1943

An experiment in teaching junior high school mathematics.

Mary A. Maher
University of Massachusetts Amherst

AN EXPERIMENT IN TEACHING JUNIOR HIGH SCHOOL MATHEMATICS

MAHER - 1943

AN EXPERIMENT IN TEACHING
JUNIOR HIGH SCHOOL MATHEMATICS

MARY A. MAHER

Problem submitted for degree of Master of Science

at

Massachusetts State College

Amherst

1943

CONTENTS

INTRODUCTION

In this study I have tried to show that arithmetic in the junior high school can be taught effectively within school time and without the use of class texts.

I have undertaken this study, because I have found, from experience, that the homework device is, generally speaking, unsatisfactory and unfair. It is unsatisfactory because the pupils it is intended to help do not or cannot do the work by themselves. Also, it is unfair to the children, who already have a long school day, because it interferes with outside activities. Provision for supervised study in school can be and should be made. Dr. Charles Russell has this to say about homework:[1] "...such a device is encroaching upon time and activities that do not of a right belong to it...it is difficult to create a proper atmosphere or to find a proper place for home study...few parents are equipped to help pupils to do their work to the best advantage."

I have also been interested to find if it is possible to give pupils a real, vital knowledge of arithmetic by taking from them the support which a text gives and making them dependent upon themselves for learning facts and skills they need.

Grateful acknowledgment is made to Dr. Earl S. Russell, Superintendent of Schools in Windsor, Connecticut, and to Francis B. Sullivan, Principal of H. Sidney Hayden Junior High School in Windsor for their cooperation in making this experiment possible.

[1] Russell, Charles--Teaching for Tomorrow pp. 333-336

PLAN OF PROCEDURE

The subject of percentage was introduced in both classes by my showing coins and letting each class point out their relation to a dollar. The terms <u>percentage</u> and <u>per cent</u> were then given and each class was shown that percentage is just another way of expressing a part. The relation of per cents to common and decimal fractions was pointed out. The per cent table is then ready to be set up. Types I, II, and III are to be taught in succession. Commission and discount are to be included.

Corrections and help are to be taken care of in the first twenty minutes of each period. When sufficient oral work is completed, written exercises based on material taught is to be given both groups on the same day. Make-up lessons are to be given absentees when all are in school again. Records of all written lessons are to be kept and tables and graphs set up for each lesson, and comparisons made. Generalizations based on the results of written work are to be found in the conclusion.

PLAN OF EXPERIMENT

7B, the control group, is to use the text for oral class work and to do homework assignments based on exercises in the book. All written, class exercises are to be done from the board and are taken from different texts or made by me.

7A, the experimental group, is to depend upon me and themselves for facts and understandings, through oral discussion, dictation, and board work. All help and corrections are to be taken care of in class time and no homework assignments are to be given.

Both groups are to be given a standard test on basic skills in arithmetic at the start, and a standard test on percentage at the end of the experiment. The experiment is to cover the unit on percentage. Both groups are to accomplish the same work under these different conditions, and written class lessons are to be the same for both classes.

THE EXPERIMENT

This is an experiment in teaching junior high school mathematics.

The experiment was started on December 8, 1942, at H. Sidney Hayden Junior High School in Windsor, Connecticut. Two groups of 25 pupils each were selected from two seventh grades of 40 pupils each. The selection was based on a comparison of intelligence quotients and chronological ages. (See Table I.) I teach both groups.

7B is the control group. Classes meet four times a week for a total of 220 minutes, or 55 minutes per day. Assignments to be done at home are given twice a week--on Tuesday and Thursday. Each assignment is to require $\frac{1}{2}$ hr. The rest of the class, not in this experiment, is given attention while the other group is doing written work or corrections. The textbook used by 7B is Study Arithmetics for Grade 7, by Ruch, Knight, and Studebaker.

7A is the experimental group. The pupils use no texts at any time. No homework assignments are given. Otherwise, the conditions are the same as for 7B. Instead of textbooks in the pupils' hands, the responsibility for learning devolves upon the teacher and upon the pupils themselves.

The study began by giving both groups a standard test--Iowa Every-Pupil Tests of Basic Skills, Advanced Battery--Form L, Test D--Basic Arithmetic Skills. The testing was done in one day--Dec. 8, 1942. The tabulated results may be seen in Table II.

Table I

CONTROL GROUP 7B	I.Q.	C.A.	EXPERIMENTAL GROUP 7A	I.Q.	C.A.
1. Fuller, Bidwell	139	11-10	Shimkis, Dolores	142	11-10
2. McLeod, Gene	138	11-9	Stresky, Patricia	133	11-8
3. Evans, Gilbert	127	12-7	St. John, Seth	128	12-6
4. Main, Clifford	119	12	Tomolonis, Joseph	121	12-3
5. Douglas, Robert	117	12-8	Royce, Donald	115	12-7
6. Bacon, Patricia	117	12-3	Woluns, Robert	116	12-4
7. Whipple, Betty	124	11-11	McCready, William	129	11-6
8. Greene, Joyce	129	12-5	McNamara, Mary	123	12-6
9. Jensen, Carol	132	12-1	Weitzel, Catherine	136	12-8
10. Kennedy, Dorothy	109	12-2	Young, Jacqueline	110	12-2
11. Bagg, Joanne	109	12-5	Shepard, Lorraine	111	12-4
12. Bieri, Ramon	115	13-6	White, Donald	116	11-9
13. Gilbert, Gwenyth	106	11-11	Noreika, Janet	107	11-11
14. Alford, Ruth	103	12-5	Keily, Ronald	103	12-1
15. Clark, William	108	12-4	Loomis, Raymond	114	12-3
16. Jones, David	83	13-4	Moule, Betty	83	13-6
17. Boudreau, Claire	110	11-10	Rustic, Paul	110	12
18. Fitzpatrick, Stuart	102	12-4	Boutwell, Arlene	102	12-8
19. Mahan, Dorothy	119	12-6	Tustin, Richard	110	11-11
20. Clarke, Gladys	100	12-8	Rozanski, Dorothy	99	12-9
21. Howes, Charles	102	12-10	Standow, Herbert	100	13-1
22. Rossing, George	97	12-7	Smith, Nancy	99	12-3
23. McGann, William	105	12-6	Keiper, Edward	105	12-5
24. Exposito, Helen	104	12-3	Uricchio, Ralph	106	12-3
25. Burnham, Joanne	108	12-6	Dudley, Robert	111	13-5

I.Q. scores were based on the results of the National Intelligence test given these pupils while in the sixth grade.

C.A. lists were made up from the ages of the pupils at the time they took the first test of this project--The Iowa Every-Pupil Tests of Basic Skills.

Intelligence Quotients of 7A Pupils

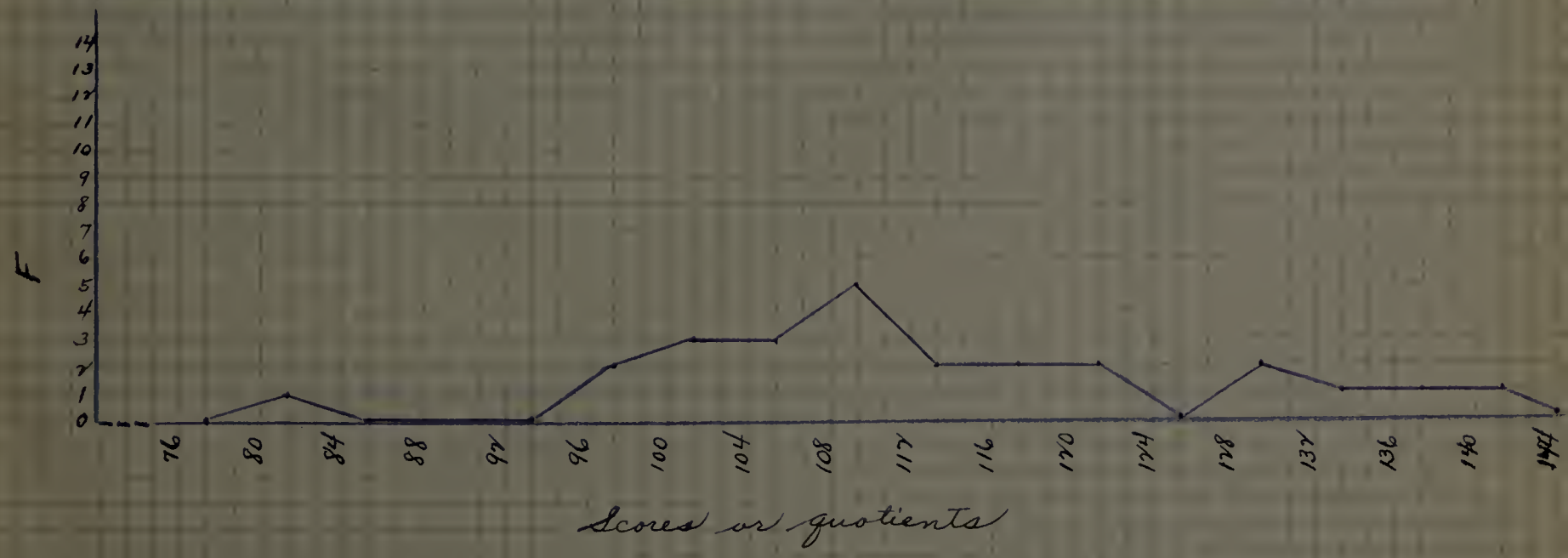
Table I A. and Graph

Interval	4
Highest score =	142
Lowest score =	83

Scores

142	116	111	83	100
133	129	116	110	99
128	123	107	102	105
121	136	103	110	106
115	110	114	99	111

Class Interval	Frequency Tally	Frequency No.	Midpoint Midpt. =	Percentages 1/25 = /100 = 4%	Cumulative Frequencies	Cumulative Percentage
140 - 143.9	I	1	142	4	25	100
136 - 139.9	I	1	138	4	24	96
132 - 135.9	I	1	134	4	23	92
128 - 131.9	II	2	130	8	22	88
124 - 127.9		0	126	0	20	80
120 - 123.9	II	2	122	8	20	80
116 - 119.9	II	2	118	8	18	72
112 - 115.9	II	2	114	8	16	64
108 - 111.9	HHII	5	110	20	14	56
104 - 107.9	III	3	106	12	9	36
100 - 103.9	III	3	102	12	6	24
96 - 99.9	II	2	98	8	3	12
92 - 95.9	0	0	94	0	1	4
81 - 91.9	0	0	90	0	1	4
84 - 87.9	0	0	86	0	1	4
80 - 83.9	I	1	82	4	1	4



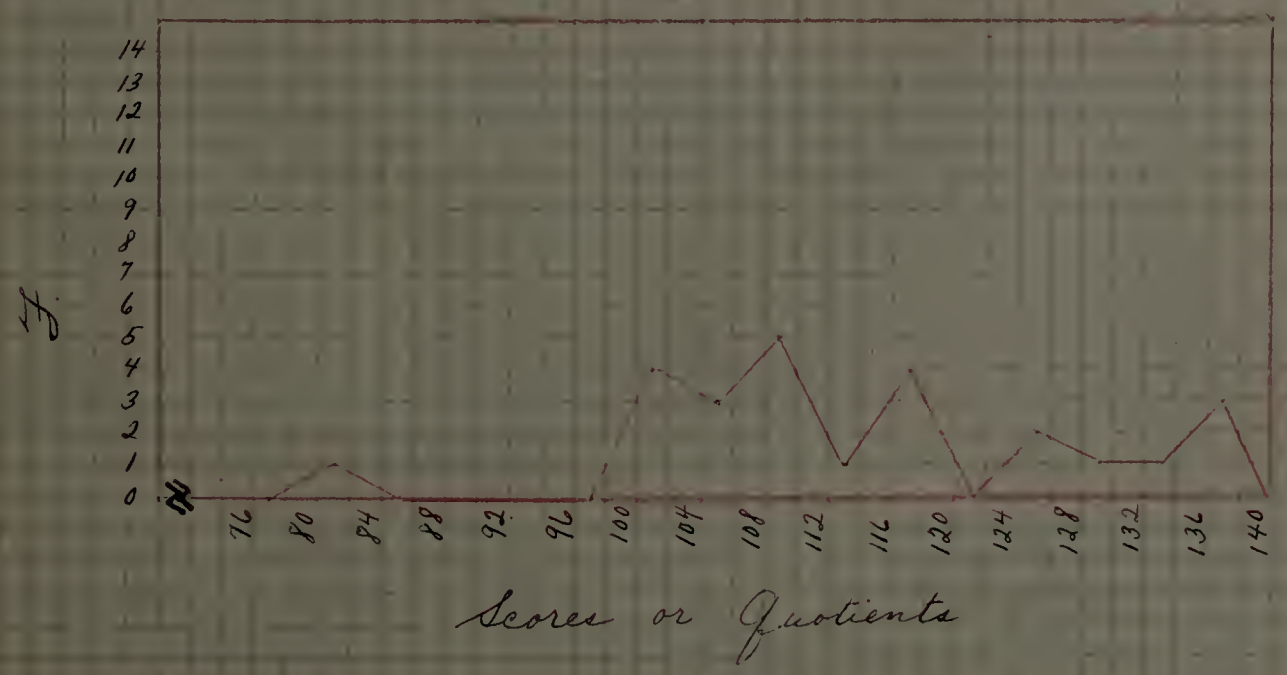
Intelligence Quotients of 70 Pupils

Interval = 4
Highest Score = 139
Lowest Score = 83

Table I B and Graph

137	117	109	83	102
138	124	115	110	97
127	129	106	102	105
119	132	103	119	104
117	109	108	100	101

Class Interval	Frequency Tally	Frequency No.	Midpoints Mdpt. = ll + i/2	Percentages N = 25, 1/25 of 100 = 4%	Cumulative Frequency	Cumulative Percentages
136-139.9	II	2	138	8	25	100
132-135.9	I	1	134	4	23	92
128-131.9	I	1	130	4	22	88
124-127.9	II	2	126	8	21	84
120-123.9		0	122	0	19	76
116-119.9	IIII	4	118	16	19	76
112-115.9	I	1	114	4	15	60
108-111.9	IIII	5	110	20	14	56
104-107.9	III	3	106	12	9	36
100-103.9	IIII	4	102	16	6	24
96-99.9	I	1	98	4	2	8
92-95.9		0	94	0	1	4
88-91.9		0	90	0	1	4
84-87.9		0	86	0	1	4
80-83.9	I	1	82	4	1	4



Comparison Sheet for Table I

The highest I.Q. for 7A was 142.
The highest I.Q. for 7B was 139.
The lowest I.Q. for both groups was 83.
The mode for both groups was 110.

The Mean, Standard Deviation, and Coefficient of Variation for both groups follow.

7A	7B
M--113.36	M--113.36
SD--13.64	SD--13.08
V--12.03	V--11.54

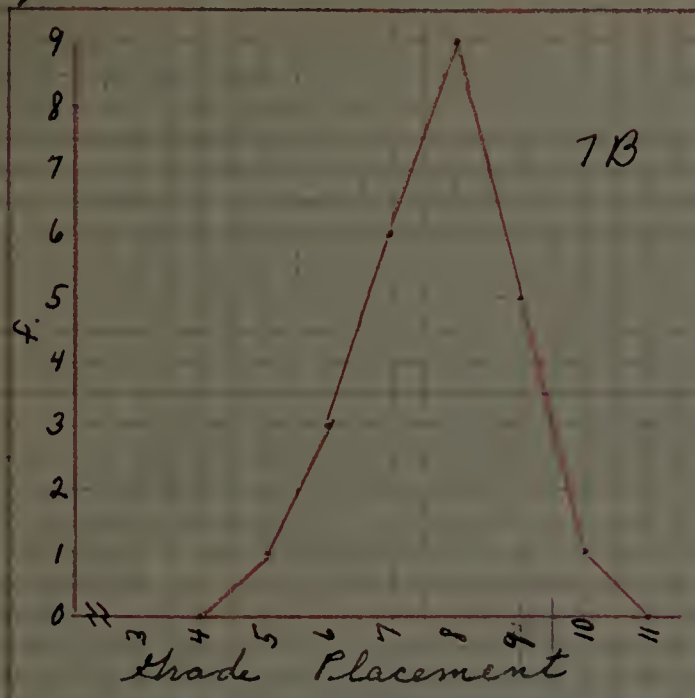
While the Means for both groups are identical, there is a slight variability in the sigmas.
7B scores tend to scatter more around their central tendency than do 7A scores.
In comparing the variability of the two groups in intelligence, I find that 7B is 96% as variable as 7A. However, this is the best group selection that could be made.

