tr>
<td>23</td>
<td>.37</td>
<td>63%</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>21</td>
<td>.36</td>
<td>53%</td>
<td>2</td>
<td>5</td>
<td>18</td>
</tr>
<tr>
<td>57</td>
<td>.35</td>
<td>52%</td>
<td>2</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>49</td>
<td>.30</td>
<td>26%</td>
<td>1</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>58</td>
<td>.29</td>
<td>44%</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>51</td>
<td>.28</td>
<td>57%</td>
<td>2</td>
<td>13</td>
<td>50</td>
</tr>
<tr>
<td>39</td>
<td>.27</td>
<td>65%</td>
<td>2</td>
<td>3</td>
<td>10</td>
</tr>
</tbody>
</table>

Factor I for the 1981 eighth grade test had an eigenvalue of 8.79 and accounted for 17% of the variance in the overall test scores.

Table 13
Factor Analysis Results
of the 1980 Eleventh Grade Test

FACTOR I
KNOWLEDGE OF MATHEMATICAL FACTS AND RELATIONSHIPS

<table>
<thead>
<tr>
<th>ITEM</th>
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<th>OBJECTIVE</th>
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<tr>
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<td>#</td>
<td>#</td>
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<tr>
<td>27</td>
<td>.68</td>
<td>78%</td>
<td>2</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>43</td>
<td>.68</td>
<td>79%</td>
<td>2</td>
<td>14</td>
<td>54</td>
</tr>
<tr>
<td>28</td>
<td>.54</td>
<td>78%</td>
<td>2</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>45</td>
<td>.50</td>
<td>51%</td>
<td>2</td>
<td>10</td>
<td>38</td>
</tr>
<tr>
<td>38</td>
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<td>85%</td>
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</tr>
<tr>
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<td>5</td>
</tr>
<tr>
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<td>50%</td>
<td>4</td>
<td>11</td>
<td>44</td>
</tr>
<tr>
<td>37</td>
<td>.37</td>
<td>77%</td>
<td>1</td>
<td>10</td>
<td>37</td>
</tr>
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</table>

Factor I for the 1980 eleventh grade test had an eigenvalue of 11.52 and accounted for 23% of the variance of the overall test scores.
### Table 14

Factor Analysis Results for the 1981 Eleventh Grade Test

**FACTOR I**

**KNOWLEDGE OF MATHEMATICAL FACTS AND RELATIONSHIPS**

<table>
<thead>
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<th>ITEM #</th>
<th>FACTOR LOADING</th>
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<th>OBJECTIVE</th>
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<td>44</td>
</tr>
<tr>
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<td>.84</td>
<td>39%</td>
<td>4</td>
<td>11</td>
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<tr>
<td>57</td>
<td>.62</td>
<td>55%</td>
<td>3</td>
<td>12</td>
<td>47</td>
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<tr>
<td>39</td>
<td>.62</td>
<td>41%</td>
<td>4</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>38</td>
<td>.54</td>
<td>56%</td>
<td>4</td>
<td>11</td>
<td>44</td>
</tr>
</tbody>
</table>

Factor I for the 1981 eleventh grade test had an eigenvalue of 11.52 and accounted for 22% of the variance in the overall test scores.

### Table 15

Factor Analysis Results for the 1981 Eleventh Grade Test

**FACTOR II**

**MATHEMATICAL PROBLEM-SOLVING ABILITY**

<table>
<thead>
<tr>
<th>ITEM #</th>
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<th>% CORRECT</th>
<th>ABILITY</th>
<th>TOPIC</th>
<th>OBJECTIVE</th>
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<tr>
<td>42</td>
<td>.65</td>
<td>87%</td>
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<td>13</td>
<td>50</td>
</tr>
<tr>
<td>43</td>
<td>.65</td>
<td>91%</td>
<td>2</td>
<td>13</td>
<td>50</td>
</tr>
<tr>
<td>24</td>
<td>.57</td>
<td>90%</td>
<td>2</td>
<td>11</td>
<td>42</td>
</tr>
<tr>
<td>50</td>
<td>.52</td>
<td>92%</td>
<td>2</td>
<td>14</td>
<td>54</td>
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<tr>
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<td>13</td>
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<td>45</td>
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<td>79%</td>
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</tr>
<tr>
<td>41</td>
<td>.47</td>
<td>73%</td>
<td>2</td>
<td>13</td>
<td>50</td>
</tr>
<tr>
<td>23</td>
<td>.40</td>
<td>94%</td>
<td>2</td>
<td>11</td>
<td>42</td>
</tr>
</tbody>
</table>

