DOCUMENT RESUME

ED 231 647   SE 042 098

AUTHOR   Brennan, Mervin M.
TITLE   Illinois Inventory of Educational Progress.
                Mathematics Results for 1980 and 1981.
INSTITUTION   Illinois State Board of Education, Springfield, Dept.
                of Planning, Research and Evaluation.
PUB DATE   Jul 83
NOTE   63p.
PUB TYPE   Reports - Research/Technical (143) --
                Tests/Evaluation Instruments (160)

EDRS PRICE   MF01/PC03 Plus Postage.
DESCRIPTORS   Academic Achievement; *Educational Assessment;
                Educational Objectives; Educational Research;
                Educational Trends; Elementary Secondary Education;
                *Factor Analysis; *Mathematics Achievement;
                Mathematics Curriculum; *Mathematics Education;
                Mathematics Instruction; Problem Solving; *Testing;
                Test Items
IDENTIFIERS   Illinois; *Illinois Inventory of Educational
                Progress; Mathematics Education Research

ABSTRACT
        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)

1980-81
Mathematics
Results

Illinois
State Board of
Education

SE

Illinois Inventory of Educational Progress

1980-81
Mathematics
Results

Illinois
State Board of
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

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.

Table of Contents

6

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.

o   Illinois students of 1981 showed significantly higher mathematics achievement than 1976 students in elementary school mathematics.

o   Illinois students of 1981 showed significantly lower mathematics achievement than 1970 students in high school mathematics.

o   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.

o   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

o   Students who took advanced courses in mathematics tended to achieve higher scores than those who did not.

o   Students whose parents showed an active interest in their academic achievement achieved higher scores than those whose parents showed little interest.

o   Students who reported low levels of test anxiety tended to achieve higher scores than students who said tests made them quite anxious.

o   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.

o   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.

CHAPTER 1

Illinois Inventory of Educational Progress - Mathematics

Development of the IIEP in Mathematics

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
MATRIX OF MATHEMATICS OBJECTIVES
MATHEMATICAL TOPICS BY ABILITIES

MATHEMATICS ABILITIES

MATHEMATICS TOPICS	RECALL	COMPUTATION	UNDERSTANDING	PROBLEM SOLVING
1. Numeration Concepts	1*	2	3	4
2. Properties of Numbers and Operations	5	6	7	8
3. Whole Numbers	9	10	11	12
4. Fractions	13	14	15	16
5. Decimals	17	18	19	20
6. Percent	21	22	23	24
7. Integers	25	26	27	28
8. Rationals	29	30	31	32
9. Reals	33	34	35	36
10. Measurement	37	38	39	40
11. Algebra	41	42	43	44
12. Geometry	45	46	47	48
13. Probability and Statistics	49	50	51	52
14. Personal and Consumer Mathematics	53	54	55	56

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

12

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.

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 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.	stu. score	43%
b.	ten thousand twenty-nine.	oppor. learn.	97%
c.	one thousand two hundred nine.	teach. est.:	70%

18. Do the following problem: 12 - 7 =

a.	4	stu. score	92%
b.	5	oppor. learn	100%
c.	6	teach est.:	14%
d.	7		

19. What is the missing number in this pattern?

322, 324, 326, 328. ☐

a.	329	stu. score	74%
b.	330	oppor. learn	88%
c.	331	teach. est.	80%
d.	332		

20. The number that is 200 less than 800 is

a.	1000	stu. score	75%
b.	400	oppor. learn	93
c.	600	teach. est	79%

[number line: -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10]
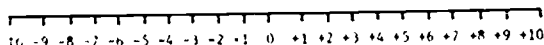
Using the number line above, solve the following problems:

21. What is the difference between +2 and +5?

a.	2	stu. score	55%
b.	3	oppor. learn	57%
c.	7	teach. est	66%
d.	10		

22. What is the difference between -5 and +2?

a.	2	stu. score	35%
b.	3	oppor. learn	30%
c.	5	teach. est.	42%
d.	7		

23. What is the difference between +2 and +4?

a.	1	stu. score	60%
b.	2	oppor. learn	57%
c.	3	teach. est.	66%
d.	4		

24. Is the following statement true or false?

15 + 3 = 10 + 8

a.	True	stu. score:	70%
b.	False	oppor. learn:	91%
		teach. est.:	81%

25. If you spent 72 cents how much change should you get back from one dollar?

a.	8 cents	stu. score:	86%
b.	14 cents	oppor. learn:	95%
c.	16 cents	teach. est.:	73%
d.	28 cents		

26. The figure below is a
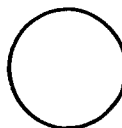
a.	triangle.	stu. score:	98%
b.	cube.	oppor. learn:	97%
c.	circle.	teach. est.:	94%
d.	rectangle.		

27. How many inches are there in a foot?

a.	12 inches	stu. score:	74%
b.	24 inches	oppor. learn:	89%
c.	36 inches	teach. est.:	80%
d.	48 inches		

28. Which one of the following sets has the same number of elements (members) as the picture shown below?
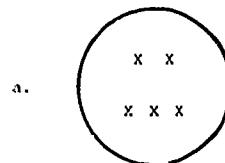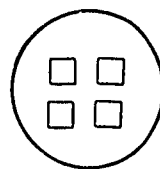
stu. score:	92%
oppor. learn:	84%
teach. est.:	86%

a.

b.

c.
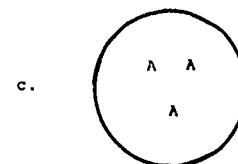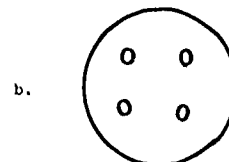
29. Do the following problem: 48 ÷ 6 =

a.   8
b   12   stu. score: 79%
c.   40   oppor. learn: 85%
d.   42   teach. est.:   80%

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

a.   6   stu. score: 71%
b.   7   oppor. learn: 89%
c.   8   teach. est.   83%
d.   9

31. Multiply: 38   stu. score: 70%
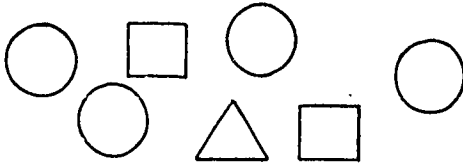   7   oppor. learn   96%
                               teach. est.   75%
a.   256
b.   266
c.   271
d.   276

32. Since 43 = 4 tens + 3 ones and 52 = 5 tens + 2 ones,

    than 43 + 52 = _____ tens + _____ ones.

a.   4 tens + 5 ones   stu. score: 66%
b.   5 tens + 5 ones   oppor. learn   85%
c.   9 tens + 5 ones   teach. est.   69%
d.   9 tens + 8 ones

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

33. What fraction of the figures are circles?

a. $\frac{4}{4}$ stu score   45%
                               oppor learn   37%
                               teach est   45%
b. $\frac{3}{7}$

c. $\frac{2}{7}$

d. $\frac{4}{7}$

34. What fraction of the figures are geometric shapes?

a. $\frac{3}{7}$ stu. score: 26%
                               oppor. learn   27%
b. $\frac{7}{7}$ teach. est.   39%

c. $\frac{4}{7}$

d. $\frac{2}{7}$

35. Four and two-fifths is written as

a. $\frac{42}{5}$ stu. score: 68%
                               oppor. learn: 27%
b. $\frac{4}{25}$ teach. est.:   44%

c. $4\frac{2}{5}$

d.   None of these

36. The figure below is divided into equal parts.
    What fractional part is shaded?
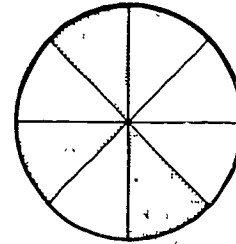
a. $\frac{1}{2}$ stu. score: 72%
                               oppor. learn: 42%
                               teach. est.:   47%
b. $\frac{3}{6}$

c. $\frac{3}{8}$

d. $\frac{3}{10}$

37. John has 385 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.   stu. score: 66%
b.   1,000 stamps.   oppor. learn: 98%
c.   1,100 stamps.   teach. est.:   76%
d.   1,200 stamps.