Table II

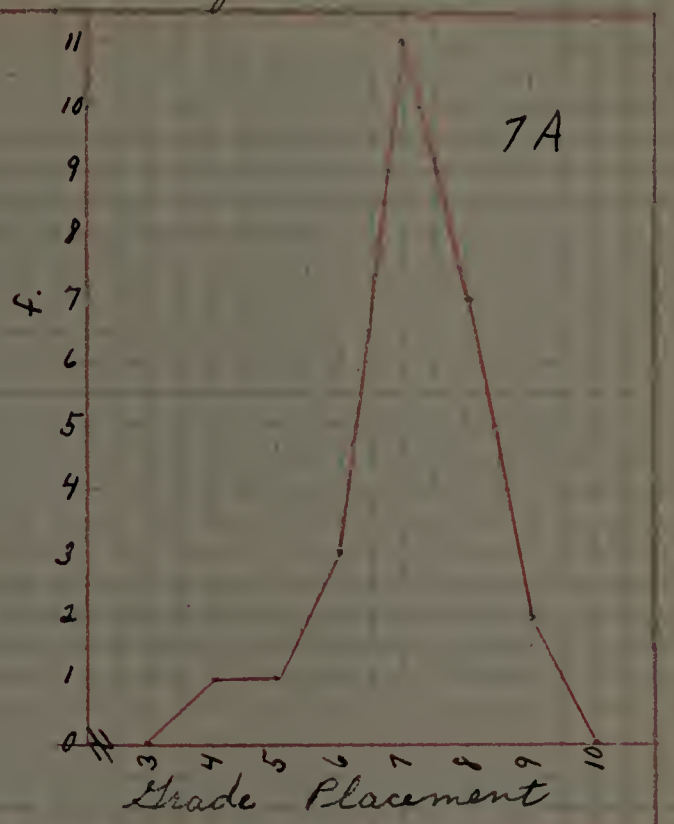
Test D.- Basic Arithmetic Skills Advanced Battery- Form L. Dec. 8, 1942

Part I- Vocabulary and Fundamental Knowledge

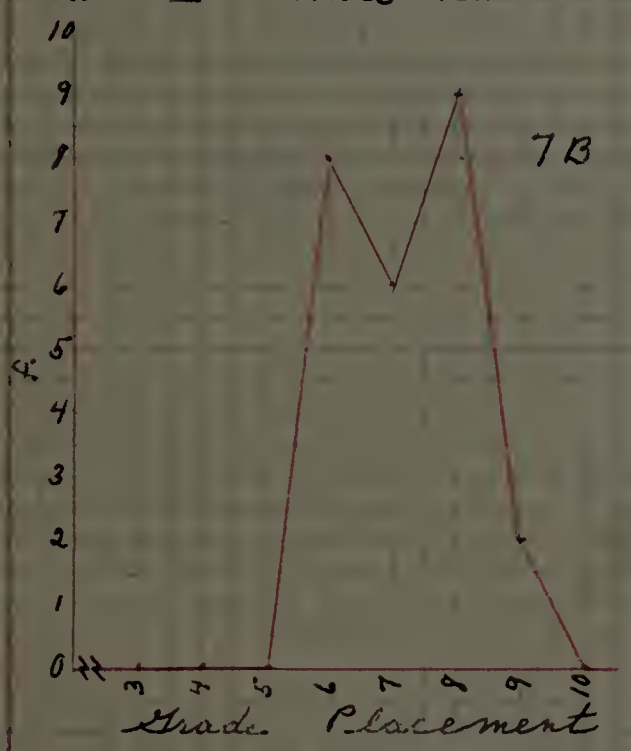
The following graphs show the grade placement of 7A and 7B for the different parts of the test.



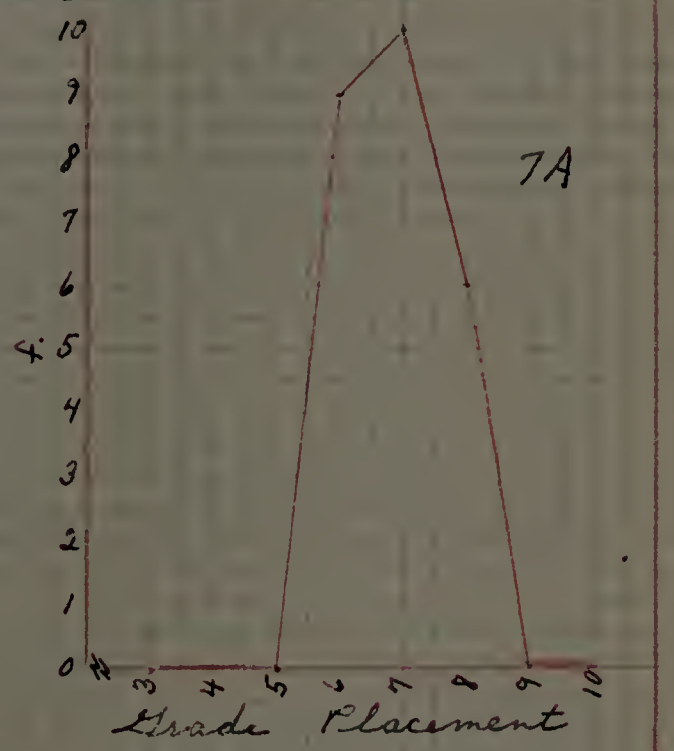
Part III - Problems

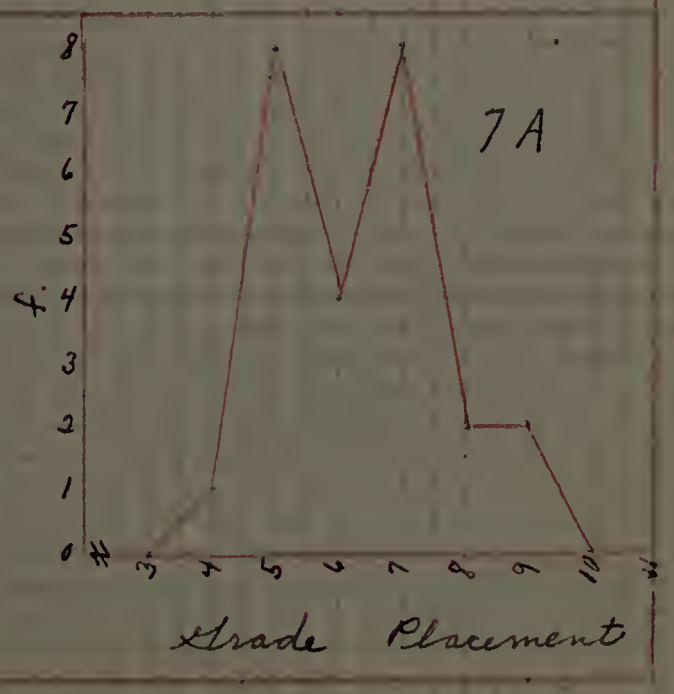


Part II - Whole Numbers and Fractions



Part III - Problems





Comparison Sheet for Table II

Part I--Vocabulary and Fundamental Knowledge

7A	7B
M--7.1	M--6.3
SD--1.1	SD--1.2
V--16	V--19

The Mean for 7A is .8 of a point higher than for 7B.
7A scores tend to scatter more around their central tendency than 7B scores.
The middle 2/3 of 7A scores lie between grades 6 and 8.2.
The middle 2/3 of 7B scores lie between grades 5.1 and 7.5.
7A is 84% as variable as 7B.

Part II--Whole Numbers and Fractions

7A	7B
M--6.9	M--7.2
SD--.77	SD--.98
V--11.2	V--13.6

The Mean for 7B is .3 of a point higher than for 7A.
7B scores tend to scatter slightly more around their central tendency than 7A scores.
The middle 2/3 of 7B scores lie between grades 6.2 and 8.2.
The middle 2/3 of 7A scores lie between grades 6.1 and 7.7.
7A is 82% as variable as 7B.

Part III--Problems

7A	7B
M--6.3	M--6.6
SD--1.3	SD--1.5
V--20.6	V--22.7

The Mean for 7B is .3 of a point higher than for 7A.
7B scores scatter more around their central tendency than do 7A scores, to a slight degree.
The middle 2/3 of 7B scores lie between grades 5.1 and 8.1.
The middle 2/3 of 7A scores lie between grades 5 and 7.6.
7A is 91% as variable as 7B.

As was explained in the Plan of Procedure, this experiment is to cover the unit on percentage. After the introduction was made, the relation to common and decimal fractions was made for per cents and indicated thus:

$\frac{25}{100}$ .25 25%

Much practice on the interchange of these expressions was given. The pupils were shown the convenience of changing common fractions to decimals and per cents to compare them easily. Simple problems were given, such as class attendance, games and scores, and comparison of areas. Next, per cents commonly used were expressed as common fractions and the following table was made and memorized:

10% 1/10	20% 1/5	12½% 1/8	16 2/3% 1/6	14 2/7% 1/7
30% 3/10	40% 2/5	37½% 3/8	83 1/3% 5/6	28 4/7% 2/7
70% 7/10	60% 3/5	62½% 5/8	33 1/3% 1/3	5% 1/20
90% 9/10	80% 4/5	87½% 7/8	66 2/3% 2/3	25% 1/4
	100% 1			50% 1/2
				75% 3/4

On Dec. 10, 1942, the following written lesson was given to both groups:

I. Express as common fractions or per cents.

75%	5/8	20%	7/10	5%
83 1/3%	4/5	87½%	1/2	33 1/3%
90%	1/4	14 2/7%	2/5	100%
37½%	3/10	50%	1/10	175%
66 2/3%	1/6	12½%	2/7	500%

II. Write as per cents.

.63	5.26
.42	.045
.06	.19½
.05½	2
6.9	5.19

III. Write as decimals.

18%	8%	15 3/4%	136%	4%
1½%	.7%	300%	13.6%	2 1/5%

IV. Write as per cents.

23/100	65/100
6/100	135/100
100/100	96/100
49/100	54/100
81/100	319/100

This test was made by me. See Table III and Graph for results. A comparison sheet accompanies the table and graph.

On Dec. 17, 1942, another written lesson was givento both groups and was as follows:

1. What does percentage mean?
2. What does per cent mean?
3. In what ways may a per cent be expressed?
4. How is a decimal fraction written as a per cent?
5. How is a per cent written as a decimal?
6. How may a per cent like 87½% be expressed as a common fraction?
7. Express 35% as a common fraction and as a decimal.
8. 83 1/3% equals what common fraction?
9. 5/8 equals what common fraction?
10. 3½% equals what decimal fraction?

See Table IV and Graph, together with comparison sheet. This lesson was made by me.

The first lesson after the Christmas vacation was given over to oral and written review for both groups. Twenty minutes of each period was used for individual corrections of prework and for special help.

On Jan. 7, 1943, the following written lesson, made up by me, was given to both groups:

I. Write as decimals.[1]

3%	36%
41%	.15%
6.1%	7½%
2/5%	208%
12½%	18.7%

[1] De Groat and Young--Iroquois New Standard Arith. Gr.7--p.69

Grade 7A – Dec 10, 1942

55 examples on writing per cents as common fractions and decimals, decimals as per cents, and common fractions as per cent.

Interval – 4
Highest score = 52
Lowest score = 11

Table III A

Scores – (Number right)

31	43	39	29	30
32	31	15	28	11
22	46	18	42	29
50	40	26	13	37
41	13	52	25	30

Class Interval	Frequency Tally	Frequency No.	Midpoints Mdpt = ll + i/2	Percentages N = 25 1/25 of 100 = 4%	Cumulative Frequencies	Cumulative Percentages
52-55.9	I	1	54	4	25	100
48-51.9	I	1	50	4	24	96
44-47.9	I	1	46	4	23	92
40-43.9	HH	4	42	16	22	88
36-39.9	II	2	38	8	18	72
32-35.9	I	1	34	4	16	64
28-31.9	HHII	7	30	28	15	60
24-27.9	II	2	26	8	8	32
20-22.9	I	1	22	4	6	24
16-19.9	I	1	18	4	5	20
12-15.9	III	3	14	12	4	16
8-11.9	I	1	10	4	1	4

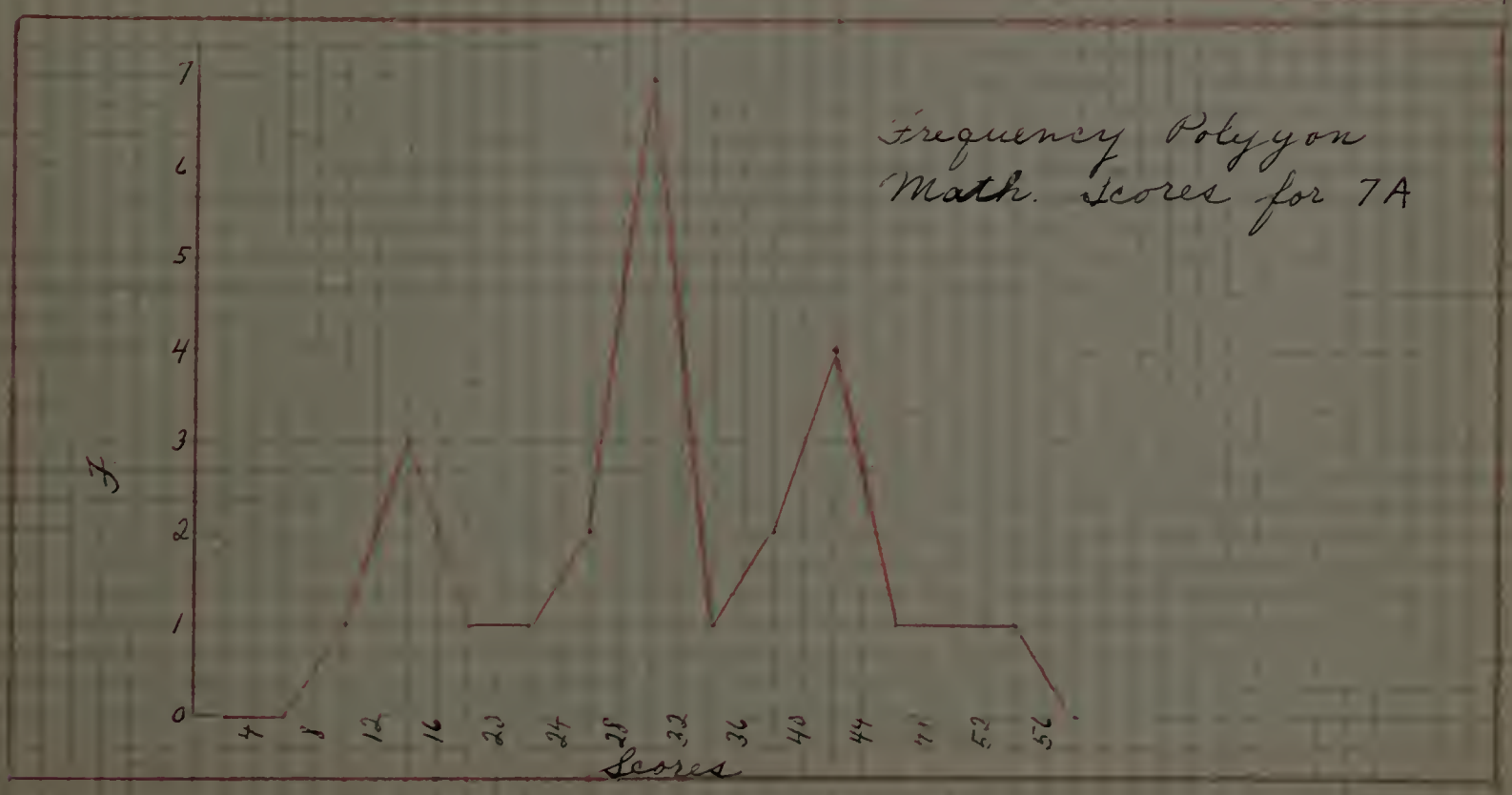


Table III B

Subject - Mathematics - 55 ex. on writing per cents, as common fractions or decimals and vice versa.