Factor II of the 1981 eleventh grade test had an eigenvalue of 2.33 and accounted for 5% of the variance in the overall test scores.
Discussion

The research hypothesis of the 1980 and 1981 IIEP mathematical assessments was supported by the data. That is, the factors were consistent with the hypothesis every instance. "Knowledge of mathematical facts and relationships" accounted for the greatest amount of variance (from 13% to 23%) in all six tests. "Mathematical problem-solving ability" was the second factor in the 1981 fourth grade test and the 1981 eleventh grade test, accounting for 4% and 5% of the variances, respectively.

These factor analysis results are congruent with the crystallized and fluid models of intelligence originally proposed by R.B. Cattell in 1963. Jensen (1980) describes Cattell's model as follows:

If we factor analyze a large number of highly diverse mental tests and rotate the factor axes so as to allow them to be oblique (i.e., correlated) to approximate the criterion of simple structure as closely as possible and then factor analyze the correlations among the primary factors so as to obtain second-order factors, which we also rotate to simple structure, we will usually come out either with one factor or with two large factors, that is, either $g$, $g_f$, and $g_c$. Even when $g_f$ and $g_c$ are found in place of a unitary $g$, they are usually highly correlated. Raymond B. Cattell (b. 1905) first discovered these two correlated aspects of $g$, which sometimes emerge as second-order factors, and named them fluid and crystallized general intelligence (Cattell, 1963; 1971b, Ch. 5). Cattell's theory of fluid and crystallized intelligence is especially important in any discussion of cultural or educational bias in mental testing.

The essential distinction between fluid and crystallized general intelligence, or $g_f$ and $g_c$ for short, can be gleaned in part from noting the kinds of tests that load most heavily on one or the other factor. Tests loaded mostly on $g_f$ are those that have little informational content, but demand the ability to see relationships, often complex relationships, between relatively simple elements: number series and letter series, figure classification, figure analogies, spatial visualization, closure tests, embedded figures tests, block designs, and matrices. Tests loaded mostly on $g_c$ are those that have informational content and draw on the subject's already acquired knowledge and skills: general information, vocabulary, arithmetic, mechanical information and tool identification, verbal syllogisms and other formal logical reasoning problems, and abstruse verbal analogies.

Notice that the $g_c$-$g_f$ distinction is not the same as the verbal-nonverbal distinction. For example, verbal analogies based on highly familiar words, but demanding a high level of relation education are loaded on $g_f$, whereas analogies based on abstruse or specialized words and terms rarely encountered outside the context of formal education are loaded on $g_c$ (p.234).
The verbal-nonverbal distinction makes little sense for instructional validity. In fact, mathematics as Irons (1982) notes, is a language, one involving real language experiences and one based on the realities of everyday problem situations.

The factor analyses of the 1980 and 1981 IIEP tests showed that two psychological processes are related to success on the tests. In language terminology, the first process is the vocabulary and syntax of mathematics. To utilize this process successfully, students have to know mathematical definitions such as sum, remainder, right angle, perimeter, squared, etc. They must have mastered computational facts such as the addition, subtraction, multiplication, and division facts. They need to have accumulated geometry facts, e.g. the sum of the interior angles of a triangle is 180°, the Pythagorean theorem, etc. Also, they must understand basic mathematical relationships and their meanings such as a single whole (one) is greater than three-fourths of that whole (3/4 of one), that 50% is equal to .5 which is equal to one half of one, that eleven inches is less than one foot, etc. All this is related to a learning process of memorizing and understanding existent facts, facts which must be studied until comprehended and rehearsed until memorized. In this sense, mathematical facts and relationships are the vocabulary and syntax of the language of mathematics.