38. An angle may be measured in units called

a.   centimeters.
b.   degrees.   stu. score: 31%
c.   grams.   oppor. learn: 17%
d.   inches.   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   stu. score: 43%
c.   9 + 10 = 19   oppor. 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   stu. score: 74%
c.   10 pints   oppor. learn: 82%
d.   21 pints   teach. est.:   66%

ction

THE ILLINOIS INVENTORY OF EDUCATIONAL PROGRESS
1981   TABLE 3   GRADE 4

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.

18. The figure below is a

    a. triangle.   stu. score: 94%
    b. cube.
    c. circle.
    d. rectangle.

19. Divide   9 ÷ 3 =

    a. 3   stu. score: 75%
    b. 6   oppor. learn: 81%
    c. 12   teach. est.:   90%
    d. 27

20. What digit is in the tens place in 4,263?

    a. 2   stu. score: 73%
    b. 3   oppor. learn: 97%
    c. 4   teach. est.:   93%
    d. 6
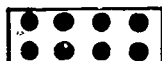
21. If one-fourth of the dots in the above figure are taken away, how many dots will be left?

    a. 2 dots   stu. score: 21%
    b. 5 dots
    c. 6 dots
    d. 7 dots

22. How many tens are there in 79?

    a. 7   stu. score: 57%
    b. 9
    c. 70
    d. 90

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

    a. 6   stu. score: 57%
    b. 7   oppor. learn: 81%
    c. 8   teach. est.:   77%
    d. 9

24. What is another name for two hundred thirteen?

    a. 20,013
    b. 2,310   stu. score: 82%
    c. 2,130
    d. 213

25. Four and two-fifths is written as

    a. $\frac{42}{5}$ stu. score: 71%
                          oppor. learn: 14%
    b. $\frac{4}{25}$ teach. est.:   35%

    c. $4\frac{2}{5}$

    d. None of these

26. What even number is greater than 6 and less than 9?

    a. 6
    b. 7   stu. score: 71%
    c. 8
    d. 10

27. Find the difference: 2043
                           - 317

    a. 1,736
    b. 1,627   stu. score: 61%
    c. 1,726   oppor. learn: 97%
    d. 1,636   teach. est.:   86%

28. Multiply: 529
                 × 47

                           stu. score: 44%
    a. 24,863
    b. 25,503
    c. 25,843
    d. 28,863

29. 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   stu. score: 42%
    c. 6   oppor. Learn: 33%
    d. 7   teach. est.:   32%

7:00 8:00 9:00 10:00 11:00 12:00 1:00 2:00 3:00 4:00 5:00
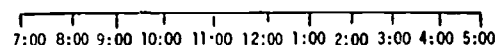
The line above shows the hours from 7:00 a.m. to 5:00 p.m. Use the line to solve the following problems.

30. Peter left home at 2:00 p.m. and arrived back home at 5:00 p.m. How many hours was he away from home?

    a. 1 hour   stu. score: 66%
    b. 2 hours
    c. 3 hours
    d. 4 hours

31. Janet worked from 8:00 a.m. to 5:00 p.m. She had an hour for lunch. How many hours did she work?

    a. 3 hours
    b. 5 hours
    c. 8 hours   stu. score: 57%
    d. 10 hours

Here is a set of stars.
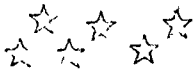
32. Which set below has fewer members than the set of stars?

a.

stu. score   85%

b.

c.

d. ||||||||
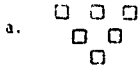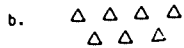
33. Add: $7 + \frac{7}{8} =$

stu. score: 27%

a. $7\frac{7}{8}$

b. $1\frac{6}{8}$

c. $\frac{7}{15}$

d. $8\frac{7}{8}$

34. Solve $13.84
          $+ 5.62$

a. $.1846
b. $.1946   stu. score·   59%
c. $18.46
d. $19.46

35. Mrs. Sanchez paid for $7.23 worth of groceries with a ten-dollar bill. How much change should she receive?

a. $2.77
b. $2.87   stu. score: 45%
c. $3.77
d. $3.87

36. The figure below is a

a. triangle.   stu. score: 84%
b. cube.
c. circle.
d. rectangle.

37. Find the difference: $4.21
                          $- 2.17$

a. $214
b. $204   stu. score: 51%
c. $2.04
d. $2.14

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. 144 miles   stu. score: 58%
b. 154 miles   oppor. learn: 50%
c. 164 miles   teach. est.:   49%
d. 174 miles

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

a. A square
b. A circle   stu. score: 78%
c. A triangle
d. A star

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

a. $\frac{7}{16}$ stu. score: 23%

b. $\frac{10}{16}$

c. $\frac{7}{8}$

d. $\frac{10}{8}$

16

41. In which of these numbers does the digit 9 represent the greatest value?

   a. 7,968
   b. 9,002   stu. score: 69%
   c. 10,391
   d. 14,239

Look at the picture below

PENCIL A

0 1 2 3 4 5 6 7 8 9 10 11 12 13
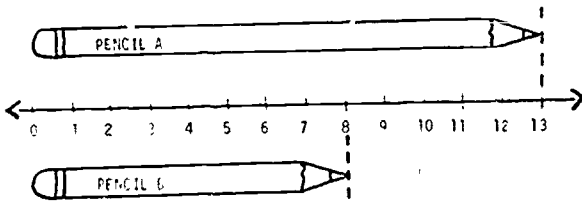
PENCIL B

42. How many units shorter is PENCIL B than PENCIL A?

   a. 5
   b. 6
   c. 10   stu. score: 73%
   d. 13

43. Which of the shapes below could you cut out, fold on the dotted lines, and have the sides match?

A   B.

C   D
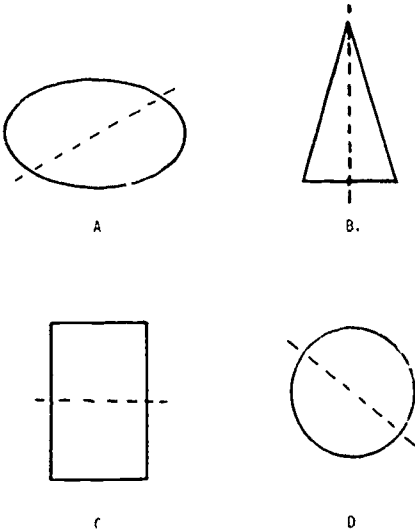
   a. A only   stu. score: 37%
   b. C only
   c. B and D only
   d. B, C, and D only
   e. All of them

Pete was playing a game with a spinner like this.
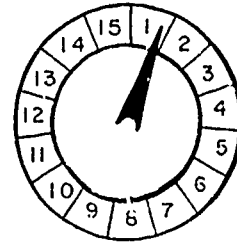
44. The spinner was divided into 15 sections of equal size. Five of these sections were white, two were blue, four were red and four were black. What is the most likely color for the spinner to stop on?

   a. White   stu. score: 63%
   b. Blue
   c. Red
   d. Black

45. What should replace the ☐ in $\frac{2}{7} + \frac{1}{7} = \frac{3}{☐}$?

   a. 1   stu. score: 34%
   b. 3
   c. 7
   d. 14

46. How many ounces are there in two pounds?

   a. 8 ounces   stu. score: 26%
   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   stu. core: 35%
   c. $16.00
   d. $20.00

48. Add: 3.9
         + 6.6

   a. 10.54   stu. score: 57%
   b. 10.44
   c. 6.93
   d. 1.044

49. Mark bought a basketball that cost $8.98 plus tax. If the sales tax on an $8.98 purchase is 45¢, how much change should he receive from a ten-dollar bill?

   a. 47¢
   b. 57¢   stu. score: 32%
   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   stu. score: 87%
    b. 7
    c. 8
    d. 9

51. How many games did Central High School win during its best year?

    a. 14
    b. 13
    c. 12   stu. score·   78%
    d 11

52. How many more games did Central High School win in 1973 than it won in 1968?

    a. 13   stu. score: 57%
    b. 12
    ^. 11
    d. 10

RECORD OF BASKETBALL GAMES WON
BY CENTRAL HIGH SCHOOL

YEARS

GAMES WON
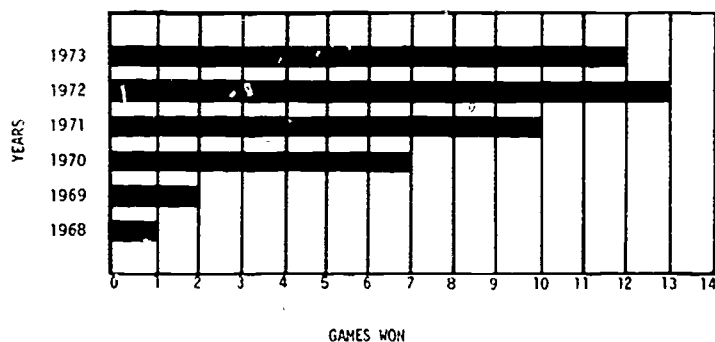
53. One of the following is <u>not</u> a square. which one?

    a.   stu. score: 65%

    b.

    c.

    d.