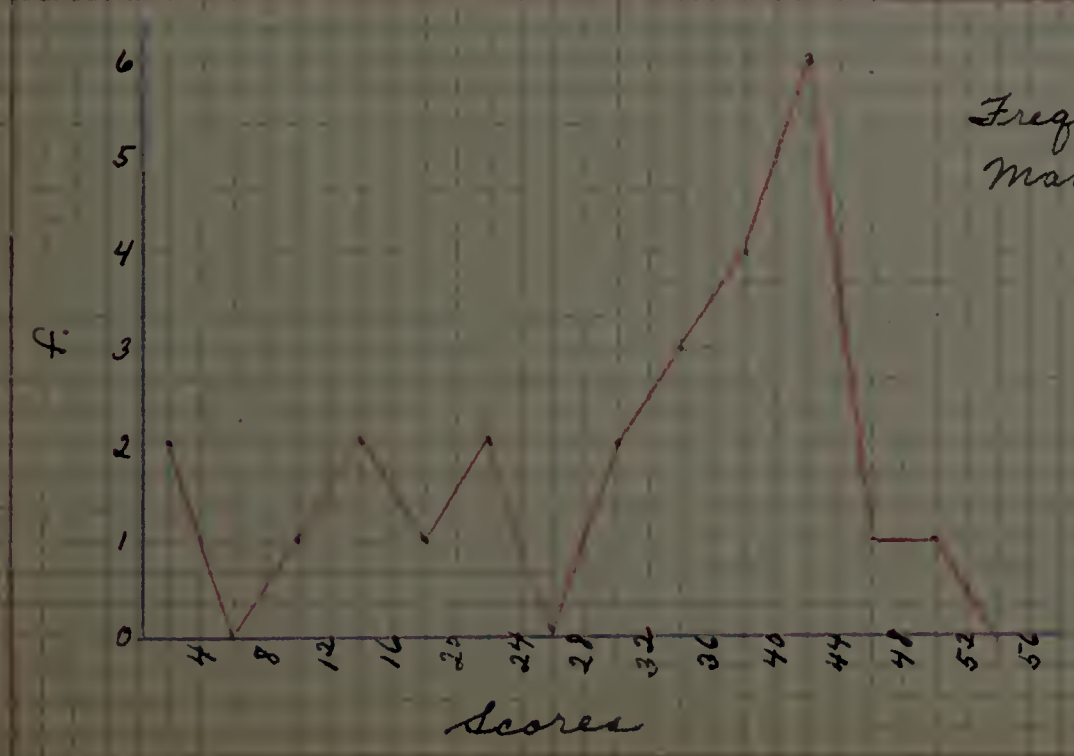
Grade 7B Dec. 10, 1942 Table and Graph

Interval = 4
Highest score = 49
Lowest score = 0

Scores

25	42	36	38	17
20	40	28	36	0
0	11	32	15	38
37	8	9	40	40
33	36	49	31	30

Class Interval	Freq. Tally	Freq. No.	Midpoints Mdpt. = ll + i/2	% 's N=25 55 of 100 = 47%	Cumulative Freq.	Cumulative Percentages
48-51.9	I	1	50	4	25	100
44-47.9	I	1	46	4	24	96
40-43.9	HHII	6	42	24	23	92
36-39.9	HH	4	38	16	17	68
32-35.9	III	3	34	12	13	52
28-31.9	II	2	30	8	10	40
24-27.9		0	26	0	8	32
20-23.9	II	2	22	8	8	32
16-19.9	I	1	18	4	6	24
12-15.9	II	2	14	8	5	20
8-11.9	I	1	10	4	3	12
4-7.9		0	6	0	2	8
0-3.9	II	2	2	8	2	8



Frequency Polygon
Math. scores for
7 B pupils

Comparison Sheet for Table III

The highest score for 7A was 52.
The highest score for 7B was 49.
The lowest score for 7A was 11.
The lowest score for 7B was 0.
The mode for 7A was 30 with 7 frequencies.
The mode for 7B was 42 with 6 frequencies.

The Mean, Standard Deviation, and Coefficient of Variation follow.

7A	7B
M--31.3	M--30.6
SD--11.5	SD--13.5
V--36.8	V--44.1

The Mean for 7A was .7 of a point higher than for 7B.
The 7A scores tend to scatter around their central tendency a little better than do 7B scores.
The middle 2/3 of 7A scores lie between 20 and 43.
The middle 2/3 of 7B scores lie between 17 and 44.
Both groups scored over almost exactly the same part of the scale.
7A is 83% as variable as 7B.

Grade 7A - Dec. 17, 1942. Table IX A

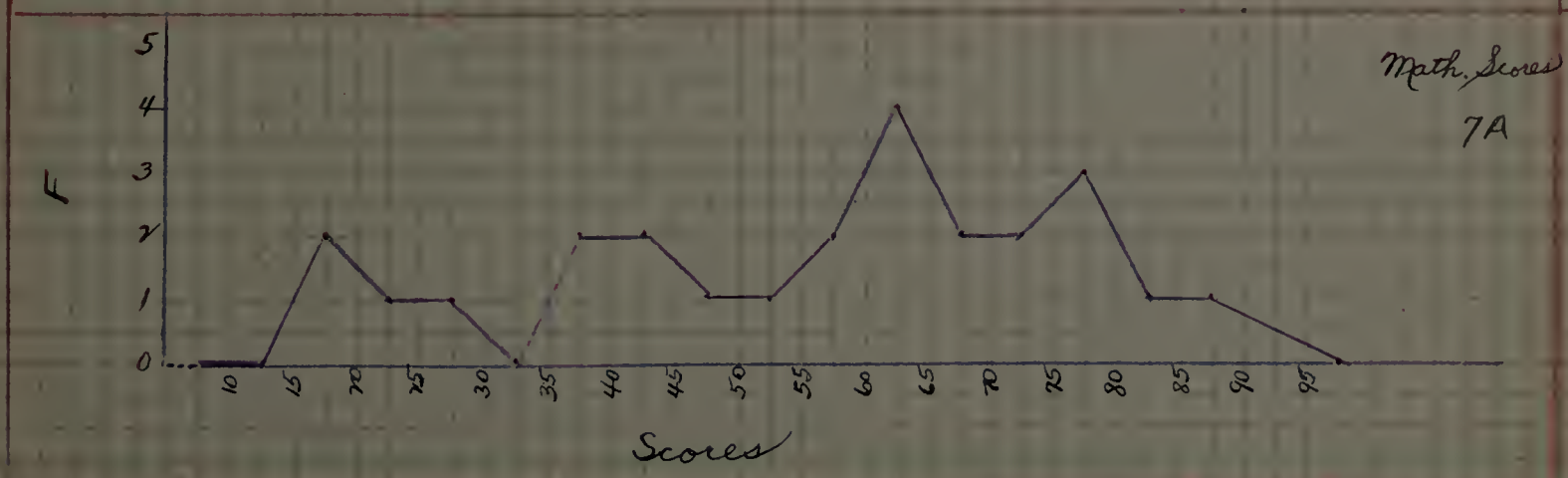
This was a review of definitions, explanations, and writing of a per cent as a fraction, fraction as a per cent, per cent as a decimal and common fraction. There were 10 questions with the scores expressed in percentages.

Interval = 5
Highest Score = 85
Lowest Score = 15

Scores

35	65	70	60	75
65	70	50	40	15
15	45	60	60	40
80	20	75	60	35
55	55	85	25	75

Class Interval	Frequency Tally	Frequency No.	Midpoints Mdpt. = ll + i/2	Percentages N = 25 1/25 x 100 = 4%	Cumulative Frequencies	Cumulative Percentage
85-89.9	I	1	87.5	4	25	100
80-84.9	I	1	82.5	4	24	96
75-79.9	III	3	77.5	12	23	92
70-74.9	II	2	72.5	8	20	80
65-69.9	II	2	67.5	8	18	72
60-64.9	IIII	4	62.5	16	16	64
55-59.9	II	2	57.5	8	12	48
50-54.9	I	1	52.5	4	10	40
45-49.9	I	1	47.5	4	9	36
40-44.9	II	2	42.5	8	5	32
35-39.9	II	2	37.5	8	6	24
30-34.9		0	32.5	0	4	16
25-29.9	I	1	27.5	4	4	16
20-24.9	I	1	22.5	4	3	12
15-19.9	II	2	17.5	8	2	8



Grade 7B – Dec. 17, 1942 Table and Graph II B

This was a review of definitions, explanations, and writing of a per cent as a fraction, a per cent as a decimal and as a common fraction, and a fraction as a per cent. There were 10 questions with the scores expressed in percentages.

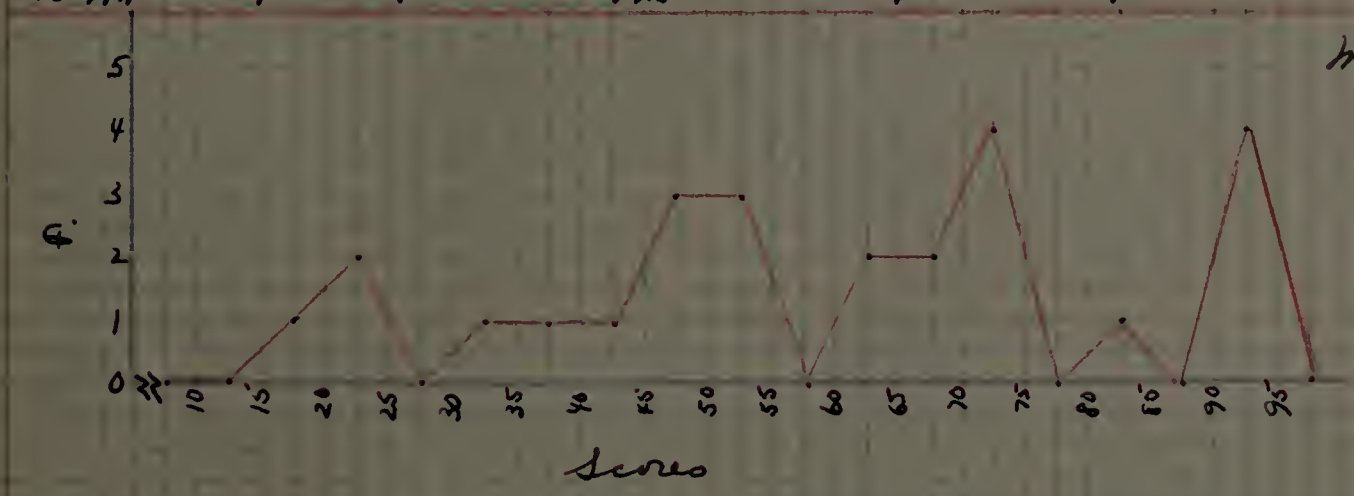
Interval = 5

Highest score = 90

Lowest score = 15

70	40	70	90	60	65	35	45	70
60	50	50	70	45	20	90	20	
65	30	45	80	90	15	50	90	

Class Interval	Freq. Tally	Freq. No.	Midpoints Midpt. = $ll + \frac{i}{2}$	Percentages $N=25$ $\frac{f}{25} \times 100 = 4f$%	Cumulative Freq.	Cumulative Percentages
90-94.9	HH	4	92.5	16	25	100
85-89.9		0	87.5	0	21	84
80-84.9	1	1	82.5	4	21	84
75-79.9		0	77.5	0	20	80
70-74.9	HH	4	72.5	16	20	80
65-69.9	11	2	67.5	8	16	64
60-64.9	11	2	62.5	8	14	56
55-59.9		0	57.5	0	12	48
50-54.9	111	3	52.5	12	12	48
45-49.9	111	3	47.5	12	9	36
40-44.9	1	1	42.5	4	6	24
35-39.9	1	1	37.5	4	5	20
30-34.9	1	1	32.5	4	4	16
25-29.9		0	27.5	0	3	12
20-24.9	11	2	22.5	8	3	12
15-19.9	1	1	17.5	4	1	4



Comparison Sheet for Table IV

The highest score for 7A was 85.
The highest score for 7B was 90.
The lowest score for both groups was 15.
The mode for 7A was 62.5 with 4 frequencies.
The modes for 7B were 77.5 and 92.5 with 4 frequencies each.

The Mean, Standard Deviation, and Coefficient of Variation follow.

7A	7B
M--55.7	M--59.1
SD--20.1	SD--22
V--36.1	V--37.2

The Mean for 7B was 3.4 points higher than for 7A.
7B scores tend to scatter more around their central tendency than do 7A scores.
The middle 2/3 of 7B scores lie between 37 and 81.
The middle 2/3 of 7A scores lie between 36 and 76.
Both groups scored over almost exactly the same part of the scale.
7A is 97% as variable as 7B.

II. Write as per cents.

.12	.00 3/5
.9	31.19
.04	1.5
.01 3/4	.0561
.507	8.28

III. Change to per cents.

1/2	5/6
2/3	1/10
4/5	3/50
1/6	7/20
7/8	5/8

IV. Which does 2% equal: .2, .02 or 2?
Which does 18% equal: 1.8, 18 or .18?
Which does 134% equal: 134, 1.34 or 13.4?

V. Copy columns A and B. In column C write the equivalents of column A as expressed in column B.

A	B	C
80%	1/8	---
2/3	.37½%	---
.00 3/8	3/4	---
.12½	60%	---
3/5	4/5	---
75%	.66 2/3	---

See Table V and Graph and Comparison sheet for an interpretation of results.

7A was prepared for the above test through dictation and board and seat drill. 7B was prepared by using the drill exercises in the text and through homework assignments.