The second process is mathematical problem solving. This ability to see relationships is different from the first process and more complex. It is the ability to approach a mathematical problem with multiple strategies of analysis, synthesis, and evaluation to produce the desired solution from the data using appropriate mathematical facts, relationships, and procedures. "Mathematical problem-solving ability" enables the student to divide complex problems into two or more simple problems, solve each simple problem, and put the simple solutions together to solve the complex problem. For example, students having this ability know that computation of a mean requires addition of scores to arrive at a sum and subsequent division of the sum by the number of scores. Students having this ability know that one piece of information can be coupled with other bits of information to generate additional information. For instance, they have learned that if they know the length of one side of a square, they know the lengths of all four sides, can find the perimeter and area, and can solve a number of problems. Also, students having this ability know that they can add to given information to solve problems that at first seem insoluble. For instance, they know that given the lengths of the base and one other side of an isosceles triangle they can construct or imagine a perpendicular bisector and use algebra and tables to determine the height, area, degrees of the angles, etc. of that isosceles triangle.

Conclusion

This report has presented some results of the 1980 and 1981 IIEP tests in mathematics. Other results are presented in Student Achievement in Illinois: An Analysis of Student Progress, a report by the Illinois State Board of Education, 100 North First Street, Springfield, IL 62777, December, 1982. That report describes the trends in student achievement (including mathematics) for Illinois between 1970 and 1981. It also compares Illinois with the rest of the United States. Finally, the aforementioned State Board Report describes the relationships between achievement and other variables such as amount of mathematics studied, parental interest, level of reading ability, and motivation.
Student achievement in mathematics as well as all academic disciplines is complex. This report shows, however, that there may be general abilities related to mathematics achievement. Two such abilities are tentatively identified, "knowledge of mathematical facts and relationships" and "mathematical problem-solving ability." Undoubtedly these abilities can be developed through a number of methodologies. The point here is not to propose any particular methodology, but to suggest that two distinct abilities appear to be needed for success in mathematics, each one attained by divergent mental processes.
CITED REFERENCES


## APPENDIX A

**Correct Answer Keys for the Mathematics Tests of the Illinois Inventory of Educational Progress**

### Fourth Grade Tests

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<td>17.</td>
<td>a</td>
<td>17.</td>
<td>d</td>
<td>18.</td>
<td>e</td>
<td>17.</td>
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<td>c</td>
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<tr>
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### Eighth Grade Tests

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### Eleventh Grade Tests
APPENDIX B

TABLES OF MATHEMATICAL ITEMS AND OBJECTIVES

A comprehensive understanding of what the IIEP tests measured in 1980 and 1981 can be gained from the tables given here. The distribution of test items indicates the objectives, topics, and abilities measured. Each item measured an objective, a topic, and an ability. Tables 16 to 21 show this data. The cells contain the item numbers which measured the objective, topic, and ability represented by that cell.
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<th>UNDERSTANDING</th>
<th>PROBLEM SOLVING</th>
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</table>

* The numbers in the upper left of the cells are the objective numbers of the IIEP. There are 56 IIEP mathematics objectives.

** The numbers in the center of the cells indicate the IIEP test items which measured the objective, topic, and ability represented by that cell.
Table 17

Objectives, Topics, and Abilities
Measured by the 1981 Fourth Grade IIEP Test

MATRIX OF MATHEMATICS OBJECTIVES*

MATHEMATICAL TOPICS BY ABILITIES

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<th>UNDERSTANDING</th>
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* The numbers in the upper left of the cells are the objective numbers of the IIEP. There are 56 IIEP mathematics objectives.
Table 18
Objectives, Topics, and Abilities Measured by the 1980 Eighth Grade IIEP Test

**MATRIX OF MATHEMATICS OBJECTIVES**

**MATHEMATIC TOPICS BY ABILITIES**

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* The numbers in the upper left of the cells are the objective numbers of the IIEP. There are 56 IIEP mathematics objectives.
Table 19
Objectives, Topics, and Abilities Measured by the 1981 Eighth Grade IIEP Test