54. What is the product of $\frac{1}{3}$ of 27?

    a. 8
    b. 9
    c. 10   stu. score: 34%
    d. 12

55. What is the price of 9 tickets at $5.95 each?

    a. $48.55
    b. $52.55
    c. $52.65
    d. $53.55   stu. score: 50%

56. Which of the following fractions has the greatest value?

    a. $\frac{2}{3}$ stu. score: 78%

    b. $\frac{4}{5}$

    c. $\frac{9}{8}$

    d. $\frac{6}{6}$

20

THE ILLINOIS INVENTORY OF EDUCATIONAL PROGRESS

1980 　　　　　　　　　　 TABLE 4 　　　　　　　　　　 GRADE 8

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 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. Which number is the SMALLEST?

a. 2.002
b. 0.202
c. 0.22
d. 0.022

stu. score: 59%
oppor. learn: 98%
teach. est.: 70%

18. $\frac{1}{5}$ is equivalent to what percent?

a. 15%
b. 5%
c. 20%
d. 25%

stu. score: 62%
oppor. learn 84%
teach. est.: 72%

19. Subtract 4.78 from 17.5

a. 12.63
b. 12.72
c. 11.92
d. 11.72
e. 12.91

stu. score: 75%
oppor. learn: 99%
teach. est.: 74%

20. $1\frac{2}{5} - \frac{1}{2} =$

a. $\frac{2}{3}$

b. $\frac{9}{10}$

c. $1\frac{1}{10}$

d. $1\frac{1}{7}$

e. $1\frac{1}{3}$

stu. score: 59%
oppor. learn: 98%
teach. est: 63%

21. $-2 + 12 =$,

a. 24
b. -24
c. 14
d. 6

stu. score: 79%
oppor. learn: 73%
teach. est.: 70%

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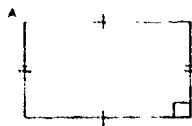
a. Acute
b. Right
c. Oblique

stu. score: 67%
oppor. learn: 79%
teach. est.: 72%

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.

stu. score: 82%
oppor. learn: 77%
teach. est.: 73%

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.

stu. score: 82%
oppor. learn: 78%
teach. est.: 72%

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. 60 kilometers per hour
d. 90 kilometers per hour
e. 150 kilometers per hour

stu. score: 32%
oppor. learn: 73%
teach. est.: 54%

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.

stu. score: 57%
oppor. learn: 59%
teach. est.: 54%

27. If x is replaced by 3, then the value of $x^2 - 1$ is

a. 8
b. 11
c. 5
d. 2

stu. score: 57%
oppor. learn: 66%
teach. est.: 59%

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.

stu. score: 42%
oppor. learn: 58%
teach. est.: 53%

29. Which of the following is true?

a. 8 < 7
b. 1 < 0
c. -1 < 0
d. -5 > -4
e. -7 > 6

stu. score: 66%
oppor. learn: 86%
teach. est.: 68%

30. $4^3 =$

a. 12
b. 24
c. 48
d. 64

stu. score: 62%
oppor. learn: 89%
teach. est.: 64%

21

31. $\frac{1}{2} \times \frac{1}{4} =$

   stu. score   76%
   oppor. learn   99%
   teach. est.   83%

   a. $\frac{1}{6}$

   b. $\frac{1}{8}$

   c. $\frac{2}{6}$

   d. $\frac{2}{8}$

32. $11.09 - 8.53 =$

   stu. score.   39%
   oppor. learn: 100%
   teach. est.·   83%

   a. 2.06
   b. 2.56
   c. 3.06
   d. 3.53
   e. 3.56

33. $-27 \div 3 =$

   stu. score: 85%
   oppor. learn: 81%
   teach. est.:   71%

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

34. An angle may be measured in units called

   stu. score: 78%
   oppor. learn: 90%
   teach. est.:   79%

   a. centimeters.
   b. degrees.
   c. grams.
   d. inches.

35. Which illustration below shows that the ratio of the number of squares to the number of circles is 1:2?

   stu. score: 85%
   oppor. learn: 69%
   teach. est.:   67%

   a. ☐ ☐ ○

   b. ☐ ☐ ○ ○

   c. ☐ ○ ○

   d. ☐ ○

36. 2 meters + 3 millimeters =

   stu. score: 43%
   oppor. learn: 68%
   teach. est.:   50%

   a. 2.0003 meters
   b. 2.003 meters
   c. 2.03 meters
   d. 2.3 meters
   e. 5 meters

37. A 15 centimeter piece is cut from a stick one meter long. What is the length of the remaining piece?

   stu. score: 69%
   oppor. learn: 70%
   teach. est.:   57%

   a. 85 cm
   b. 115 cm
   c. 985 cm
   d. 1015 cm
   e. 9985 cm

38. Solve the following equation:

   $3x - 3 = 12$
      $x =$

   stu. score·   57%
   oppor. learn: 67%
   teach. est.·   57%

   a. 15
   b. 5
   c. 3
   d. 9

39. Which of the following represents the expression, "the sum of a number and 3 times that number is less than 30"?

   stu. score: 63%
   oppor. learn: 52%
   teach. est.:   52%

   a. $x + x < 30$
   b. $3x - x = 30$
   c. $x + 3x < 30$
   d. $x + 3x > 30$

40. What is the altitude of the triangle below?
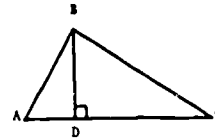
   stu. score: 74%
   oppor. learn: 58%
   teach. est.:   63%

   a. $\overline{AB}$
   b. $\overline{BC}$
   c. $\overline{AC}$
   d. $\overline{BD}$

41. 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?

   stu. score: 65%
   oppor. learn: 76%
   teach. est.:   58%

   a. $ 95
   b. $105
   c. $200
   d. $375

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

   stu. score: 58%
   oppor. learn: 79%
   teach. est.:   68%
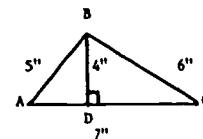
   a. 22 inches
   b. 18 inches
   c. 14 inches
   d. 28 inches

43. Which set of the following diagrams illustrates the statement, "Set S is a subset of Set T"?

   a.   b.

   c.   d.
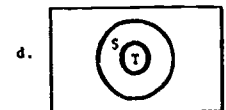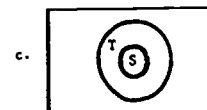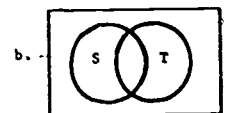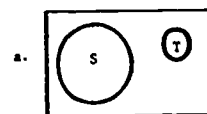
   stu. score: 58%
   oppor. learn: 41%
   teach. est.:   48%