The groups are now ready for the first case in percentage. The terms base, rate, and percentage were introduced and defined. Examples were given orally and on the board. (Examples: 50% of 10 problems; 30% of $.80; 87½% of 32 baseball games.) The formula (P-BxR) was given and examples were

[1] De Groat and Young--Iroquois New Standard Arith. Bk. 7--p. 69 70, 71

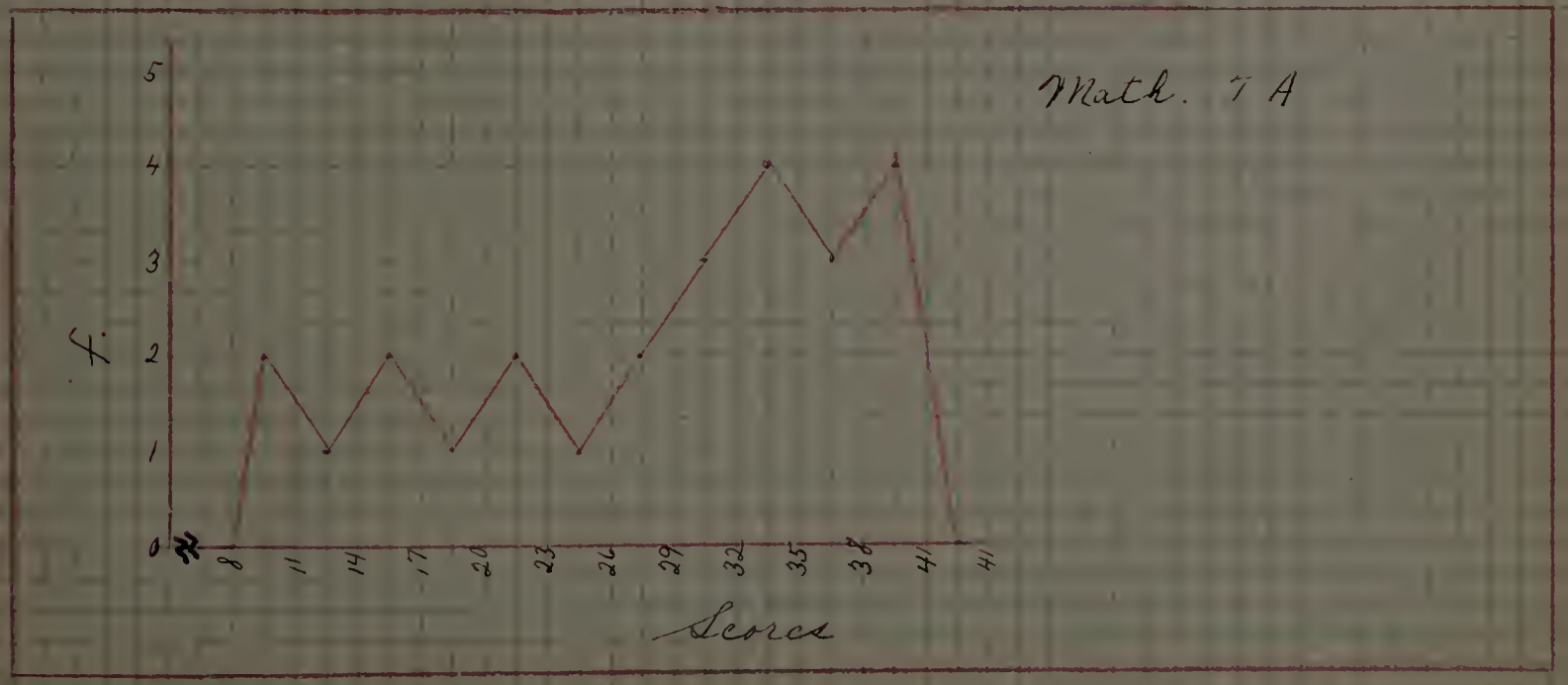
Grade 7 A. - January 7, 1943. Table and Graph. IX A

This is a review of per cents to be written as decimals, decimals as per cents, common fractions as per cents, per cents with three choices given, one of which is correct, and a matching exercise with two columns given. There were 39 examples with a score of 1 for each example.

Interval = 3
Highest score = 38
Lowest score = 9

Scores				
28	38	29	38	14
21	36	29	34	9
25	30	33	34	14
38	17	37	35	30
26	11	34	10	38

Class Interval	Frequency Tally	Frequency No.	Midpoints Midpt. = ll + ½	Percentages N = 25 20 x 100 = 40/0	Cumulative Frequencies	Cumulative Percentages
38-41.9	IIII	4	39.5	16	25	100
35-37.9	III	3	36.5	12	21	84
32-34.9	IIII	4	33.5	16	18	72
29-31.9	III	3	30.5	12	14	56
26-28.9	II	2	27.5	8	11	44
23-25.9	I	1	24.5	4	9	36
20-22.9	II	2	21.5	8	8	32
17-19.9	I	1	18.5	4	6	24
14-16.9	II	2	15.5	8	5	20
11-13.9	I	1	12.5	4	3	12
8-10.9	II	2	9.5	8	2	8



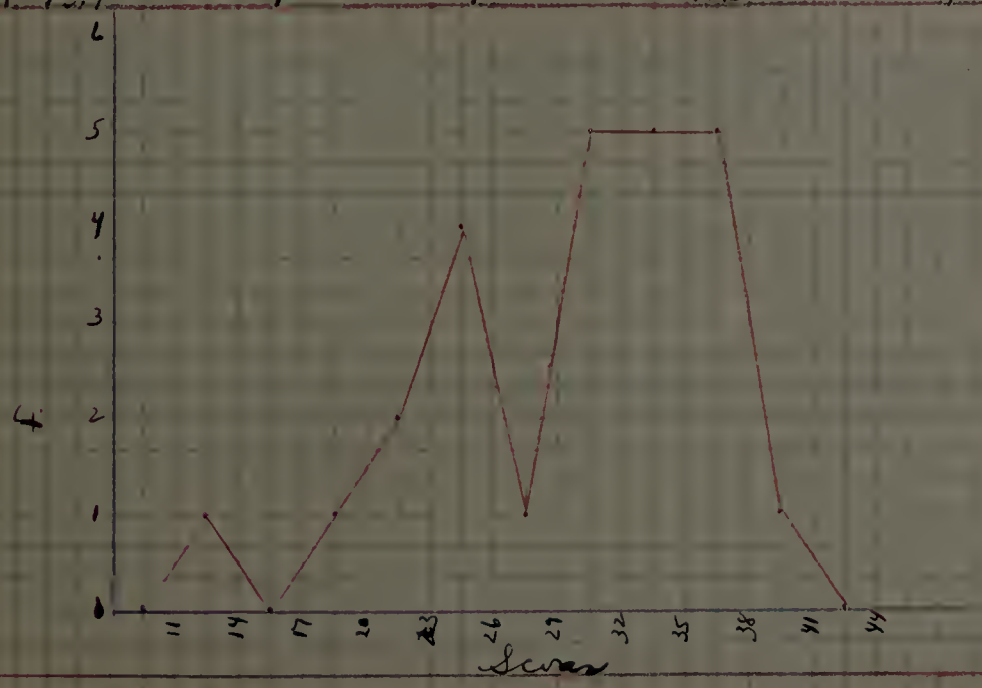
This is a review of per cents to be written as decimals, decimals as per cents, common fractions as per cents, per cents with three choices given, one of which is correct and a matching exercise with two colums given. There were 39 examples with a score of 1 for each example.

Interval = 3
Highest score = 38
Lowest score = 13

Scores

29	29	34	20	37
29	24	37	32	13
19	28	31	38	24
32	36	33	22	36
31	25	36.	24	33

Class Interval	Frequency Tally	Frequency No.	Midpoints Mdpt. = ll ½	Percentages N = 25 1/25 x 100 = 4%	Cumulative Frequencies	Cumulative Percentages
38-41.9	1	1	39.5	4	25	100
35-37.9	HH 1	5	36.5	20	24	96
32-34.9	HH 1	5	33.5	20	19	76
29-31.9	HH 1	5	30.5	20	14	56
26-28.9	1	1	27.5	4	9	36
23-25.9	HH	4	24.5	16	8	32
20-22.9	11	2	21.5	8	4	16
17-19.9	1	1	18.5	4	2	8
14-16.9		0	15.5	0	1	4
11-13.9	1	1	12.5	4	1	4



Math. 7B

Comparison Sheet for Table V

The highest score for both groups was 38.
The lowest score for 7B was 13.
The lowest score for 7A was 9.
The modes for 7A were 33.5 and 39.5 with 4 frequencies each.
The modes for 7B were 30.5, 33.5, and 36.5 with 5 frequencies each.

The Mean, Standard Deviation, and Coefficient of Variation follow.

7A	7B
M--27.9	M--29.7
SD--9.6	SD--6.6
V--34.5	V--22.1

The Mean for 7B was 1.8 points higher than for 7A.
7B scores tend to scatter more around their central tendency than do 7A scores.
The middle 2/3 of 7B scores lie between 23 and 36.
The middle 2/3 of 7A scores lie between 19 and 37.
7B scored over a higher part of the scale than 7A did.
7B is 64% as variable as 7A.

7A had 6 absences compared with 3 for 7B. This would materially affect the scores and partly account for 7B's better showing on this test.

given in which the base, rate, and percentage were named and found.

Illustrations of the methods of solving and the types of examples in the first case of percentage, for 7A and 7B, are as follows:

Case I--Finding a per cent of a number.

(a) Find 33 1/3% of 84 bushels.
P-BxR
33 1/3%-1/3 (This step is omitted as the pupil advances.)
84 bu. x 1/3-28 bu.

(b) Find 175% of $200.
P-BxR
175%-1 3/4-7/4
$200 x 7/4-$350

(c) Find 15% of 12
P-BxR
15%-.15
12
.15
60
12
1.80

(d) Find 102% of 70
P-BxR
102%-1.02
70
1.02
140
700
71.40

(e) Find 4/5% of $21
P-BxR
4/5%-.00 4/5
$21 x .00 4/5-$\frac{84}{5}$-$.16 4/5-$.17

On January 13th, the following written lesson was given both classes:

Find:
1. 33 1/3% of 975

2. 16 2/3% of $243
3. 87½% of $200
4. 62½% of 140 mi.
5. 37½% of 132 qt.
6. 40% of 2.5
7. 66 2/3% of 72 ft.
8. 28 4/7% of $1.47
9. 83 1/3% of $1854
10. 75% of 92.8

See Table VI with Graph and Comparison sheet which follow.

On January 19th, a written lesson based on (b) of Case I was given. The preceding lessons were used for drill and corrections. 7A is doing well at dictation and oral work. 7B are getting their drill through book exercises and home-work assignments. The lesson for Jan. 19th follows:

Find:

1. 120% of 210
2. 300% of 900
3. 250% of $4.80
4. 166 2/3% of 9
5. 125% of 160
6. 230% of 40
7. 283 1/3% of 36
8. 1000% of 12
9. 160% of 100
10. 480% of $96

See Table VII with Graph and Comparison sheet which follow Table VI.

Both groups are still working with per cents greater than 100%. The lesson of Jan. 19th contained per cents which were to be changed to improper fractions. Practice for both groups was given on using odd per cents greater than 100%. On January 27th, a written lesson was given both groups in which the per cents used were greater than 100% and were to

January 13, 1943 7A [22] Table and Graph VI A

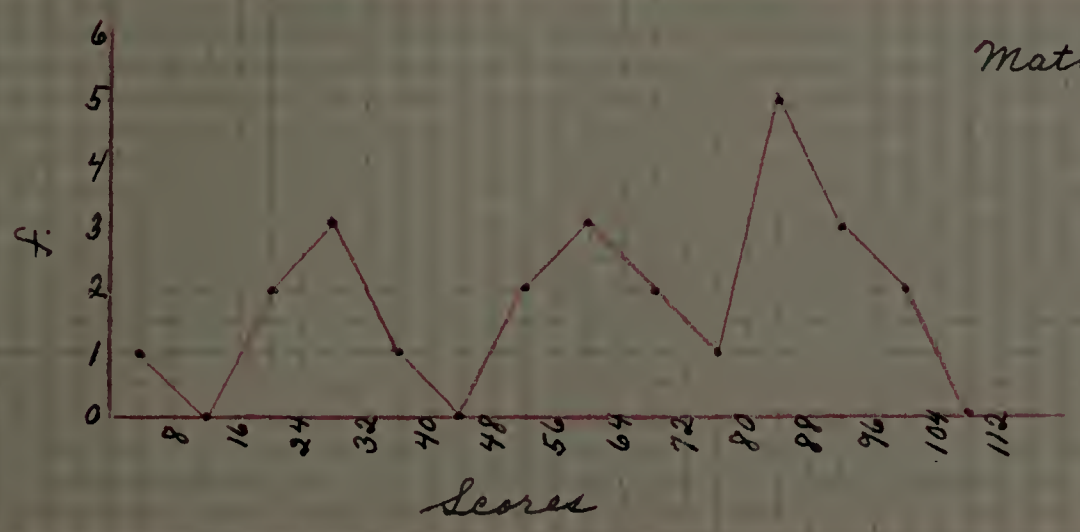
Frequency Polygon showing results of 10 examples in which a per cent of a number was found. All per cents were to be expressed as common fractions.

Interval = 8
Highest score = 100
Lowest score = 0

Scores

50	80	100	70	90
50	70	60	35	25
60	0	80	60	30
30	80	100	80	75
80	20	90	20	90

Class Interval	Freq. Tally	Freq. No.	Midpoints	%'s n = 25	Cumulative Freq.	Cumulative %'s
96 - 103.9	II	2	100.5	8	25	100
88 - 95.9	III	3	92.5	12	23	92
80 - 87.9	𝍸 I	5	84.5	20	20	80
72 - 79.9	I	1	76.5	4	15	60
64 - 71.9	II	2	68.5	8	14	56
56 - 63.9	III	3	60.5	12	12	48
48 - 55.9	II	2	52.5	8	9	36
40 - 47.9		0	44.5	0	7	28
32 - 39.9	I	1	36.5	4	7	28
24 - 31.9	III	3	28.5	12	6	24
16 - 23.9	II	2	20.5	8	3	12
8 - 15.9		0	12.5	0	1	4
0 - 7.9	I	1	4.5	4	1	4



January 13, 1943 7B Table and Graph

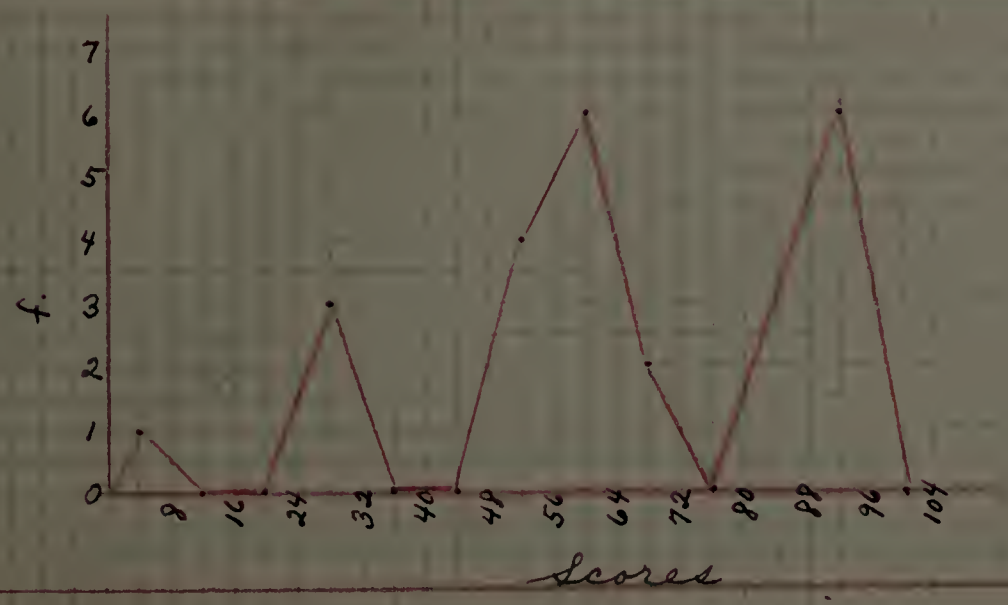
Frequency Poly-gon showing results of 10 examples in which a part of a number was found. All were odd per cents - greater than 100% and were expressed as decimals. 20 minutes was the time allowance.

Interval = 8
Highest Score = 90
Lowest Score = 0

Scores

0	90	90	50	80
90	60	60	60	50
30	60	50	90	30
80	70	80	70	30
90	50	90	60	60

Class Interval	Freq. Tally	Freq. No.	Midprints	Percentages N=25	Cumul. Freq.	Cumul. %'s
88 - 95.9	𝍸 |	6	92.5	24	25	100
80 - 87.9	|||	3	84.5	12	19	76
72 - 79.9		0	76.5	0	16	64
64 - 71.9	||	2	68.5	8	16	64
56 - 63.9	𝍸 ||	6	60.5	24	14	56
48 - 55.9	𝍸	4	52.5	16	8	32
40 - 47.9		0	44.5	0	4	16
32 - 39.9		0	36.5	0	4	16
24 - 31.9	|||	3	28.5	12	4	16
16 - 23.9		0	20.5	0	1	4
8 - 15.9		0	12.5	0	1	4
0 - 7.9	|	1	4.5	4	1	4



Math. 7B

Comparison Sheet for Table VI

The highest score for 7A was 100.
The highest score for 7B was 90.
The lowest score for both groups was 0.
The mode for 7A was 84.5 with 5 frequencies.
The modes for 7B were 60.5 and 92.5 with 6 frequencies each.