MATRIX OF MATHEMATICS OBJECTIVES*
MATHEMATICAL TOPICS BY ABILITIES

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* The numbers in the upper left of the cells are the objective numbers of the IIEP. There are 56 IIEP mathematics objectives.
Table 20
Objectives, Topics, and Abilities
Measured by the 1980 Eleventh Grade IIEP Test

MATRIX OF MATHEMATICS OBJECTIVES*
MATHEMATICAL TOPICS BY ABILITIES

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* The numbers in the upper left of the cells are the objective numbers of the IIEP. There are 56 IIEP mathematics objectives.
Table 21
Objectives, Topics, and Abilities
Measured by the 1981 Eleventh Grade IIEP Test

MATRIX OF MATHEMATICS OBJECTIVES*

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<td>8. Rationals</td>
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<td>9. Reals</td>
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<td>10. Measurement</td>
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<td>11. Algebra</td>
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<td>12. Geometry</td>
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<td>13. Probability and Statistics</td>
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<td>14. Personal and Consumer Mathematics</td>
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* The numbers in the upper left of the cells are the objective numbers of the IIEP. There are 56 IIEP mathematics objectives.
### Sample Teacher Survey Instrument

#### 8th GRADE 1981 MATH ATTENDANCE CENTER TEACHER SURVEY

**INSTRUCTIONS.** Starting with Column 7, indicate your response by placing a number corresponding to your opinion in the appropriate box. Return the form to your building principal when completed.

<table>
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<th>ITEM NUMBER</th>
<th>TO WHAT EXTENT HAVE STUDENTS BEEN EXPOSED TO THE ITEM CONTENT?</th>
<th>INDICATE THE DIFFICULTY OF THE ITEM.</th>
<th>WHAT PERCENTAGE OF STUDENTS WILL ANSWER THIS ITEM CORRECTLY?</th>
<th>ITEM NUMBER</th>
<th>TO WHAT EXTENT HAVE STUDENTS BEEN EXPOSED TO THE ITEM CONTENT?</th>
<th>INDICATE THE DIFFICULTY OF THE ITEM.</th>
<th>WHAT PERCENTAGE OF STUDENTS WILL ANSWER THIS ITEM CORRECTLY?</th>
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</table>
APPENDIX D

Description of Factor Analysis

Factor analysis is a highly technical mathematical and statistical procedure which cannot be fully explained here. However, an intuitive understanding of factors and their derivation is possible. Fred Kerlinger, in his book Foundations of Behavioral Research (1973) wrote:

Factor analysis is a method for determining the number and nature of the underlying variables among large numbers of measures.

Generally speaking, if two tests measure the same thing, the scores obtained from them can be added together. If, on the other hand, the two tests do not measure the same thing, their scores cannot be added together. Factor analysis tells us, in effect, what tests or measures can be added and studied together, rather than separately. It thus limits the variables with which the scientist must cope. It also (it is hoped) helps the scientist to locate and identify unities or fundamental properties underlying tests and measures.

A factor is a construct, a hypothetical entity that is assumed to underlie tests and test performance. A number of factors have been found to underlie intelligence, for example: verbal ability, numerical ability, abstract reasoning, spatial reasoning, and memory.

A HYPOTHETICAL EXAMPLE

Suppose we administer six tests to a large number of seventh grade pupils. We suspect that the six tests are not measuring six, but some smaller number of variables. The tests are: vocabulary, reading, synonyms, numbers, arithmetic (standardized tests), and arithmetic (teacher-made tests). The names of these tests indicate their nature. We label them respectively, V, R, S, N, AS, AT. (The last two tests, though both arithmetic, have different contents and reliabilities. We assume a good reason for including them both in a test battery.) After the tests are administered and scored, coefficients of correlation are computed between each test and every other test. We lay out the r's in a correlation matrix (usually called R matrix). The matrix is given in Table 37.1 (Table 23).
Table 23