22

44. $3(2 + 7) =$

a. 6
b. 12
c. 13
d. 23
e. 27

stu. score: 70%
oppor. learn: 87%
teach. est.:   72%

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

stu. score: 78%
oppor. learn: 92%
teach. est.:   65%

46. Which one of the following equals $\frac{47}{5}$?

a. $4\frac{7}{5}$

b. $9\frac{2}{5}$

c. $47\frac{1}{5}$

d. $47 - \frac{1}{5}$

stu. score: 79%
oppor. learn: 99%
teach. est.:   78%

47. Divide. $16.4 \div .04 =$

a. 165
b. 371.42
c. 410
d. 450

stu. score: 86%
oppor. learn: 98%
teach. est.   68%

48. Which of the following is NOT true?

a. $.65 = \frac{65}{100}$

b. $\frac{2}{4} = .5$

c. $\frac{1}{10} = .1$

d. $\frac{70}{100} = .07$

stu. score: 43%
oppor. learn: 91%
teach. est.:   67%

49. The number of centimeters in one meter is

a. $\frac{1}{100}$

b. 10

c. 100

d. 1000

stu. score: 63%
oppor. learn: 86%
teach. est.:   69%

50. Which one of the metric units below is equivalent to .07 kilograms?

a. 7 hectograms
b. 7 grams
c. 70 grams
d. 7000 milligrams

stu. score: 38%
oppor. learn: 61%
teach. est.:   45%

51. Solve the missing value in this proportion and choose the correct response.

Solve for n: $\frac{12}{26} = \frac{18}{n}$

a. 39
b. 32
c. 13
d. 38

stu. score: 38%
oppor. learn: 74%
teach. est.:   58%

52. Let $a * b = a(a + b)$, then $2 * 3 =$

a. $2(2 + 3)$
b. $3(2 + 3)$
c. $(2 + 3)(2 + 3)$
d. $3(2 + 2)$

stu. score: 69%
oppor. learn: 20%
teach. est.:   39%

53. Which line segment is a diameter of the circle with the center N?
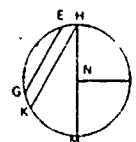
a. NP
b. HM
c. EG
d. HK

stu. score: 68%
oppor. learn.   77%
teach. est.:   66%

54. Which polygon has an area of 12 square centimeters?
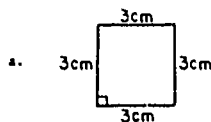
stu. score: 28%
oppor. learn: 22%
teach. est.:   62%
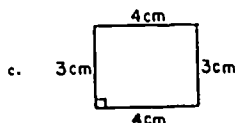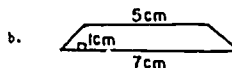
55. A sports car owner says that the car gets 22 miles per gallon of gasoline. How many miles could the car go on seven gallons of gasoline?

a. 154 miles
b. 144 miles
c. 134 miles
d. 124 miles

stu. score: 88%
oppor. learn: 92%
teach. est.:   72%

THE ILLINOIS INVENTORY OF EDUCATIONAL PROGRESS

1981 TABLE 5 GRADE 8

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.

18. Add: $ 3.06
         10.00
          9.14
          5.10

 stu. score: 76%
 oppor. learn: 100%
 teach. est.:   91%

 a. $2730
 b. $7.20
 c. $17.30
 d. $27.20
 e. $27.30

19. Subtract: 1627
              - 918

 stu. score: 87%
 oppor. learn: 100%
 teach. est.:   91%

 a. 609
 b. 619
 c. 709
 d. 719

20. Multiply: 529
              × 47

 stu. score: 69%
 oppor. learn: 99%
 teach. est.:   87%

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

21. Divide. $.04 \overline{)\ 8}$

 stu. score: 53%
 oppor. learn: 93%
 teach. est.:   73%

 a. 0.02
 b. 2
 c. 20
 d. 200

22. Add: 30,000 + 300 + 6?

 stu. score: 94%
 oppor. learn: 99%
 teach. est.:   88%

 a. 300,003,006
 b. 33,006
 c. 30,306
 d. 3,306

23. Select the true statement.

 a. 4507 rounded to the nearest tens is 4500.
 b. 4507 rounded to the nearest thousands is 5000.
 c. 4507 rounded to the nearest hundreds is 4600.
 d. 4507 rounded to the nearest thousands is 4000.

 stu. score: 63%
 oppor. learn: 89%
 teach. est.:   74%

24. Add· 3.9
        + 6.54

 stu. score: 93%
 oppor. learn: 100%
 teach. est.:   89%

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

25. 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

 stu. score: 64%
 oppor. learn: 69%
 teach. est.:   64%

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

 a. 15
 b. 5
 c. 3
 d. 9

 stu. score: 55%
 oppor. learn: 43%
 teach. est.:   56%

27. The figure below illustrates which of the following?
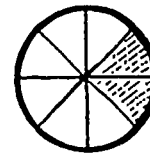
 stu. score: 82%
 oppor. learn: 94%
 teach. est.:   80%

 a. $\frac{2}{8} = \frac{1}{4}$

 b. $\frac{2}{6} = \frac{1}{3}$

 c. $\frac{6}{8} = \frac{2}{4}$

 d. $\frac{2}{8} = \frac{6}{8}$

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

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

 stu. score: 50%
 oppor. learn: 82%
 teach. est.:   69%

29. Angle A is what kind of angle?
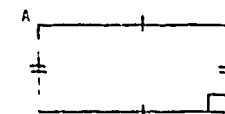
 stu. score: 61%
 oppor. learn: 60%
 teach. est.:   70%

 a. Acute
 b. Right
 c. Oblique

30. What is .731 written as a fraction?

 a. $\frac{7.31}{100}$

 b. $\frac{731}{1000}$

 c. $\frac{731}{100}$

 d. $\frac{731}{10}$

 stu. score: 74%
 oppor. learn: 88%
 teach. est.:   75%

24

31. Which of the shapes below could you cut out, fold on the dotted lines, and have the sides match?
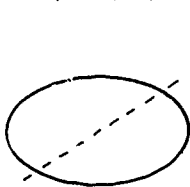
A.

B.

C.

D.
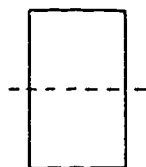
a. A only
b. C only
c. B and C only
d. B, C, and D only
e. All of the

stu. score: 59%
oppor. learn: 30%
teach. est.: 67%

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

stu. score: 85%
oppor. learn: 73%
teach. est.: 75%

33. What should replace the □ in the number sentence

□ × □ = 36?

a. 3
b. 6
c. 18
d. 36

stu. score: 88%
oppor. learn: 81%
teach. est.: 82%

34. -27 ÷ 3 =

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

stu. score: 51%
oppor. learn: 59%
teach. est.: 60%

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

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

stu. score: 82%
oppor. learn: 67%
teach. est.: 66%

36. In the statement, "Today 20% of the students were absent from school," which one of the following statement 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.

stu. score: 82%
oppor. learn: 34%
teach. est.: 61%

37. How many fewer objects (x's) are there inside the ○ than inside the □ ?
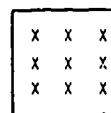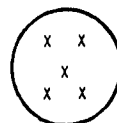
a. 0
b. 3
c. 4
d. 5

stu. score: 93%
oppor. learn: 69%
teach. est.: 88%

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

a. 15
b. 16
c. 18
d. 61

stu. score: 96%
oppor. learn: 88%
teach. est.: 80%

39. 4^3 =

a. 12
b. 24
c. 48
d. 64

stu. score: 66%
oppor. learn: 73%
teach. est.: 65%

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

stu. score: 44%
oppor. learn: 42%
teach. est.: 47%

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. $1.73
b. $2.03
c. $2.13
d. $2.23

stu. score: 86%
oppor. learn: 86%
teach. est.: 69%

42. The area of the triangle shown below can be found using the formula A = ½bh. What is the area of the triangle?

8 feet

12 feet
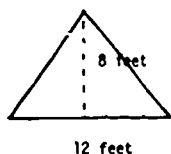
a. 10 square feet — stu. score: 47%
b. 24 square feet — oppor. learn: 59%
c. 48 square feet — teach. est.: 62%
d. 96 square feet

The table below shows the average gas mileage over a five-year period for three different cars.