The Mean, Standard Deviation, and Coefficient of Variation follow.

7A	7B
M--62.7	M--63.9
SD--27.9	SD--23.7
V--44.5	V--37

The Mean for 7B is 1.2 points higher than that for 7A.
7B scores tend to scatter more around their central tendency than do 7A scores.
The middle 2/3 of 7B scores lie between 40 and 88.
The middle 2/3 of 7A scores lie between 35 and 91.
Both groups scored over almost exactly the same part of the scale.
7B is 83% as variable as 7A.

January 19, 1943 7A — Table and Graph VII A

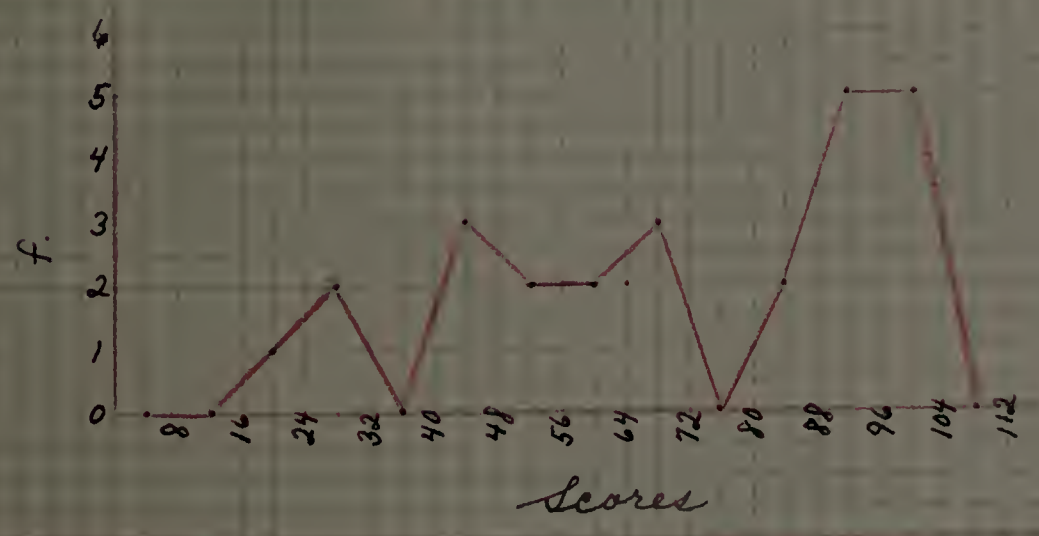
Frequency Polygon showing results of 10 examples in which a part of a number is found. All per cents were greater than 100 %. and were expressed as improper fractions. Time allowance was 30 minutes.

Interval = 8
Highest Score = 100
Lowest Score = 20

Scores

40	90	90	90	20
80	90	70	50	70
50	30	80	100	40
40	60	100	100	30
90	60	100	70	100

Class Interval	Freq. Tally	Freq. No.	Midpoints	Percentages N=25	Cumul. Freq.	Cumul. %'s
96 - 103.9	𝍸	5	100.5	20	25	100
88 - 95.9	𝍸	5	92.5	20	20	80
80 - 89.9	II	2	84.5	8	15	60
72 - 79.9		0	76.5	0	13	52
64 - 71.9	III	3	68.5	12	13	52
56 - 63.9	II	2	60.5	8	10	40
48 - 55.9	II	2	52.5	8	8	32
40 - 47.9	III	3	44.5	12	6	24
32 - 39.9		0	36.5	0	3	12
24 - 31.9	II	2	28.5	8	3	12
16 - 23.9	I	1	20.5	4	1	4



Math. 7A

January 19, 1943 7B 26 Table and Graph VII B

Frequency Polygon showing results of 10 examples in which a part of a number is found. All per cents were greater than 100% and were to be expressed as improper fractions. Time allowed was 30 minutes.

Interval = 8

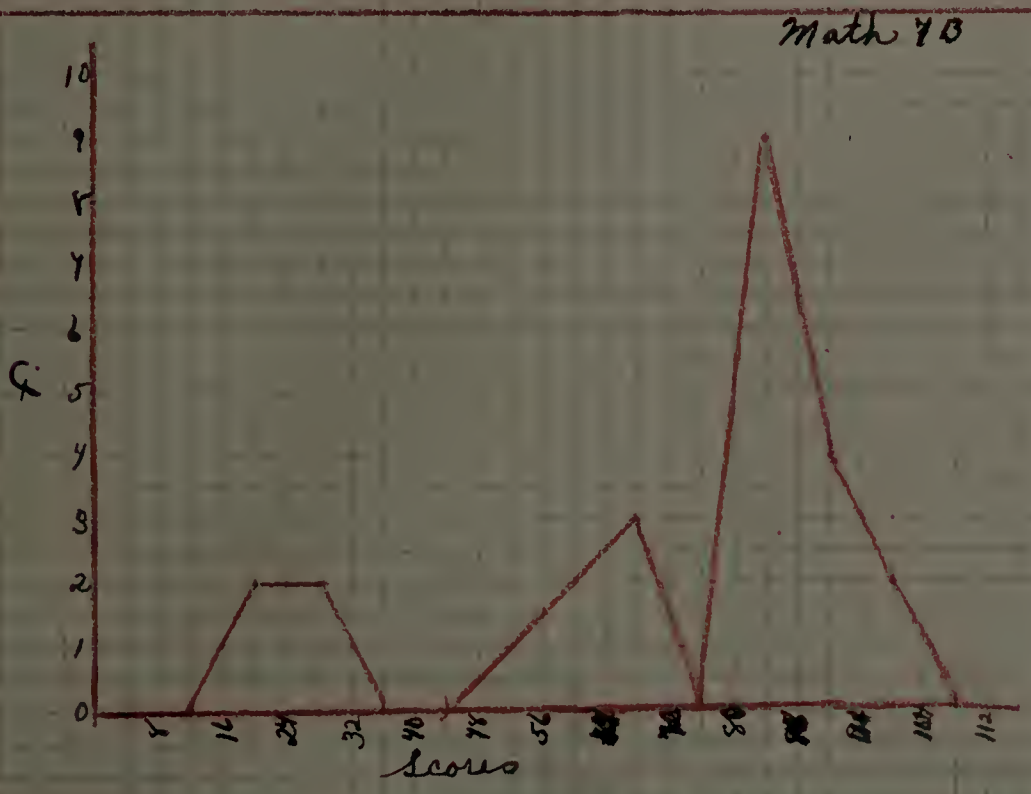
Highest score = 160

Lowest score = 20

Scores

50	80	80	20	80
30	30	100	80	70
60	90	90	100	80
80	20	90	70	60
70	80	80	90	80

Class Interval	Freq. Tally	Freq. No.	Midpoints	Percentages N = 25	Cumulative Freq.	Cumulative %'s
96-103.9	//	2	100.5	8	25	100
88-95.9	////	4	92.5	16	23	92
80-87.9	//// //// /	9	84.5	36	19	76
72-79.9		0	76.5	0	10	40
64-71.9	///	3	68.5	12	10	40
56-63.9	//	2	60.5	8	7	28
48-55.9	/	1	52.5	4	5	20
40-47.9		0	44.5	0	4	16
32-39.9		0	36.5	0	4	16
24-31.9	//	2	28.5	8	4	16
16-23.9	//	2	20.5	8	2	8



Comparison Sheet for Table VII

The highest score for both groups was 100.
The lowest score for both groups was 20.
The mode for 7B was 84.5 with 9 frequencies.
The modes for 7A were 92.5 and 100.5 with 5 frequencies each.

The Mean, Standard Deviation, and Coefficient of Variation follow.

7A	7B
M--71.1	M--72.3
SD--25.4	SD--24
V--35.8	V--33.2

7Bhas a higher mean than 7A by 1.2 points.
7B has a better scatter around the central tendency than 7A.
The middle 2/3 of 7B scores lie between 48 and 96.
The middle 2/3 of 7A scores lie between 46 and 97.
Both groups scored over almost the same part of the scale.
7B is 93% as variable as 7A.

be expressed as mixed decimals. The lesson follows:

Find:
1. 185% of $350
2. 219% of $2000
3. 112% of 486
4. 107% of 84 lb.
5. 272% of $ 1562
6. 129% of $375
7. 263% of $596
8. 137% of $68.95
9. 254% of 3.06
10. 334% of 12.7

The two lessons above were constructed by me. See Table VIII with Graph and Comparison sheet which follow immediately.

The following lessons were used for further drill on using all kinds of per cents in doing Case I problems.

On February 1st, a written lesson was given in which all types of per cents were used. It was the first full review lesson of Case I. Both groups did the same lesson.

The exercises were:
Find:
1. 15% of $450.50
2. 175% of 96 lb.
3. 5 3/4% of $81
4. 122% of $2100
5. 56% of 1.08
6. $87\frac{1}{2}$% of 450 lb.
7. $2\frac{1}{2}$% of $10
8. 6.7% of $350
9. 208% of 1600
10. 230% of $660

This test was also constructed by me. Table IX with Graph and Comparison sheet follow immediately after Table VIII.

The next written lesson was not given until February 11th. Due to much absence because of illness and bad weather, it was impossible to go ahead with new work. Therefore, on the 11th, another review lesson was given. It was as follows:

January 27, 1943 7A. Table VII A and Graph

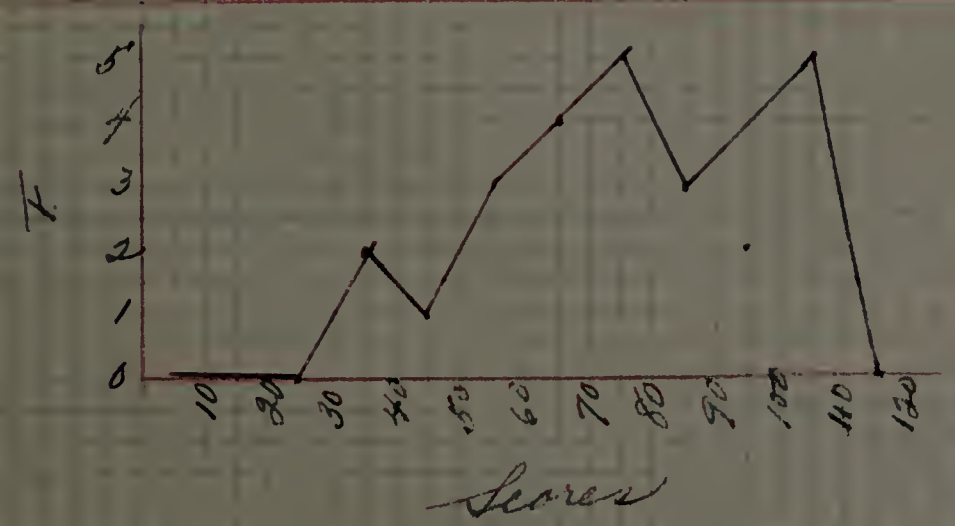
Frequency Polygon showing results of 10 examples in which a part of a number was found. All were odd per cents — greater than 100% and were expressed as decimals. 20 minutes was the time allowance.

Interval = 10
Highest Score = 100
Lowest Score = 30

Scores

30	70	100	80	100
50	70	90	80	30
70	70	60	80	60
40	50	100	100	60
70	60	90	50	100

Class Interval	Freq. Tally	Freq. No.	Midpoints Midpt = Lo + Hi / 2	% of N N = 25 f/25 × 100 = f%	Cumulative Frequencies	Cumulative Percentages
100 - 109.9	HHI	5	105.5	20	25	100
90 - 99.9	II	2	95.5	8	20	80
80 - 89.9	III	3	85.5	12	18	72
70 - 79.9	HHI	5	75.5	20	15	60
60 - 69.9	HH	4	65.5	16	10	40
50 - 59.9	III	3	55.5	12	6	24
40 - 49.9	I	1	45.5	4	3	12
30 - 39.9	II	2	35.5	8	2	8
20 - 29.9						
10 - 19.9						



January 27, 1943 — 7B — Table and Graph

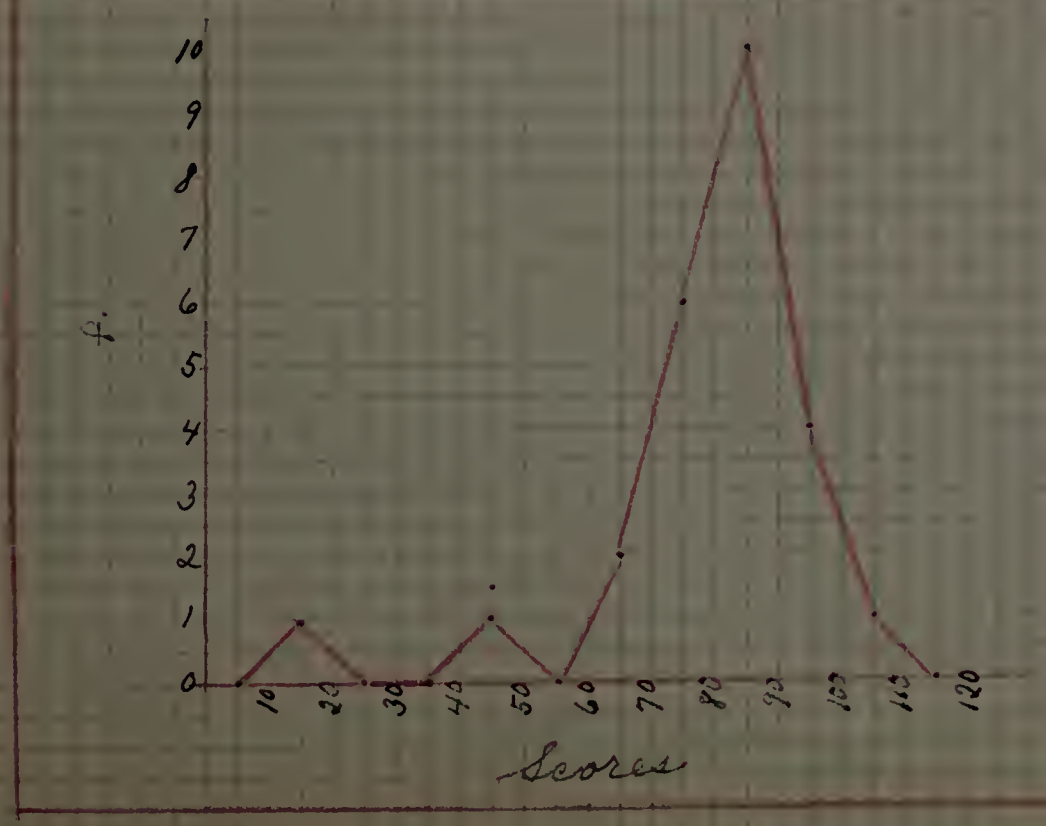
Frequency Polygon showing results of 10 examples in which a part of a number was found. All were odd per cents - greater than 100% and were expressed as decimals. 20 minutes was the time allowance.

Interval = 10
Highest score = 100
Lowest score = 10

Scores

80	80	90	80	80
90	80	80	90	70
10	70	100	70	80
60	80	70	70	80
80	60	90	40	70

Class Interval	Freq. Tally	Freq. No.	Midpoints	Percentages	Cumul. Freq.	Cumul. %'s
100 - 109.9	I	1	105.5	4	25	100
90 - 99.9	IIII	4	95.5	16	24	96
80 - 89.9	IIII IIII II	10	85.5	40	20	80
70 - 79.9	IIII II	6	75.5	24	10	40
60 - 69.9	II	2	65.5	8	4	16
50 - 59.9		0	55.5	0	2	8
40 - 49.9	I	1	45.5	4	2	8
30 - 39.9		0	35.5	0	1	4
20 - 29.9		0	25.5	0	1	4
10 - 19.9	I	1	15.5	4	1	4



Math. 7B

Comparison Sheet for Table VIII

The highest scores for both groups were 100.
The lowest score for 7B was 0.
The lowest score for 7A was 30.
The modes for 7A were 75.5 and 105.5 with 5 frequencies each.
The mode for 7B was 85.5 with 10 frequencies.