Table 37.1 R MATRIX: COEFFICIENTS OF CORRELATION AMONG SIX TESTS

<table>
<thead>
<tr>
<th></th>
<th>V</th>
<th>R</th>
<th>S</th>
<th>N</th>
<th>AS</th>
<th>AT</th>
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<td>V</td>
<td>.72</td>
<td>.63</td>
<td>.09</td>
<td>.09</td>
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<tr>
<td>Cluster I</td>
<td>R</td>
<td>.72</td>
<td>.57</td>
<td>.15</td>
<td>.16</td>
<td>.09</td>
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<tr>
<td>S</td>
<td>.63</td>
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<td>AT</td>
<td>.00</td>
<td>.09</td>
<td>.09</td>
<td>.63</td>
<td>.72</td>
<td></td>
</tr>
</tbody>
</table>

Cluster II

...How many underlying variables or factors are there?...The factors are presumed to be underlying unities between the test performances. They are reflected in the correlation coefficients. If two or more tests are substantially correlated, then the tests share variance. They have common factor variance. They are measuring something in common.

...There are two factors. This is indicated by the clusters of r's circled and labeled I and II in Table 37.1. Note that V correlates with R, .72; V with S, .63; and R with S, .57. V, R, and S appear to be measuring something in common. It is important to note, however, that the tests in Cluster I, though themselves intercorrelated, are not to any great extent correlated with the tests in Cluster II. Likewise, N, AS, and AT, though themselves intercorrelated, are not substantially correlated with the tests V, R, and S. What is measured in common by the tests in Cluster I is evidently not the same as what is measured in common by the tests in Cluster II. There appear to be two clusters or factors in the matrix (pp. 659-661).

For further discussion of factor analysis, see Kerlinger (1973, pp. 659-692) and cited references.
APPENDIX E

IIEP MATHEMATICS PANEL

Willie D. Anderson
Carbondale Community High School
Carbondale

Janet Barnard
Parkside Junior High School
Normal

William B. Duffie
Chicago Public Schools
Chicago

Margariete Montague Wheeler
Northern Illinois University
DeKalb

Aurum I. Weinzeig
University of Illinois - Chicago Circle
Chicago

Linda K. Wyatt
Rockford School District #205
Rockford

Mervin M. Brennan
Illinois State Board of Education
Springfield

Wendell A. Meeks
Illinois State Board of Education
Springfield
The following is a listing of recent publications available from the Program Evaluation and Assessment Section. Only those publications for which copies are available for distribution are included on the list. Supplies are limited. In order to receive one copy of a publication, contact the person listed below the document title. Address and phone number are:

Illinois State Board of Education
Program Evaluation and Assessment Section (S-284)
100 North First Street
Springfield, IL 62777
(217) 782-4823

The documents are listed in chronological order by date of publication.

Standards and Criteria for the Selection of Educational Tests (1978)
Leslie J. Fyans, Jr.
15 pages

Adapted from 1974 American Psychological Association, American Educational Research Association, and National Council for Measurement in Education publication entitled Standards for Educational and Psychological Tests. That manual presents comprehensive guidelines for selecting instruments to measure educational growth, achievement, and outcomes and includes a subset of characteristics absolutely necessary for a test to be considered acceptable. The adapted publication presents the essential characteristics in a declarative sentence checklist format useful to district personnel in determining the acceptability of test instruments for local use.

1978 Reading Item Results
Illinois Inventory of Educational Progress (March, 1980)
Carmen Woods Chapman
200 pages

Presents 1978 IIEP reading results and professional comments on the results. Includes purpose and goals of the statewide assessment program, reading objectives, student sampling model, reporting variables, and how to interpret the results.

Tests Appropriate for Model A-1 in Illinois (March, 1980)
Rose O. Maye
102 pages

Presents descriptive information concerning all nationally normed standardized achievement tests appropriate for use with Model A-1, the norm-referenced model, used in evaluation of Illinois Title I programs in reading, language arts, and mathematics. Detailed information
concerning each test includes whether the test has an expanded standard score, the name given by the publisher for the expanded scale score, and whether out-of-level norms are available.