	1969	1970	1971	1972	1973
Ranger	15	16.5	18	18	17
Chief	20	17	17	16	15
Bomb	13	15	17.6	18	20.2

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.
d. The Ranger got better mileage in 1973 than in 1970.

stu. score: 69%
oppor. learn: 44%
teach. est.: 67%

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

a. 9.62   stu. score: 48%
b. 9.17   oppor. learn: 96%
c. 4.67   teach. est.: 74%
d. 5.67

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

a. 0.0371   stu. score: 57%
b. 0.371   oppor. learn: 88%
c. 370.100   teach. est.: 68%
d. 371.000

46. Which fraction below has a numerator of 3?

a. $\frac{3}{7}$ stu. score: 75%
             oppor. learn: 99%
b. $3\frac{1}{5}$ teach. est.: 87%

c. $\frac{2}{3}$

d. $2\frac{1}{3}$

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

a. 8¢   stu. score: 63%
b. 11¢   oppor. learn: 62%
c. 28¢   teach. est.: 63%
d. 36¢

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   stu. score: 55%
c. $9.19   oppor. learn: 61%
d. $9.35   teach. est.: 59%

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

a. $\frac{13}{15}$ stu. score: 26%
              oppor. learn: 74%
b. $1\frac{2}{13}$ teach. est.: 61%

c. $\frac{13}{28}$

d. $\frac{15}{28}$

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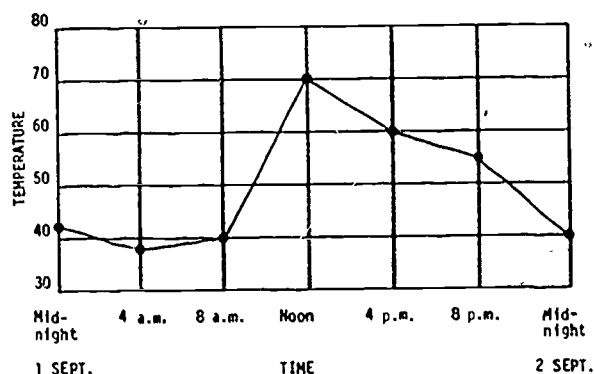
50. Approximately what is the difference between the highest and lowest temperatures recorded on September 1st?

a. 50 degrees
b. 40 degrees   stu. score: 67%
c. 30 degrees   oppor. learn: 54%
d. 20 degrees   teach. est.: 67%

26

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:	83%
oppor. learn:	51%
teach. est.:	67%

54. Solve: $-2 \times 12 =$

    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. 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. 429
    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 $\frac{1}{8}$ of it. How much more did Clyde eat than Jim?

    a. $\frac{1}{6}$

    b. $\frac{3}{8}$

    c. $\frac{1}{2}$

    d. $\frac{3}{4}$

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

58. The length of a box was measured and found to be nine centimeters <u>to the nearest centimeter</u>. Which of these could have been the length of the box measured more accurately?

    a. 10 cm
    b. 9.9 cm
    c. 9.62 cm
    d. 9.6 cm
    e. 8.6 cm

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

59. $x^3 \cdot x^2 =$

    a. $5x$

    b. $3x^2$

    c. x^5

    d. $2x^2 + x$

stu. score:	63%
oppor. learn:	22%
teach. est.:	39%

THE ILLINOIS INVENTORY OF EDUCATIONAL PROGRESS

1980   TABLE 6   GRADE 11

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 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.   2037
    × 82

a.	167,770	stu. score:	82%
b.	194,334	oppor. learn:	100%
c.	230,034	teach. est.:	86%
d.	167,034		

18. $\frac{3}{5}$ =

a.	6 percent	stu. score:	61%
b.	15 percent	oppor. learn:	99%
c.	23 percent	teach. est.:	72%
d.	30 percent		
e.	60 percent		

19. Which fraction is the GREATEST?

a.	$\frac{2}{3}$	stu. score:	44%
		oppor. learn:	100%
b.	$\frac{3}{4}$	teach. est.:	69%
c.	$\frac{4}{5}$		
d.	$\frac{5}{8}$		

20. Tom bought a bicycle last year for $70. This year the same model is selling for 10% more. What is the price of the bicycle this year?

a.	$77	stu. score:	64%
b.	$80	oppor. learn:	97%
c.	$82	teach. est.:	64%
d.	$87		

21. 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	stu. score:	78%
b.	$10	oppor. learn:	92%
c.	$15	teach. est.:	60%
d.	$25		

22. If x is replaced by 3, then the value of $x^2 - 1$ is

a.	8		
b.	11	stu. score:	76%
c.	5	oppor. learn:	97%
d.	2	teach. est.:	68%

23. Solve the following equation:

     $3x - 3 = 12$
        $x =$

a.	15	stu. score:	74%
b.	5	oppor. learn:	98%
c.	3	teach. est.	69%
d.	9		

24. Which is true?

a.	All rectangles are squares.		
b.	All squares are rectangles.	stu. score:	39%
c.	No squares are rectangles.	oppor. learn:	89%
d.	No rectangles are squares.	teach. est.:	59%
e.	None of the above.		

25. 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°	stu. score:	58%
b.	35°	oppor. learn:	88%
c.	55°	teach. est.:	63%
d.	180°		

26. $\frac{1}{2} + \frac{1}{3}$ =

a.	$\frac{1}{5}$	stu. score:	62%
		oppor. learn:	100%
b.	$\frac{2}{6}$	teach. est.	70%
c.	$\frac{4}{5}$		
d.	$\frac{5}{6}$		

27. $\frac{1}{2} \times \frac{1}{4}$ =

a.	$\frac{1}{6}$	stu. score:	78%
		oppor. learn:	100%
b.	$\frac{1}{8}$	teach. est.:	78%
c.	$\frac{2}{6}$		
d.	$\frac{2}{8}$		

28. What is the SMALLEST number that can be divided by 3, 6, and 9 without a remainder?

a.	9		
b.	12	stu. score:	78%
c.	18	oppor. learn:	97%
d.	36	teach. est.:	72%

29. The solution set of the equation $x^2 = 9$ is

a.	{3}		
b.	{-3}	stu. score:	46%
c.	{x=3}	oppor. learn:	95%
d.	{-3,3}	teach. est.:	59%

30. A door-to-door salesperson receives 20 percent of the retail value of his/her sales as commission. What must his/her total retail sales be if he/she is to earn a commission of $60?

a.	$120	stu. score:	56%
b.	$200	oppor. learn:	81%
c.	$250	teach. est.:	51%
d.	$300		

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 50c
        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 15c on ice cream cones for each of his six
        friends, how much did he spend?

stu. score:	81%
oppor. learn:	83%
teach. est.:	60%

32. Which one of the following gives ALL of the __factors__ of 12?

    a. {1, 3, 4}

    b. {1, 12}

stu. score:	81%
oppor. learn:	92%
teach. est.:	67%

    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

stu. score	87%
oppor. learn	99%
teach. est.	78%

    a. >
    b. =
    c. <

34. $\frac{7}{9}$ as a decimal is

stu. score:	67%
oppor. learn	91%
teach. est.:	67%

    a. .7777...
    b. .7171...
    c. .8383...
    d. .6666...

35. Do the following problem: $3\frac{1}{2} \div 2 =$

    a. $1\frac{1}{2}$

stu. score:	66%
oppor. learn	99%
teach. est.:	63%

    b. $1\frac{1}{8}$

    c. $1\frac{3}{4}$

    d. $2\frac{1}{4}$

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

stu. score:	64%
oppor. learn:	83%
teach. est.:	59%

37. Which is the closest to the size of one cm^2?

    a. A tennis court
    b. Your thumbnail
    c. A slice of bread
    d. The cover of a record album

stu. score:	77%
oppor. learn:	81%
teach. est.:	61%

38. Which one of the following equals $\frac{47}{5}$?

    a. $4\frac{7}{5}$

stu. score:	85%
oppor. learn:	100%
teach. est.:	78%

    b. $9\frac{2}{5}$

    c. $47\frac{1}{5}$

    d. $47 - \frac{1}{5}$

39. If a + 3 = b and 3 + c = b, then

stu. score:	81%
oppor. learn:	87%
teach. est.:	61%

    a. a equals c.
    b. a is less than c.
    c. a is greater than 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.

stu. score:	75%
oppor. learn:	87%
teach. est.:	69%

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

    a. $\frac{13}{15}$

stu. score:	48%
oppor. learn:	96%
teach. est.:	65%

    b. $\frac{13}{26}$

    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. 169 square feet
    c. 182 square feet
    d. 196 square feet

stu. score:	43%
oppor. learn:	89%
teach. est.:	54%

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

stu. score:	79%
oppor. learn:	87%
teach. est.:	61%

44. (4x + 2) (x - 5) =

    a. 4x + 2 × x - 5

stu. score:	50%
oppor. learn:	84%
teach. est.:	53%

    b. $4x^2 - 18x - 10$

    c. 4x - 10

    d. 4x + 2x - 3

29

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: 71%
oppor. learn: 39%
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: 47%
oppor. learn: 23%
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. 45.41
b. 61.07
c. 59.01
d. 61.52

stu. score: 91%
oppor. learn: 100%
teach. est.: 77%

50. Do the following division: 12) 9864

a. 821
b. 822
c. 814
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 5 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: 368 -243

a. 123
b. 125
c. 136
d. 152

stu. score: 96%
oppor. learn: 100%
teach. est.: 61%

53. Divide: 16.4 ÷ .04 =

a. 165
b. 371.42
c. 410
d. 450

stu. score: 88%
oppor. learn: 98%
teach. est.: 70%

54. Given A = {2,4,5} and B = {1,2,3,6}, what is A ∪ B?

a. 7,8,9
b. 4,5
c. 3,6
d. 2
e. 1,2,3,4,5,6

stu. score: 71%
oppor. learn: 81%
teach. est.: 60%

30

THE ILLINOIS INVENTORY OF EDUCATIONAL PROGRESS
1981   TABLE 7   GRADE 11

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.