The Mean, Standard Deviation, and Coefficient of Variation follow.

7A	7B
M--75.9	M--79.5
SD--21.3	SD--18
V--28.1	V--22.6

7Bhas a higher mean than 7A by 3.6 points.
7B scores tend to scatter more around their central tendency than do 7A scores.
The middle 2/3 of 7B scores lie between 62 and 98.
The middle 2/3 of 7A scores lie between 55 and 97.
Both groups scored over the same part of the scale, except that 7A went 7 points farther down in the scale than 7B.
7B is 80% as variable as 7A.

The big slump of 7A's was due, in part, to the fact that four absentees had returned to school and had taken the test cold.

February 1, 1923 TA. Table IIA and Graph

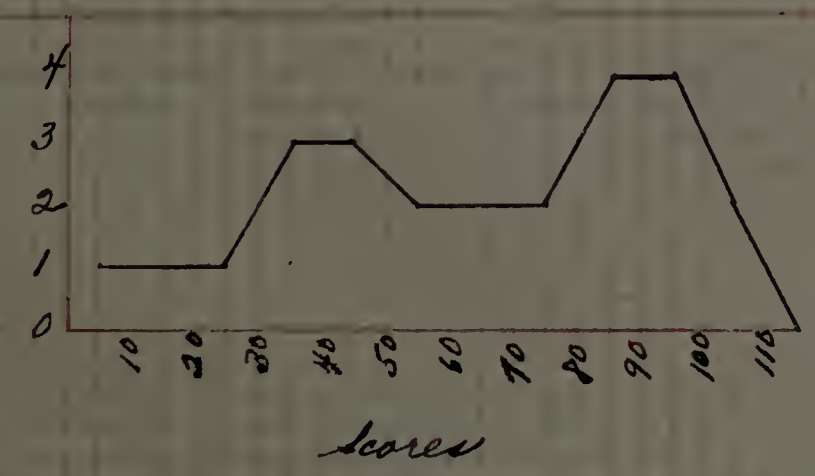
Frequency Polygon showing results of examples in which a part of a number was found. Per cents written in every possible way were used. The time allowed was 30 minutes.

Interval = 10
Highest Score = 100
Lowest Score = 0

Scores

30	100	100	80	90
80	80	70	40	30
30	40	80	60	10
90	70	90	60	40
50	30	50	0	90

Class Interval	Freq. Tally	Freq No.	Midpoints Mdpt. = ll + i/2	% 's N = 25 1/25 % 100 = 4%	Cumulative Freq.	Cumulative Percentages
100-109.9	I	2	105.5	8	25	100
90-99.9	IIII	4	95.5	16	23	92
80-89.9	IIII	4	85.5	16	19	76
70-79.9	II	2	75.5	8	15	60
60.-69.9	II	2	65.5	8	13	52
50-59.9	II	2	55.5	8	11	44
40-49.9	III	3	45.5	12	9	36
30-39.9	III	3	35.5	12	6	24
20-29.9	I	1	25.5	4	3	12
10-19.9	I	1	10.5	4	2	8
0-9.9	I	1	5.5	4	1	4



Math TA.

Table IX B Graph

February 1, 1943 7B

Frequency Polygon showing results of 10 examples in which a part of a number was found. Percents written in every possible way were used. The time allowed was 30 minutes.

Interval = 10

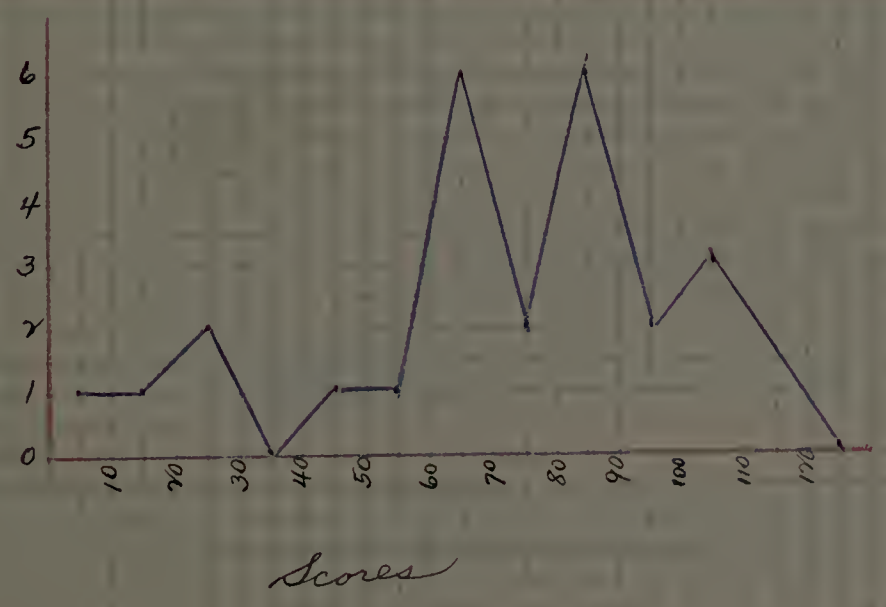
Highest score = 100

Lowest score = 0

Scores

40	80	100	60	70	80	90	80	60	60
0	80	70	100	10	60	70	80	50	70
	100	80	90	60	60				

Class Interval	Frequency Tally	Frequency No.	Midpoints Mpt = ll + i/2	% 's N = 75 1/75 x 100 = 4%	Cumulative Frequencies	Cumulative Percents
100 - 109.9	III	3	105.5	12	75	100
90 - 99.9	II	2	95.5	8	72	88
80 - 89.9	HH II	6	85.5	24	70	80
70 - 79.9	II	2	75.5	8	14	56
60 - 69.9	HH II	6	65.5	24	12	48
50 - 59.9	I	1	55.5	4	6	24
40 - 49.9	I	1	45.5	4	5	20
30 - 39.9		0	35.5	0	4	16
20 - 29.9	II	2	25.5	8	4	16
10 - 19.9	I	1	15.5	4	2	8
0 - 9.9	I	1	5.5	4	1	4



Comparison Sheet for Table IX

The highest score for both groups was 100.
The lowest score for both groups was 0.
The modes for 7B were 65.5 and 85.5, with 5 frequencies each.
The modes for7A were 85.5 and 95.5, with 4 frequencies each.

The Mean, Standard Deviation, and Coefficient of Variation follow.

7A	7B
M--64.7	M--69.5
SD--28.5	SD--27
V--44	V--38.8

The Mean for 7B was 4.8 points higher than for 7A.
7B scores scatter more around their central tendency than do 7A scores.
The middle 2/3 of 7B scores lie between 43 and 97.
The middle 2/3 of 7A scores lie between 36 and 93.
Both groups have about the same range, but 7B scores lie more toward the upper part of the scale.
7B is 88% as variable as 7A.

Find:

1. 26% of $32.50
2. 1.06% of $215
3. 37½% of $480
4. 2¼% of $685
5. 5 3/8% of 216
6. .9% of $500
7. 4% of 1200
8. 14 2/3% of 86
9. 175% of $2000
10. 3/8% of 912

See Table X with Graph and Comparison sheet which follow immediately.

On February 19th, a problem test of ten examples was given.[1] Both groups had been getting daily practice with real problems. 7B also did problems from the text for class and home assignments. 7A did their problems from dictation and from the board. These problems in the written test taken by both groups were a mixture of Types I and II in percentage. Forty minutes were allowed for the written work. This test was as follows:

1. The population of a certain city is 96,000. 24% are of foreign birth. How many foreigners are there?

2. James answered correctly 12 questions out of 20 in a history examination. What per cent did he answer correctly?

3. If 12% of the school children remained away from school on account of a storm, how many were absent, there being 1850 pupils enrolled?

4. In a school of 650 pupils, 60% are girls. How many boys are there in school?

5. 200% of 28 is what?

[1] Gilmartin and Russell--Advanced Problems in Arithmetic pp. 40-43

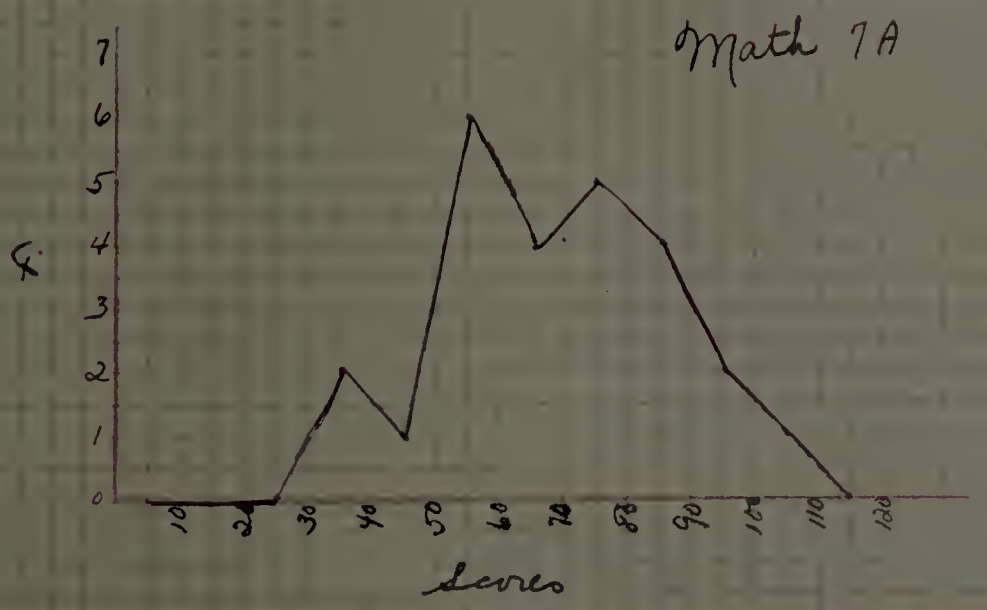
This was a lesson of 10 examples in which a part of a number was found. Every possible way of writing per cents was used. Time allotment was 30 minutes.

Interval = 10
Highest score = 100
Lowest score = 30

Scores

50	70	85	70	70
60	85	90	40	50
30	60	30	50	60
85	50	100	52	60

Class Interval	Freq. Tally	Freq. No.	Midpoints	Percentages	Cumulative Freq.	Cumulative %
100 - 109.9	1	1	105.5	4	25	100
90 - 99.9	11	2	95.5	8	24	96
80 - 89.9	𝍸	4	85.5	16	22	88
70 - 79.9	𝍸 1	5	75.5	20	18	72
60 - 69.9	𝍸	4	65.5	16	13	52
50 - 59.9	𝍸 11	6	55.5	24	9	36
40 - 49.9	1	1	45.5	4	3	12
30 - 39.9	11	2	35.5	8	2	8
20 - 29.9		0	25.5	0	0	0



Feb. 11, 1943. 7B Table and Graph IB

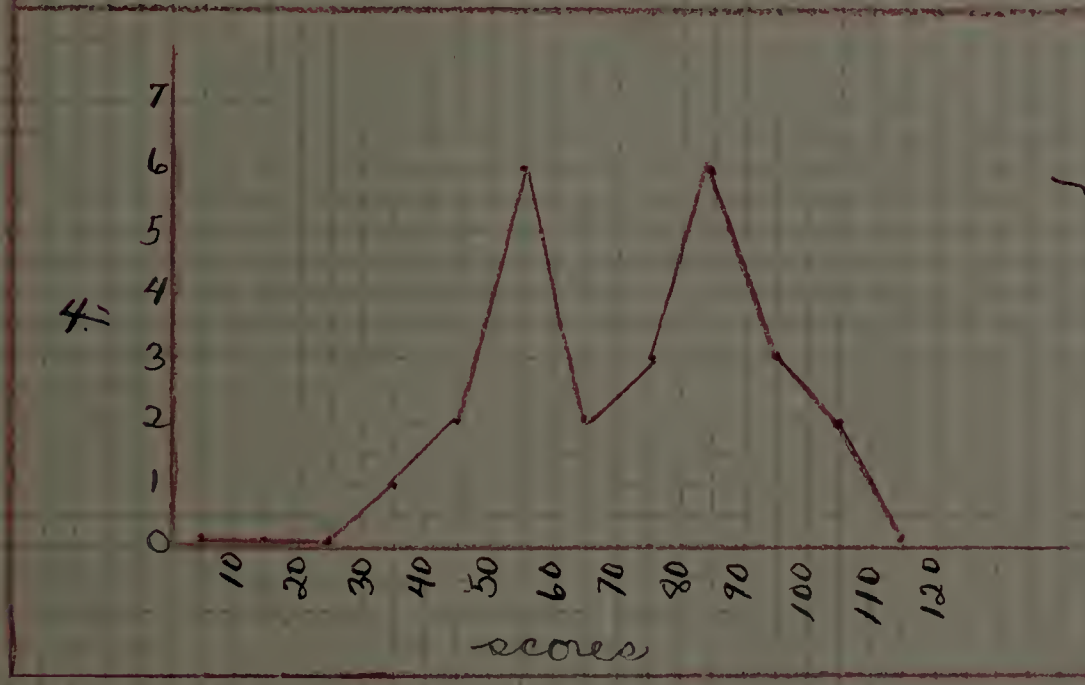
This was a lesson of 10 examples in which a part of a number was found. Every possible way of writing per cents was used. Time allotment was 30 minutes.

Interval = 10
Highest score = 100
Lowest score = 30

Scores

50	80	80	30	60
50	50	90	65	40
50	70	70	100	40
50	100	85	70	80
90	85	80	55	90

Class Interval	Freq. Tally	Freq. No.	Midpoints	% is N=25	Cumulative Freq	Cumulative % is
100-109.9	//	2	105.5	8	25	100
90-99.9	///	3	95.5	12	23	92
80-89.9	//	6	85.5	24	20	80
70-79.9	///	3	75.5	12	14	56
60-69.9	//	2	65.5	8	11	44
50-59.9	//	6	55.5	24	9	36
40-49.9	//	2	45.5	8	3	12
30-39.9	/	1	35.5	4	1	4
20-29.9		0	25.5	0	0	0



math 7B

Comparison Sheet for Table X

The highest score for both groups was 100.
The lowest score for both groups was 30.
The modes for 7B were 55.5 and 85.5 with 6 frequencies each.
The mode for 7A was 55.5 with 6 frequencies.

The Mean, Standard Deviation, and Coefficeient of Variation follow.

7A	7B
M--69.1	M--73.1
SD--17.8	SD--19.5
V--25.8	V--26.2

7Bhas a higher mean than 7A by 4 points.
7B scores scatter more around their central tendency than do 7A scores.
The middle 2/3 of 7B scores lie between 54 and 93.
The middle 2/3 of 7A scores lie between 51 and 87.
Both groups scored over nearly the same part of the scale.
7A is 98% as variable as 7B.

6. In a high school of 1,600 pupils there are 60 candidates for the football team. What per cent of the student body tries out for the team?

7. A dealer bought 360 yards of silk and sold all but 16 2/3%. How many yards did he sell?

8. Our basketball team won 5 games last year and lost 8 games. What was its per cent of victories?

9. A newsdealer sold 412 papers one week and the next week increased his sales 25%. How many papers did he sell in 2 weeks?

10. In an examination a pupil wrote 48 spelling words correctly and failed on 6 words. What per cent were spelled correctly?

See Table XI with Graph and Comparison sheet which follow immediately.

Case II in percentage had been introduced through the use of real problems. For example, you did 12 examples and got 8 right. What per cent did you have right? wrong? Or--our school collected $154.60 in war stamps. Our room contributed $28.75. About what per cent did we contribute? Or--there are 40 pupils in this class. Today, 5 are absent. What per cent are absent? present?

For Case II--finding what per cent one number is of another--the following illustrations show what is to be taught.

(a) What per cent of 8 is 4?

$\frac{4}{8} = \frac{1}{2} = 50\%$

(b) 9 is what per cent of 150?