59 pages

Presents an overview of legal, programmatic, and technical issues related to the application of minimum competency testing (MCT) to handicapped students. Based on proceedings from the State Board of Education MCT/Special Education Conference held January 3-4, 1980 in Chicago.

A Synopsis: What Statewide or Local Efforts Can Assure the Public That Students Are Appropriately Educated? (May, 1980) Norman Stenzel
26 pages

State education agency staff conducted a series of surveys to determine what a select panel of educators felt could be done on a statewide or local basis to assure the public that students are appropriately educated. Description of the methodology, copies of actual instrumentation, and results obtained are included in the synopsis.

66 pages

State education agency staff conducted a series of surveys to determine what a select panel of educators felt could be done on a statewide or local basis to assure the public that students are appropriately educated. Description of the methodology, copies of actual instrumentation, and results obtained are included in the survey report.

Citizenship Curricular Analyses and Teacher Expectation Results Illinois Inventory of Educational Progress (June, 1980) Ken Redding
27 pages

Presents curricular analyses by external reviewers of 1978 IIEP citizenship results and results on the teacher expectation survey conducted when the test was administered. The purpose of the teacher survey was to determine for each item on the citizenship test if students had been exposed to the content being assessed, if the item was of appropriate difficulty level, and teacher expectations of the percentage of students who would answer each item correctly. Includes purpose and goals of the statewide assessment program; citizenship objectives; student sampling model; analysis of results for each of grade levels four, eight, and eleven; and results for specific objectives.
Evaluation and Assessment (February, 1982)
Carmen Woods Chapman
6 pages

Provides a true-false quiz concerning State Board and local district policies on evaluation and student assessment, as well as descriptions of successful evaluation programs being used in six local districts in Illinois. The programs are more completely described in a report entitled "Local School District Approaches to Assessment and Evaluation."

IIEP Reading Report: Results of the 1979 and 1980 Illinois Inventory of Educational Progress (March, 1982)
Carmen Woods Chapman
91 pages

Provides an overview of the 1979 and 1980 Illinois Inventory of Educational Progress (IIEP) for fourth, eighth, and eleventh grade reading. Results for each grade level and comparisons in performance between years and among topic areas are presented. Information presented can be used in developing curricula and improving instruction for Illinois schools.

Local School District Approaches to Assessment and Evaluation (May, 1982)
Carmen Woods Chapman
199 pages

The State Board Advisory Policy on Evaluation and Assessment (adopted in June, 1980) encourages districts to develop and implement a total student assessment and evaluation program. Descriptions of programs being used in six Illinois districts are presented as examples of various approaches being used successfully throughout the state.

Child-Find Self-Audit (June, 1982)
Michael Plog
37 pages

Presents self-audit package useful to administrators of local education agencies for collecting and interpreting information about local child-find activities. Information gathered using the package pertains to only the three- to five-year-old unserved (not underserved) population. Package is intended for local use only. Results are not to be reported to the Illinois State Board of Education. Depending on local circumstances and needs, any one or more of the techniques presented for measuring the effectiveness of child-find programs can be utilized. Purpose of the package is to describe methods to measure the effectiveness of child-find activities, not to measure compliance with state or federal laws or regulations.

Bilingual Education Mandate: A Preliminary Report (June, 1982)
Connie J. Wise
46 pages

One of five reports prepared by Illinois State Board of Education staff concerning mandates placed on elementary and secondary education in Illinois. Includes discussion of the mandate for transitional bilingual
Brenda Pessin
115 pages

Presents a summary of significant findings and comments by the evaluator, an overview of the migrant education program, descriptions of and findings relevant to several special Illinois migrant projects, and site visitation summaries based on interviews and observations at nine local migrant projects in Illinois.

1980 Nutrition Report
Illinois Inventory of Educational Progress (April, 1981)
Carmen Woods Chapman
27 pages

Describes the goals and objectives of the Illinois Nutrition Education and Training program and the Illinois Inventory of Educational Progress (IIEP). Outlines procedures used in developing the nutrition knowledge items and presents an analysis of results obtained from fourth, eighth, and eleventh grade students throughout the state.