13. Which fraction below has a numerator of 3?

    a. $\frac{3}{7}$ stu. score: 79%
                              oppor. learn: 100%
                              teach. est.:   89%
    b. $3\frac{1}{5}$

    c. $\frac{2}{3}$

    d. $2\frac{1}{3}$

19. Which figure below is not a parallelogram?

    a. A   stu. score: 80%
    b. B   oppor. learn: 76%
    c. C   teach. est.:   68%
    d. D

20. What is three hundred seventy-one thousandths written as a decimal?

                  stu. score: 57%
    a. 0.0371   oppor. learn: 93%
    b. 0.371   teach. est.:   78%
    c. 370.100
    d. 371.000

21. Tom bought a bicycle last year for $70. This year the same model is selling for 10% more. What is the price of the bicycle this year?

    a. $77   stu. score: 62%
    b. $80   oppor. learn: 96%
    c. $82   teach. est.:   70%
    d. $87

22. What should replace the ☐ in the equation ☐ × ☐ = 36?

    a. 3
    b. 6   stu. score: 92%
    c. 18   oppor. learn: 96%
    d. 36   teach. est.:   83%

23. What value of x makes the following true?

        $x - 3 = 7$

    a. 12   stu. score: 94%
    b. 10   oppor. learn: 97%
    c. 8   teach. est.:   86%
    d. 4
    e. 1

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   stu. score: 90%
    b. 255   oppor. learn: 85%
    c. 210   teach. est.:   72%
    d. 165

25. What is the volume of the rectangular solid?
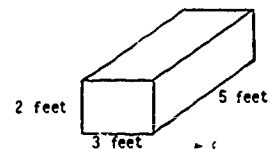
    a. 10 cubic feet
    b. 25 cubic feet   stu. score: 77%
    c. 30 cubic feet   oppor. learn: 71%
    d. 40 cubic feet   teach. est.:   69%

26. Bob saved $80.00 for ½ year. The interest rate was 6% per year. How much interest did he earn?

    a. $0.12
    b. $2.40
    c. $4.80   stu. score: 60%
    d. $6.80   oppor. learn: 68%
                        teach. est.:   60%

27. The figure below illustrates which of the following?

    a. $\frac{2}{8} = \frac{1}{4}$ stu. score: 84%
                                       oppor. learn: 91%
                                       teach. est.:   83%
    b. $\frac{2}{6} = \frac{1}{3}$

    c. $\frac{6}{8} = \frac{2}{4}$

    d. $\frac{2}{8} = \frac{6}{8}$

28. Add: 3.9
           + 6.54

    a. 10.54   stu. score: 94%
    b. 10.44   oppor. learn: 86%
    c. 6.93   teach. est.:   91%
    d. 1.044

29. If $5x - 5 = 25$, what is x?

    a. 4
    b. 5   stu. score: 83%
    c. 6   oppor. learn: 90%
    d. 8   teach. est.:   73%

30. Which of the shapes below could you cut out, fold on the dotted lines, and have the sides match?
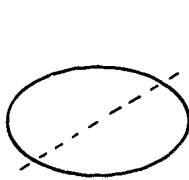
A.   B.

(D.
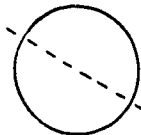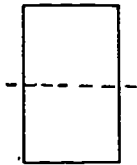
a. A only   stu. score·   64%
b. C only   oppor. learn: 43%
c. B and D only   teach. est.:   74%
d. B, C, and D only
e. All of them

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. $ 5   stu. score: 81%
b. $10   oppor. learn: 73%
c. $15   teach. est.:   65%
d $25

John's expenses for operating his mini-bike are shown in the figure below.
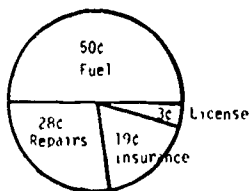
How many cents of each dollar of operating costs went for insurance?

a. 3   stu. score   92%
b. 19   oppor. earn: 72%
c. 28   teach. est.:   90%
d. 50

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

a Fuel
b. Repairs   stu. score: 98%
c. Insurance   oppor. learn: 72%
d. License   teach. est.:   91%

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

a. 17   stu. score: 75%
b. 18   oppor. learn: 83%
c. 20   teach. est.:   67%
d. 70

35. What is the perimeter of the triangle ABC below?
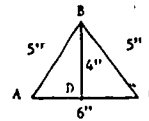
a. 20"   stu. score: 73%
b. 16"   oppor. learn: 90%
c. 15"   teach. est.:   74%
d. 24"

36. What is .731 written as a fraction?

a. $\frac{7.31}{100}$
                         stu. score: 74%
                         oppor. learn: 94%
b. $\frac{731}{1000}$ teach. est.:   77%

c. $\frac{731}{100}$

d. $\frac{731}{10}$

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
b. $105   stu. score: 79%
c. $200   oppor. learn· 81%
d. $375   teach. est.:   70%

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

x	2	3	4	5
y	7	10	13	16

a. $y = x + 5$
                         stu. score: 56%
b. $y = 3x + 1$ oppor. learn: 53%
                         teach. est.:   55%
c. $x = y - 5$

d. $x = \frac{y + 1}{3}$

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
b. 169 square feet   stu. score: 41%
c. 182 square feet   oppor. learn: 78%
d. 196 square feet   teach. est.:   57%

DIRECTIONS   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

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

      a. 5 degrees
      b. 20 degrees
      c. 30 degrees
      d. 35 degrees

      stu. score: 77%
      oppor. learn: 63%
      teach. est.   74%

41   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 4:00 p.m.
      c. Midnight September 1st and Midnight September 2nd
      d. 4:00 a.m. and 9:00 p.m.

      stu. score: 73%
      oppor. learn: 62%
      teach. est.:   72%

42   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: 87%
      oppor. learn: 60%
      teach. est.:   71%

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

      stu. score: 91%
      oppor. learn: 63%
      teach. est.:   74%

44. $(4x + 2)(x - 5) =$

      a. $4x + 2 \times x - 5$
      b. $4x^2 - 18x - 10$
      c. $4x - 10$
      d. $4x + 2x - 3$

      stu. score: 47%
      oppor. learn: 72%
      teach. est.:   59%

The table below shows the average gas mileage over a five-year period for three different cars.

	1969	1970	1971	1972	1973
Ranger	15	16.5	18	16	17
Chief	20	17	17	16	15
Corb	13	15	17.6	18	20.2

45.   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 Corb could get the best mileage in 1974.
      d. The Ranger got better mileage in 1973 than in 1970.

      stu. score: 79%
      oppor. learn: 67%
      teach. est.:   71%

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

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

      stu. score: 71%
      oppor. learn: 95%
      teach. est.:   76%

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

      stu. score: 64%
      oppor. learn: 87%
      teach. est.:   70%

48.   In the drawing below, line segments AB and CD are parallel. What is the length of line segment CD?
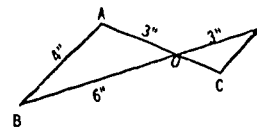
      a. $1\frac{1}{2}"$
      b. 2"
      c. 3"
      d. 4"

      stu. score: 64%
      oppor. learn: 43%
      teach. est.:   49%

49. The solution set of the equation $x^2 = 9$ is

a. {3}
b. {-3}
c. {x=3}
d {-^,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 30 minutes
d. 2 hours 45 minutes

stu. score:	92%
oppor. learn:	80%
teach. est.	80%

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 + 32 = P
b. 32 - 10 = P
c. 10 ÷ 32 = P
d. 32 ÷ 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 $60?