$\frac{9}{150} = .06 = 6\%$

$$150\overline{)9.00} \quad .06$$
$$\underline{9\ 00}$$

Feb. 19, 1943 7A Table and Graph XI A

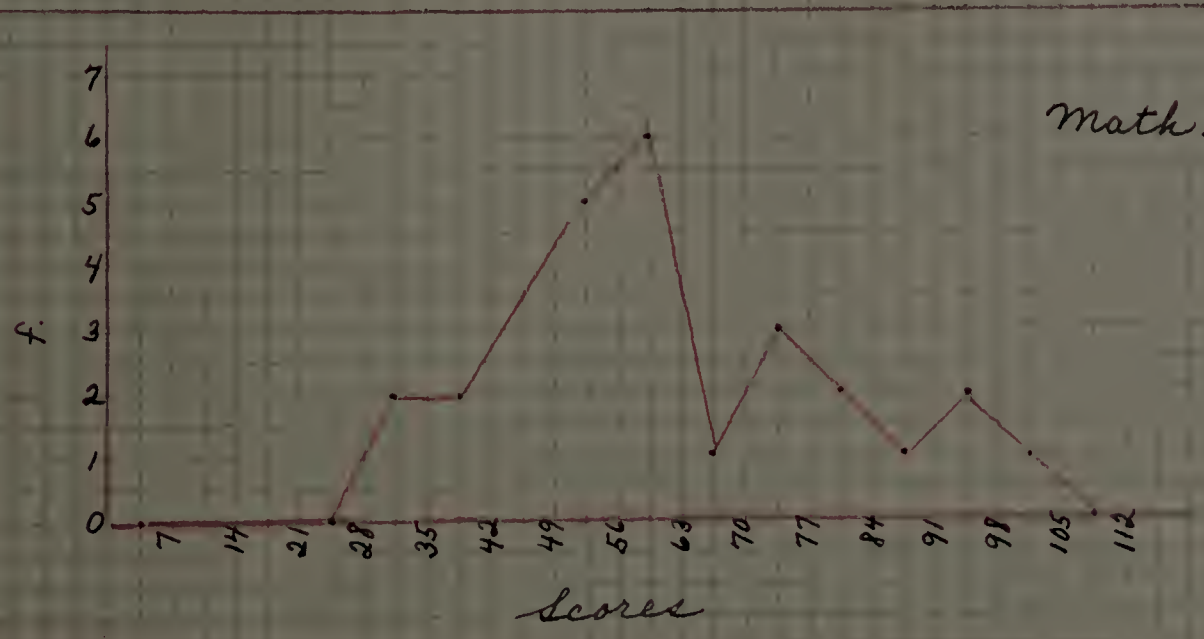
This was a problem test of 10 examples in which 6 examples were Type I and 4 examples were Type II. Time allotment was 40 minutes. The scores were found by dividing the number right by the number done.

Interval = 7
Highest Score = 100
Lowest Score = 30

Scores

50	60	60	70	60
50	70	85	65	30
35	35	60	80	50
75	50	100	95	40
80	60	50	30	95

Class Interval	Freq. Tally	Freq. No.	Midpoints Mdpts. = ll + i/2	Percentages	Cumul. Freq.	Cumul. %'s
98 - 104.9	I	1	101.5	4	25	100
91 - 97.9	II	2	94.5	8	24	96
84 - 90.9	I	1	87.5	4	22	88
77 - 83.9	II	2	80.5	8	21	84
70 - 76.9	III	3	73.5	12	19	76
63 - 69.9	I	1	66.5	4	16	64
56 - 62.9	𝍸 I	6	59.5	24	15	60
49 - 55.9	𝍸	5	52.5	20	9	36
42 - 48.9		0	45.5	0	4	16
35 - 41.9	II	2	38.5	8	4	16
28 - 34.9	II	2	31.5	8	2	8
21 - 27.9		0	24.5	0	0	0
14 - 20.9		0	17.5	0	0	0



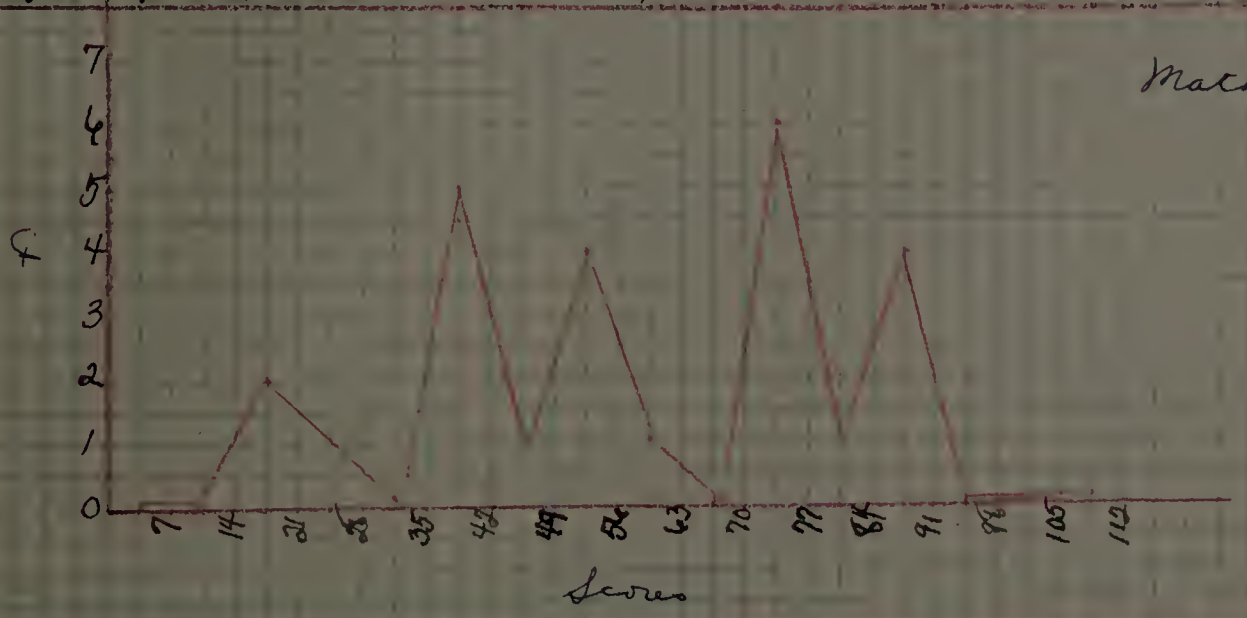
This was a problem test of 10 examples in which 6 examples were Type I and 4 examples were Type II in percentage. Time allotment was 40 minutes. The scores were found by dividing the number right by the number done.

Interval = 7
Highest score = 90
Lowest score = 20

Scores

40	20	90	50	80
60	55	85	75	45
35	70	75	76	50
35	35	55	40	70
25	20	86	85	70

Class Interval	Freq. Tally	Freq. No.	Midpoints	Percentages	Cumulative Freq.	Cumulative %
98-104.9		0	101.5	0	25	100
91-97.9		0	94.5	0	25	100
84-90.9	𝍸	4	87.5	16	25	100
77-83.9	/	1	80.5	4	21	84
70-76.9	𝍸 //	6	73.5	24	20	80
63-69.9		0	66.5	0	14	56
56-62.9	/	1	59.5	4	14	56
49-55.9	𝍸	4	52.5	16	13	52
42-48.9	/	1	45.5	4	9	36
35-41.9	𝍸	5	38.5	20	8	32
28-34.9		0	31.5	0	3	12
21-27.9	/	1	24.5	4	3	12



Comparison Sheet for Table XI

The highest score for 7A was 100.
The highest score for 7B was 90.
The lowest score for 7A was 30.
The lowest score for 7B was 20.
The mode for 7A was 59.5 with 6 frequencies.
The mode for 7B was 73.5 with 6 frequencies.

The Mean, Standard Deviation, and Coefficient of Variation follow.

7A	7B
M--63.4	M--57.5
SD--18.8	SD--21.9
V--29.7	V--38.1

7A has a higher mean than 7B by 5.9 points.
7A scores scatter more around their central tendency than do 7B scores.
The middle 2/3 of 7A scores lie between 45 and 82.
The middle 2/3 of 7B scores lie between 36 and 79.
7A is 78% as variable as 7B.

7A has done better on this problem test than 7B. 7A was more accurate and showed better reasoning ability than 7B. I think this lesson shows that the teaching techniques used have developed better thinking habits in the pupils.

(c) 2/3 is what per cent of 4/5?

$\frac{2/3}{4/5} = 83\ 1/3\%$

$2/3 \div 4/5$

$2/3 \times 5/4 = \frac{5}{6} = 83\ 1/3\%$

(d) $62\frac{1}{2}$ is what per cent of 80?

$\frac{62\frac{1}{2}}{80} = 78\ 1/8\%$

$62\frac{1}{2} \div 80$

$\frac{125}{2} \times \frac{1}{80} = \frac{25}{32}$

$32\overline{)25.00}$ = .78

224

260

256

$\frac{4}{32} = \frac{1}{8}$

The formula $(R = \frac{P}{B})$ was used with each example. Both groups were able to set up the formula themselves, after having done simple problems and analyzed them.

On February 26th, the first complete lesson for Case II was given both groups.[1] It was:

1. 88 is what per cent of 160?
2. 13 lb. is what per cent of 75 lb.?
3. What per cent of 245 bu. is 44.1 bu.?
4. 36 is what per cent of 192?
5. In an arithmetic test, Sam got 12 examples correct out of 15. What per cent did he do correctly?
6. The Windsor basketball team won 7 out of the 12 games they played this winter. What per cent did they win? lose?
7. $2.46 is what per cent of $8.20?
8. What per cent of 3000 is 36?
9. 231 is what per cent of 350?
10. What per cent of $1 is 20 cents?

See Table XII with Graph and Comparison sheet which follow immediately.

[1] De Groat and Young--Iroquois New Standard Arithmetics, Gr.7 p. 78

Feb. 26, 1943 7A. Table and Graph XII A

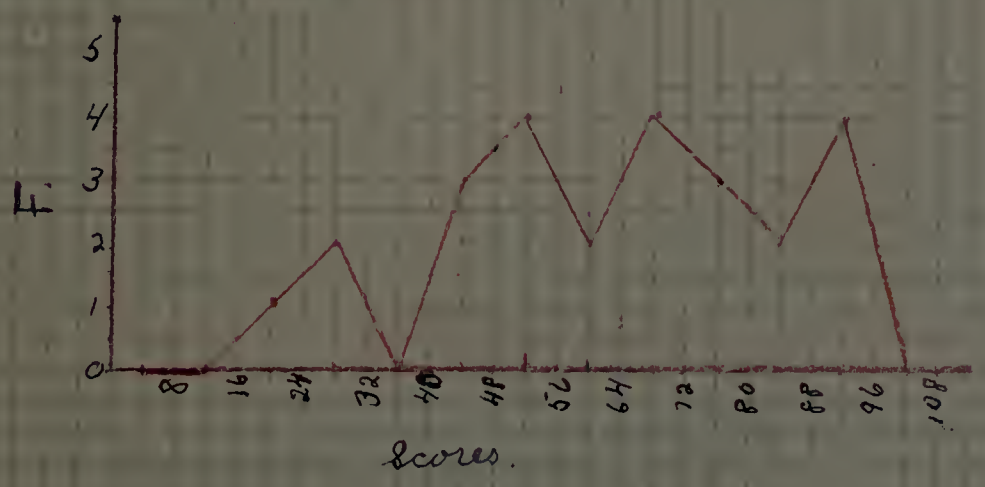
This graph shows results obtained on a ten-example test. Two of the ten examples were problems. all were type II in percentage. Enough time was allowed for everyone to finish. However, the time used did not exceed 60 minutes.

Interval = 8
Highest score = 95
Lowest score = 20

Scores

20	80	75	45	95
60	85	55	55	30
60	75	45	70	95
90	50	70	75	40
65	30	70	55	90

Class Interval	Freq. Tally	Freq. No.	Mid Points	Percentages	Cumulative Freq.	Cumulative %'s
88-95.9	𝍸	4	92.5	16	25	100
80-87.9	11	2	84.5	8	21	84
72-79.9	111	3	76.5	12	19	76
64-71.9	𝍸	4	68.5	16	16	64
56-63.9	11	2	60.5	8	12	48
48-55.9	𝍸	4	52.5	16	10	40
40-47.9	111	3	44.5	12	6	24
32-39.9.		0	36.5	0	3	12
24-31.9	11	2	28.5	8	3	12
16-23.9	1	1	20.5	4	1	4



Math. 7A

Table and Graph XII B

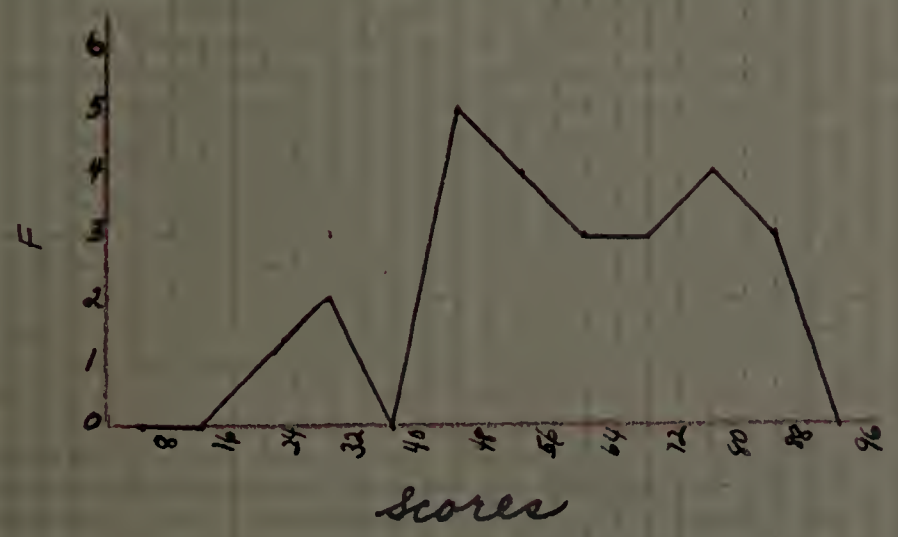
Graph showing results obtained on ten examples, two of which were problems. All examples were Type II in percentage. Time was allowed for everyone to finish. However, time used did not exceed 60 minutes.

Interval = 8
Highest score = 85
Lowest score = 20

Scores

40	30	70	45	70
55	30	80	85	55
55	45	85	60	75
40	75	55	60	60
75	65	75	45	20

Class Interval	Freq. Tally	Freq. No.	Midpoints	Percentages No. 25	Cumulative Freq.	Cumulative %'s
80-87.9	III	3	84.5	12	25	100
72-79.9	HTT	4	76.5	16	22	88
64-71.9	III	3	68.5	12	18	72
56-63.9	III	3	60.5	12	15	60
48-55.9	HTT	4	52.5	16	12	48
40-47.9	HTT I	5	44.5	20	8	32
32-39.9		0	36.5	0	3	12
24-31.9	II	2	28.5	8	3	12
16-23.9	I	1	20.5	4	1	4



Math. 7B

Comparison Sheet for Table XII

The highest score for 7A was 95.
The highest score for 7B was 85.
The lowest score for both groups was 20.
The modes for 7A were 52.5, 68.5, and 92.5, with 4 frequencies each.
The mode for 7B was 44.5 with 5 frequencies.

The Mean, Standard Deviation, and Coefficient of Variation follow.

7A	7B
M--63.4	M--58.3
SD--20.7	SD--17.8
V--32.7	V--30.6

7A has a higher mean than 7B by 5.1 points.
The scatter around the central tendency is better for 7A than for 7B.
The middle 2/3 of 7A scores lie between 43 and 84.
The middle 2/3 of 7B scores lie between 40 and 76.
7B is 93% as variable as 7A.