Policy Checklist: How Would You Rate Your District with Respect to the Illinois State Board of Education Policy for Assessment and Student Achievement? (April, 1981)
Carmen Woods Chapman
1 page

Includes twelve questions answered "yes" or "no" to indicate the extent to which district policy and procedures reflect state education agency recommendations concerning how to assess student knowledge/ability and determine promotion/graduation status of students. Presents forty-three additional questions to guide discussion of district policy at the local level.

Checklist: Qualitative Review of Evaluations (April, 1981)
Norman Stenzel
1 page

Includes thirteen questions answered "yes" or "no" to indicate qualitative strengths or weaknesses of an evaluation. The questions concern the following seven components of an evaluation and rationale or explanation concerning each component: plan, audience, focus, management, data collection, analysis, and report.

Transitional Bilingual Education in Illinois: 1979-1980
Connie J. Wise
168 pages

First annual evaluation report. Includes findings from data collected on students enrolled in Chicago and downstate transitional bilingual education programs in Illinois. Contents of the report can be used by local, state, and federal agencies in making fiscal and programmatic decisions. Target audiences include personnel of districts serving limited-English proficient students (regardless of whether or not the
district has a state-approved bilingual education program), institutions of higher education, and other agencies, as well as parent and community groups and legislators.

1979 Energy Assessment Report
Illinois Inventory of Educational Progress (June, 1981)
Norman Stenzel
39 pages

The 1979 administration of the Illinois Inventory of Educational Progress (IIEP) for grades four, eight, and eleven included questions on four energy-related topics: types and nature of energy, uses of energy, consequences of energy utilization, and conservation of energy. This document reports the results on the energy-related knowledge items administered at each of the three grade levels, as well as on nine attitude items administered at the eighth and eleventh grade levels. In addition, background information concerning the status of energy education in the schools based on principal- and teacher-written responses is presented.

Individualized Education Program Self-Audit (November, 1981)
Nancy Spinner
26 pages

Presents a self-audit package developed and tested using 16 sites and over 1,000 IEPs in Illinois. When used by providers of special education services, information concerning the quality of special education and related services will be obtained. Results from IEP self-audits will not only indicate the extent to which requirements of Public Law 94-142 are being met, but will provide useful data for improving IEP implementation and demonstrating responsible and accountable management.

1979 Mathematics Results for Fourth Grade Illinois Inventory of Educational Progress (November, 1981)
Mervin M. Brennan
29 pages

Describes development of the 1979 fourth grade IIEP mathematics test and presents fourth grade item results and analyses. Information provided should be useful in enhancing mathematics instruction in Illinois schools. Includes separate indexes of fourth grade mathematics objectives and items for the 1979 IIEP, a copy of the Fourth Grade 1979 Mathematics Attendance Center Teacher Survey, a list of the mathematics panel members, and a list of publications describing 1979 IIEP results for grades four, eight, and eleven on mathematics and energy-related questions.
1979 Mathematics Results for Eighth Grade Illinois Inventory of Educational Progress (November, 1981)
Mervin M. Brennan
36 pages

Describes development of the 1979 eighth grade IIEP mathematics test and presents eighth grade item results and analyses. Information provided should be useful to enhance mathematics instruction in Illinois schools. Includes separate indexes of eighth grade mathematics objectives and items for the 1979 IIEP, a copy of the Eighth Grade 1979 Mathematics Attendance Center Teacher Survey, a list of the mathematics panel members, and a list of publications describing 1979 IIEP results for grades four, eight, and eleven on mathematics and energy-related questions.

1979 Mathematics Results for Eleventh Grade Illinois Inventory of Educational Progress (November, 1981)
Mervin M. Brennan
34 pages

Describes development of the 1979 eleventh grade IIEP mathematics test and presents eleventh grade item results and analyses. Information provided should be useful to enhance mathematics instruction in Illinois schools. Includes separate indexes of eleventh grade mathematics objectives and items for the 1979 IIEP, a copy of the Eleventh Grade 1979 Mathematics Attendance Center Teacher Survey, a list of the mathematics panel members, and a list of publications describing 1979 IIEP results for grades four, eight, and eleven on mathematics and energy-related questions.