a. $120
b. $200
c. $250
d. $300

stu. score:	54%
oppor. learn:	64%
teach. est.	55%

53. Solve the following.   2037
                           × 82

a. 167,770
b. 194,334
c. 230,034
d. 167,034

stu. score	79%
oppor. learn:	96%
teach. est.	36%

54. $\frac{1}{2} + \frac{1}{3} =$

a. $\frac{1}{5}$

b. $\frac{2}{6}$

c. $\frac{4}{5}$

d. $\frac{5}{6}$

stu. score	57%
oppor. learn	96%
teach est.	76%

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

a. 8¢
b. 11¢
c. 28¢
d. 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 = 2RS   P = RS + SR

a. M = 50
b. M is larger than P
c. M = P
d. P = 21

stu. score:	67%
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°
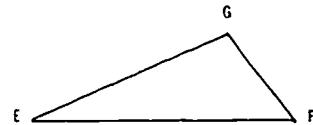
stu. score:	55%
oppor. learn:	81%
teach. est.:	67%

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 assessements 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 <u>1980</u> Fourth Grade Test

FACTOR I

KNOWLEDGE OF MATHEMATICAL FACTS AND RELATIONSHIPS

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

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 <u>1981</u> Fourth Grade Test

FACTOR I

KNOWLEDGE OF MATHEMATICAL FACTS AND RELATIONSHIPS

ITEM #	FACTOR LOADING	% CORRECT	ABILITY #	TOPIC #	OBJECTIVE #
18	.59	94%	1	12	45
20	.46	73%	1	1	1
19	.44	75%	1	3	9
24	.40	82%	1	1	1

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

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

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

ITEM #	FACTOR LOADING	% CORRECT	ABILITY	TOPIC	OBJECTIVE
28	.60	42%	2	12	46
29	.59	66%	1	2	5
22	.30	67%	1	12	45
39	.24	63%	1	11	41

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

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

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

ITEM #	FACTOR LOADING	% CORRECT	ABILITY	TOPIC	OBJECTIVE
27	.68	78%	2	4	14
43	.68	79%	2	14	54
28	.54	78%	2	3	10
45	.50	51%	2	10	38
38	.41	85%	2	4	14
54	.41	71%	1	2	5
44	.38	50%	4	11	44
37	.37	77%	1	10	37

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

ITEM #	FACTOR LOADING	% CORRECT	ABILITY #	TOPIC #	OBJECTIVE #
44	.87	47%	4	11	44
49	.84	39%	4	11	44
57	.62	55%	3	12	47
39	.62	41%	4	10	40
38	.54	56%	4	11	44

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

ITEM #	FACTOR LOADING	% CORRECT	ABILITY #	TOPIC #	OBJECTIVE #
42	.65	87%	2	13	50
43	.65	91%	2	13	50
24	.57	90%	2	11	42
50	.52	92%	2	14	54
40	.51	77%	2	13	50
45	.49	79%	1	13	49
41	.47	73%	2	13	50
23	.40	94%	2	11	42

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.

39

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 in 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 or gf and gc. Even when gf and gc 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 crystalized
> general intelligence, or gf and gc 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 gf 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 gc 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 gc-gf 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 gf, whereas
> analogies based on abstruse or specialized words and terms
> rarely encountered outside the context of formal education
> are loaded on gc (p.234).

4ʊ

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.

4i

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

Cattell, R. B. "Theory of Fluid and Crystallized Intelligence: A Critical Experiment." Journal of Educational Psychology, 1963, 54, 1-22.

Irons, C. J. "Language and the Mathematics Program." Math Lab Matrix, Mathematics Departments, Illinois State University, Normal, Illinois 61761, Fall, 1982, Issue #18, 1-3.

Jensen, A. R. Bias in Mental Testing. New York: The Free Press, 1980.

Kerlinger, F. N. Foundations of Behavioral Research (Second Edition), New York: Holt, Rinehart, and Winston, Inc., 1973.

_____. Student Achievement in Illinois: An Analysis of Student Progress. Springfield, IL: Illinois State Board of Education, 1983.

APPENDIX A

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

Fourth Grade Tests				Eigth Grade Tests				Eleventh Grade Tests			
1980		**1981**		**1980**		**1981**		**1980**		**1981**	
Item #	Correct Answer	Item #	Correct Answer	Item #	Correct Answer	Item #	Correct Answer	Item #	Correct Answer	Item #	Correct Answer
18.	c	17.	a	17.	d	18.	e	17.	d	18.	a
19.	a	18.	b	18.	c	19.	c	18.	e	19.	d
20.	d	19.	b	19.	b	20.	a	19.	c	20.	b
21.	c	20.	c	20.	b	21.	d	20.	a	21.	a
22.	a	21.	b	21.	b	22.	c	21.	a	22.	b
23.	b	22.	d	22.	b	23.	b	22.	a	23.	b
24.	d	23.	b	23.	b	24.	b	23.	b	24.	d
25.	c	24.	a	24.	d	25.	b	24.	b	25.	c
26.	c	25.	d	25.	b	26.	b	25.	a	26.	b
27.	c	26.	c	26.	b	27.	a	26.	d	27.	a
28.	a	27.	a	27.	a	28.	a	27.	b	28.	b
29.	c	28.	b	28.	c	29.	b	28.	c	29.	c
30.	c	29.	a	29.	c	30.	b	29.	d	30.	d
31.	c	30.	b	30.	d	31.	d	30.	d	31.	a
32.	c	31.	b	31.	b	32.	b	31.	a	32.	b
33.	a	32.	c	32.	b	33.	b	32.	e	33.	b
34.	d	33.	d	33.	a	34.	c	33.	c	34.	c
35.	a	34.	b	34.	b	35.	a	34.	a	35.	b
36.	b	35.	c	35.	c	36.	b	35.	c	36.	b
37.	c	36.	c	36.	b	37.	c	36.	c	37.	b
38.	b	37.	c	37.	a	38.	c	37.	b	38.	b
39.	a	38.	b	38.	b	39.	d	38.	b	39.	d
40.	c	39.	a	39.	c	40.	d	39.	a	40.	c
41.	b	40.	d	40.	d	41.	d	40.	b	41.	a
42.	a	41.	d	41.	b	42.	c	41.	d	42.	b
43.	d	42.	c	42.	b	43.	b	42.	d	43.	b
44.	a	43.	c	43.	c	44.	c	43.	b	44.	b
45.	c	44.	d	44.	c	45.	b	44.	b	45.	b
46.	d	45.	d	45.	c	46.	a	45.	d	46.	c
47.	d	46.	a	46.	b	47.	d	46.	b	47.	c
48.	b	47.	b	47.	c	48.	c	47.	b	48.	b
49.	b	48.	b	48.	d	49.	c	48.	d	49.	d
50.	b	49.	b	49.	c	50.	c	49.	b	50.	b
51.	b	50.	b	50.	c	51.	a	50.	b	51.	c
52.	c	51.	c	51.	a	52.	b	51.	c	52.	d
53.	d	52.	c	52.	a	53.	b	52.	b	53.	d
54.	b	53.	b	53.	b	54.	b	53.	c	54.	d
55.	d	54.	b	54.	c	55.	d	54.	e	55.	d
56.	c	55.	c	55.	a	56.	d			56.	c
						57.	b			57.	a
						58.	e				
						59.	c				

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.

Table 16

Objectives, Topics, and Abilities
Measured by the <u>1980</u> Fourth Grade IIEP Test

MATRIX OF MATHEMATICS OBJECTIVES*

<u>MATHEMATICAL TOPICS BY ABILITIES</u>

MATHEMATICAL ABILITIES

MATHEMATICAL TOPICS	RECALL	COMPUTATION	UNDERSTANDING	PROBLEM SOLVING
1. Numeration Concepts	1* 17,28,41**	2	3 35,42,52	4
2. Properties of Numbers and Operations	5 18, 29, 30, 36, 43, 44	6	7 19, 33, 34	8
3. Whole Numbers	9	10 20, 31, 45	11 24, 32, 46	12 25, 37, 40, 47
4. Fractions	13	14	15	16
5. Decimals	17	18	19	20
6. Percent	21	22	23	24
7. Integers	25	26 21, 22, 23	27	28
8. Rationals	29	30	31	32
9. Reals	33	34	35	36
10. Measurement	37 27, 38, 53, 54	38	39	40 55
11. Algebra	41	42	43	44
12. Geometry	45 26, 50	46	47	48
13. Probability and Statistics	49	50	51	52
14. Personal and Consumer Mathematics	53 39, 48, 51	54	55	56 25, 49,55

* 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

		MATHEMATICAL ABILITIES		
MATHEMATICAL TOPICS	RECALL	COMPUTATION	UNDERSTANDING	PROBLEM SOLVING
1. Numeration Concepts	1* 20, 24, 25, 32	2	3 22, 41	4
2. Properties of Numbers and Operations	5 23	6	7	8
3. Whole Numbers	9 19, 26	10 27, 28	11	12
4. Fractions	13	14 33, 40, 54	15 21, 24, 56	16
5. Decimals	17	18 34, 48	19	20 35, 55
6. Percent	21	22	23	24
7. Integers	25	26	27	28
8. Rationals	29	30	31	32
9. Reals	33	34	35	36
10. Measurement	37	38	39 42, 46	40 29, 38
11. Algebra	41	42	43	44
12. Geometry	45 18, 36, 53	46	47 39, 43	48
13. Probability and Statistics	49	50 50, 51, 52	51	52
14. Personal and Consumer Mathematics	53 34, 37	54 30, 31, 44	55 29, 38,	56 47, 49

* 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*

MATHEMATICAL TOPICS BY ABILITIES

	MATHEMATICS ABILITIES			
	1	2	3	4
MATHEMATICAL TOPICS	RECALL	COMPUTATION	UNDERSTANDING	PROBLEM SOLVING
1. Numeration Concepts	1	2	3	4
2. Properties of Numbers and Operations	5 17, 29, 43	6	7	8
3. Whole Numbers	9	10 30, 44, 45	11	12
4. Fractions	13	14 20, 31, 46	15	16
5. Decimals	17	18 19, 32	19	20
6. Percent	21	22	23	24
7. Integers	25	26 21, 33	27	28
8. Rationals	29 13, 35, 48	30	31	32
9. Reals	33	34	35	36
10. Measurement	37 23, 24, 34, 49	38 36, 50	39	40 25, 37
11. Algebra	41	42 27, 38, 51	43 26, 39, 52	44
12. Geometry	45 22, 40, 53	46	47 28, 42, 54	48
13. Probability and Statistics	49	50	51	52
14. Personal and Consumer Mathematics	53	54	55	56 41, 55

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

48

Table 19

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

MATRIX OF MATHEMATICS OBJECTIVES*

MATHEMATICAL TOPICS BY ABILITIES

MATHEMATICAL TOPICS	RECALL	MATHEMATICAL ABILITIES COMPUTATION	UNDERSTANDING	PROBLEM SOLVING
1. Numeration Concepts	1	2	3 20, 22, 23, 58	4
2. Properties of Numbers and Operations	5	6	7	8
3. Whole Numbers	9 38	10 19, 39	11 33, 35, 46	12
4. Fractions	13 27, 46	14	15	16 49, 57
5. Decimals	17	18 21, 24, 44	19 30, 45	20
6. Percent	21 28	22	23 36	24
7. Integers	25	26 34, 54	27	28
8. Rationals	29	30	31 55	32
9. Reals	33	34	35	36
10. Measurement	37	38	39	40 40
11. Algebra	41 59	42 26	43	44 56
12. Geometry	45 29, 31	46 42	47	48
13. Probability and Statistics	49 43	50 50, 51, 52, 53	51	52
14. Personal and Consumer Mathematics	53 43	54 18, 32, 47	55	56 25, 50, 48, 56

* 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 <u>1980</u> Eleventh Grade IIEP Test

MATRIX OF MATHEMATICS OBJECTIVES*

MATHEMATICAL TOPICS BY ABILITIES

		MATHEMATICAL ABILITIES		
MATHEMATICAL TOPICS	RECALL	COMPUTATION	UNDERSTANDING	PROBLEM SOLVING
1. Numeration Concepts	1	2	3	4
2. Properties of Numbers and Operations	5 32, 33, 54	6	7 39, 40	8
3. Whole Numbers	9	10 17, 28, 50, 52	11	12
4. Fractions	13	14 19, 26, 27, 38	15 41	16
5. Decimals	17	18 49, 53	19	20
6. Percent	21	22	23	24
7. Integers	25	26	27	28
8. Rationals	29	30 18, 34, 35	31	32
9. Reals	33	34	35	36
10. Measurement	37 37, 47, 48	38	39	40 42, 45, 46
11. Algebra	41	42 22, 23, 29	43 31, 39, 51	44
12. Geometry	45	46	47 24, 25	48
13. Probability and Statistics	49	50	51 36	52
14. Personal and Consumer Mathematics	53	54	55 31, 36	56 20, 21, 30, 43, 51

* 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*

MATHEMATICAL TOPICS BY ABILITIES

		MATHEMATICAL ABILITIES		
MATHEMATICAL TOPICS	RECALL	COMPUTATION	UNDERSTANDING	PROBLEM SOLVING
1. Numeration Concepts	1	2	3	4
2. Properties of Numbers and Operations	5	6	7	8
3. Whole Numbers	9	10 53	11 22, 51	12
4. Fractions	13 27	14 54	15	16
5. Decimals	17	18 13, 28, 46	19 20, 36	20
6. Percent	21	22	23	24 26, 47
7. Integers	25	26	27	28
8. Rationals	29	30	31	32
9. Reals	33	34	35	36
10. Measurement	37	38	39	40 39
11. Algebra	41	42 23, 29, 34, 44, 49	43	44 24, 38, 56
12. Geometry	45 19, 30	46	47 35, 57	48 25, 48
13. Probability and Statistics	49 32, 33, 45	50 40, 41, 42, 43	51	52
14. Personal and Consumer Mathematics	53 32, 33, 45	54 50, 55	55	56 21, 24, 31, 37, 52

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

APPENDIX C

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.

ITEM NUMBER (4-6)	TO WHAT EXTENT HAVE STUDENTS BEEN EXPOSED TO THE ITEM CONTENT? 1. Not at all 2. Minimally 3. Adequately 4. Heavily (7)	INDICATE THE DIFFICULTY OF THE ITEM. 1. Very easy 2. Somewhat easy 3. Appropriate 4. Somewhat difficult 5. Very difficult (8)	WHAT PERCENTAGE OF STUDENTS WILL ANSWER THIS ITEM CORRECTLY? _____% (9-11)	ITEM NUMBER (4-6)	TO WHAT EXTENT HAVE STUDENTS BEEN EXPOSED TO THE ITEM CONTENT? 1. Not at all 2. Minimally 3. Adequately 4. Heavily (7)	INDICATE THE DIFFICULTY OF THE ITEM. 1. Very easy 2. Somewhat easy 3. Appropriate 4. Somewhat difficult 5. Very difficult (8)	WHAT PERCENTAGE OF STUDENTS WILL ANSWER THIS ITEM CORRECTLY? _____% (9-11)
18				42			
19				43			
20				44			
21				45			
22				46			
23				47			
24				48			
25				49			
26				50			
27				51			
28				52			
29				53			
30				54			
31				55			
32				56			
33				57			
34				58			
35				59			
36							
37							
38							
39							
40							

1-19 (12/80)

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

		V	R	S	N	AS	AT
Cluster I	V		.72	.63	.09	.09	.00
	R	.72		.57	.15	.16	.09
	S	.63	.57		.14	.15	.09
	N	.09	.15	.14		.57	.63
	AS	.09	.16	.15	.57		.72
	AT	.00	.09	.09	.63	.72	

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 anaylsis, 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. Weinzweig
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

APPENDIX F

PARTIAL LISTING OF DOCUMENTS AVAILABLE FROM THE
PROGRAM EVALUATION AND ASSESSMENT SECTION
ILLINOIS STATE BOARD OF EDUCATION
NOVEMBER, 1982

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.

Conference Report: Minimum Competency Testing and Handicapped Students (April, 1980)
C. Thomas Kerins

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.

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

Annual Report on Title I, ESEA Migrant Program, Fiscal Year 1980 (March, 1981)
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
Program Summary and Evaluation Report (May, 1981)
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 (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 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