FY 81 Annual Report on Title I, Public Law 89-313 (January, 1982)
Connie J. Wise
78 pages

Publication prepared annually in order to comply with Federal Rules and Regulations for Title I programs and to provide descriptive and evaluative information concerning programs in the state. Based on data submitted on end-of-year self-assessment questionnaires by personnel of all fiscal year 1981 Illinois P.L. 89-313 funded projects.

Testing and Evaluation Reference (January, 1982)
Rose O. Maye
10 pages

A concise handbook for teachers and administrators of Title I, P.L. 89-10 programs. Includes: (1) definitions of commonly used testing terms; (2) purposes of district needs assessments (including kinds of data to include and ways to organize the data); (3) selection of students for Title I; (4) figuring of NCE gains; (5) interpretation of NCEs; (6) study of sustained effects; (7) evaluation of programs for which Model A-1 is not appropriate; and (8) elements of a good evaluation report.
education in terms of the study methodology, a description of the current mandate and a historical perspective of the legislation, analyses of the study questions, findings and conclusions, and preliminary recommendations for action by the State Board of Education.

Handbook for Evaluation of Special Education Effectiveness (July, 1982)
Michael Plog
99 pages

Presents information about nine separate techniques, as well as sample worksheets and other information, that can be used by local practitioners in evaluating their own special education programs. The handbook was designed for use by school administrators who are contracting with an evaluation consultant or conducting evaluation of a local program and is not intended to be a comprehensive textbook on evaluation. The handbook was prepared for use by special education practitioners, but contains information relevant to other users.

The Use, Relevance, and Appropriateness of Tests for Educational Decision Making (September, 1982)
Leslie J. Fyans, Jr.
124 pages

The use, relevance, and appropriateness of tests for educational decision making at the local level were studied in terms of the quality of teacher judgment concerning test development and implementation, utility of test information to teachers, and factors affecting student test performance. Data were obtained from fourth and eighth grade teachers and their students and ninth and eleventh grade teachers, all from Springfield School District #186. All participants responded to paper-and-pencil instruments. The ninth grade teachers were also interviewed by research assistants.

Student Achievement in Illinois: An Analysis of Student Progress (December, 1982)
C. Thomas Kerins
81 pages

Describes and synthesizes the results of six different measures of achievement of Illinois students. The tests are the Illinois Inventory of Educational Progress (IEEP), Decade Study test (DST), High School and Beyond test (HSB), Scholastic Aptitude Test (SAT), American College Test (ACT), and National Assessment of Educational Progress (NAEP). The report provides an analysis of student progress across years, from basic to advanced skills in reading, language arts, social studies, mathematics and science. The study of student achievement was conducted to answer three major questions: How well are Illinois students performing in academic areas as compared to students in other parts of the nation and the nation as a whole? How well are Illinois students of today performing in academic areas as compared to Illinois students during the last decade? What student and school characteristics are related to achievement of Illinois students?
Illinois Inventory of Educational Progress Test Booklets
Doris Slagle

Fourth Grade Test Booklets
1978: Mathematics, Reading, and Citizenship
1979: Mathematics, Reading, and Energy
1980: Mathematics, Reading, and Nutrition
1981: Mathematics, Reading, and Science
1982: Mathematical Measurement and Reading

Eighth Grade Test Booklets
1978: Mathematics, Reading, and Citizenship
1979: Mathematics, Reading, and Energy
1980: Mathematics, Reading, and Nutrition
1981: Mathematics, Reading, and Science
1982: Mathematical Measurement and Reading

Eleventh Grade Test Booklets
1978: Mathematics, Reading, and Citizenship
1979: Mathematics, Reading, and Energy
1980: Mathematics, Reading, and Nutrition
1981: Mathematics, Reading, and Science
1982: Mathematical Measurement and Reading

DLN/3091f