7A did much better than 7B on this test. This may be due to the fact that sufficient time was allowed for each child to finish the test. 7B had more speed but 7A had more accuracy.

Drill work on Case II was given both groups. 7B used exercises and problems provided in the text for board and seat work and for homework. 7A received all its drill in class time through oral and written dictation of examples and problems given by me. Also, 7A pupils made up their own examples and problems for practice work.

Another written lesson based on Case II was given both groups on March 10th.[1] The lesson was:

1. Find what per cent 64 is of 180.
2. 120 is what per cent of 300?
3. What per cent of 48 is 60?
4. Find what per cent .06 is of .3.
5. What per cent of 20 is 1.24?
6. 327 is what per cent of 450?
7. $450 is what per cent of $300?
8. What per cent of .2 is .5?
9. 840 lb. are what per cent of 10 gal.?

See Table XIII with Graph and Comparison sheet which follows immediately.

During the next class period, both groups corrected the above test. Common difficulties were worked on by the group in each class. Individual help was given by me in both classes also. The last fifteen minutes of each class period were spent in further drill, from the text for 7B, and from dictation for 7A.

On March 12th, a written lesson in which Cases I and II were combined was given to both groups. The lesson was:

1. What is 125% of $40.50?
2. 9 is what per cent of 18?
3. What per cent of 1 week is 2 da.?

[1] De Groat and Young--Iroquois New Standard Arithmetics, Gr.7 p.86

March 10, 1943 7A — Table and Graph XIII A

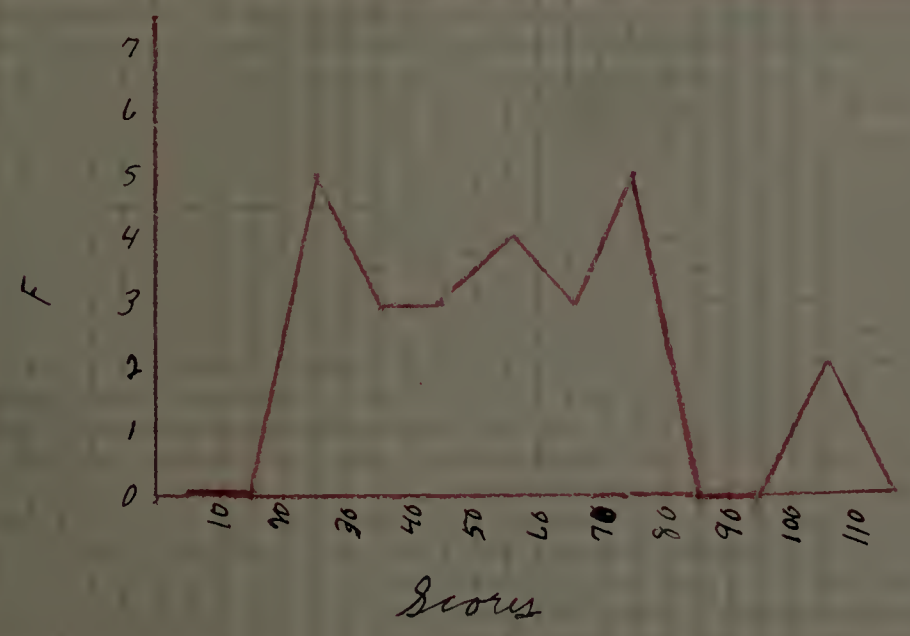
This lesson was made up of 10 examples of Type II. Everyone had time to finish, but not more than 40 min. was used.

Interval = 10
Highest score = 100
lowest score = 20

Scores

70	45	50	40	70
30	70	65	70	70
60	60	50	70	40
70	50	100	70	30
70	70	50	30	100

Class Interval	Freq. Tally	Freq. No.	Midpoints	Percentages N = 75	Cumulative Freq.	Cumulative %'s
100-109.9	II	2	105.5	8	75	100
90-99.9		0	95.5	0	73	92
80-89.9		0	85.5	0	73	92
70-79.9	𝍸 I	5	75.5	20	73	92
60-69.9	III	3	65.5	12	18	72
50-59.9	𝍸	4	55.5	16	15	60
40-49.9	III	3	45.5	12	11	44
30-39.9	III	3	35.5	12	8	32
20-29.9	𝍸 I	5	25.5	20	5	20
10-19.9		0	15.5	0	0	0



Math. 7A.

March 10, 1943 7B Table and Graph. XIII B

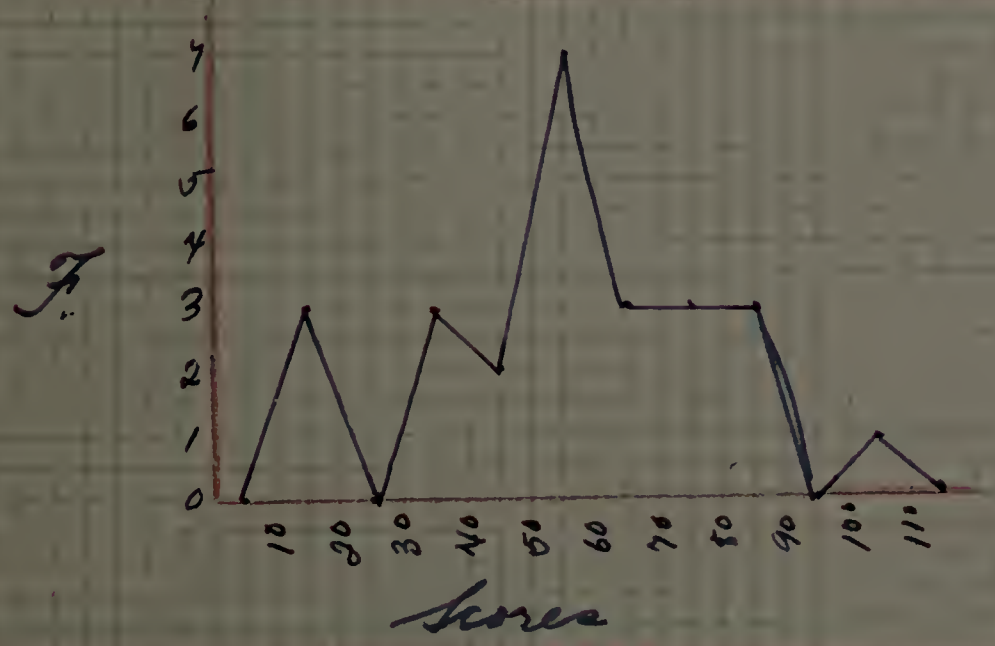
This lesson was made up of 10 examples of type II. Everyone had time to finish but not more than 40 minutes was used.

Interval = 10
Hightestscore = 100
Lowest score = 10

Scores

30	30	80	50	70
50	50	40	70	60
50	30	70	100	10
40	50	60	10	80
50	60	50	10	80

Class Interval	Freq Tally	Freq Nr.	Midpoints Mdpt.	% 's $\frac{N=25}{40}=4\%$	Cumulative Freq.	Cumulative % 's
100-109.9	1	1	105.5	4.	25	100
90-99.9		0	95.5	0	24	96
80-89.9	III	3	85.5	12	24	96
70-79.9	III	3	75.5	12	21	84
60-69.9	III	3	65.5	12	18	72
50-59.9	IIII III	7	55.5	28	15	60
40-49.9	II	2	45.5	8	8	32
30-39.9	III	3	35.5	12	6	24
20-29.9		0	25.5	0	3	12
10-19.9	III	3	15.5	12	3	12



Comparison Sheet for Table XIII

The highest score for both groups was 100.
The lowest score for 7A was 20.
The lowest score for 7B was 10.
The modes for 7A were 25.5 and 75.5 with 5 frequencies each.
The mode for 7B was 55.5 with 7 frequencies.

The Mean, Standard Deviation, and Coefficient of Variation follow.

7A	7B
M--55.9	M--56.7
SD--20	SD--23
V--35.8	V--40.6

7B has a higher mean than 7A by .8 of a point.
7B scores tend to scatter more around their central tendency than do 7A scores.
The middle 2/3 of 7B scores lie between 34 and 80.
The middle 2/3 of 7A scores lie between 36 and 76.
Both groups scored over almost exactly the same part of the scale.
7A is 88% as variable as 7B.

4. Find 2½% of 563.2 lb.
5. What is 2.9% of $500?
6. 60 cents are what per cent of $1?
7. Find 4/5% of $865.
8. 164 is what per cent of 900?
9. What is 63% of $821.65?
10. $3.50 is what per cent of $10?

See Table XIV with Graph and Comparison sheet which follow immediately. The above lesson was constructed by me.

Both groups are now ready for Case III. I introduced it to both classes in the same way. I showed the pupils 6 yellow pencils. I told them that those were 50% of what I had in all. They very quickly told me what the whole number was. Next, I showed them a dime. I said it was 20% of all the money I had. Knowing that the whole of anything is 100%, they had no difficulty in seeing that I had 50 cents. After several more easy examples were given, we were ready to set up the formula. They knew they were trying to find the base or whole number. They discovered that the number given in each example was the percentage, because it told them a part of the number. They discovered, through questions, that they had divided to get the answer, so the formula--$B=\frac{P}{R}$--was quickly determined.

This is the hardest type of percentage for most children, so much oral and written drill was given both groups. 7B, of course, had homework while 7A depended upon class work for practice.

The following are illustrations of Case III to be taught:

Math 7A March 12, 1943 Table XIV A and graph

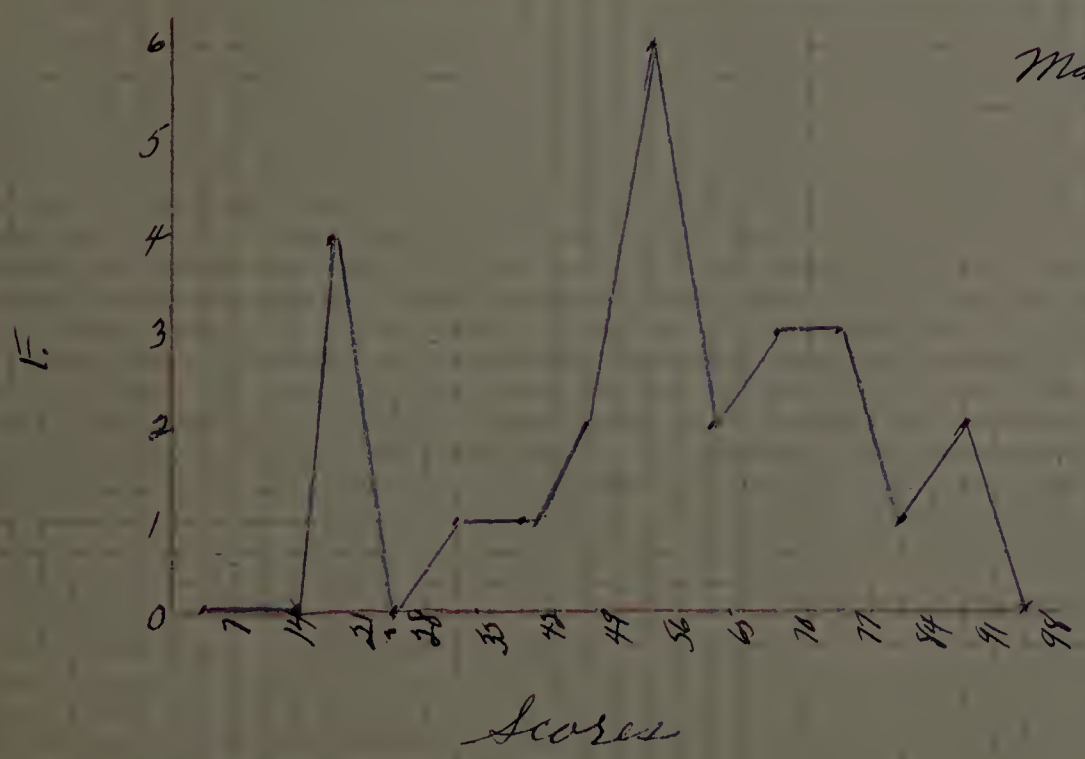
A Frequency Polygon showing the distribution of score in a lesson of 10 examples, combining Types I and II in percentage. The time limit was 45 min.

Interval = 7
Highest Score = 90
Lowest Score = 20

Scores

20	65	50	20	85
45	70	70	60	50
60	30	70	50	45
50	65	80	50	65
55	20	40	10	90

Class Interval	Freq. Tally	Freq. No.	Midpoint	Percentage N = 25	Cumulative Freq.	Cumulative %
84-90.9	II	2	87.5	8	25	100
77-83.9	I	1	80.5	4	23	92
70-76.9	III	3	73.5	12	22	88
63-69.9	III	3	66.5	12	19	76
56-62.9	II	2	59.5	8	16	64
49-55.9	4HII	6	52.5	24	14	56
42-48.9	II	2	45.5	8	8	32
35-41.9	I	1	38.5	4	6	24
28-34.9	I	1	31.5	4	5	20
21-27.9		0	24.5	0	4	16
14-20.9	4H	4	17.5	16	4	16



Math 7B March 12, 1943 — Table and Graph XIII B

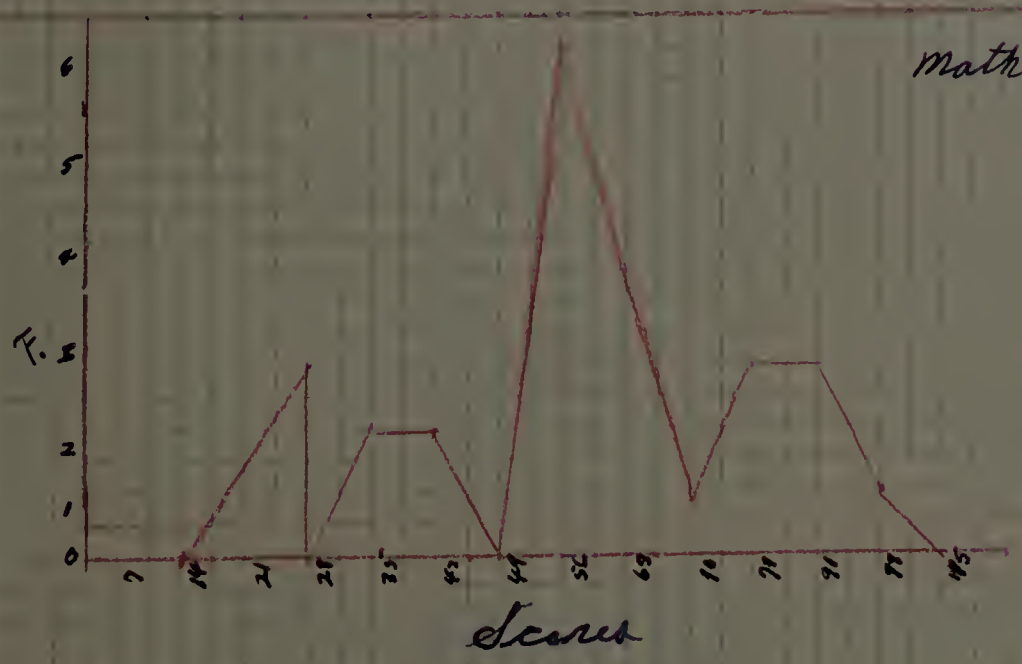
a Frequency Polygon showing the distributions of scores in a lesson of ten examples combining Types I and II.
The time limit was 60 min.
all had time to finish.

Interval = 7
Highest score = 90
Lowest score = 20

Scores

30	70	50	90	20	80
60	70	30	20	70	60
40	70	50	60	80	50
30	70	80	60	50	20
65	70	60	70	20	50

Class Interval	Freq. Tally	Freq. No.	Midpoints	Percentages N = 25	Cumulative Freq.	Cumulative %
84-90.9	I	1	87.5	4	25	100
77-83.9	III	3	80.5	12	24	96
70-76.9	III	3	73.5	12	21	84
63-69.9	I	1	66.5	4	18	72
56-62.9	IIII	4	59.5	16	17	68
49-55.9	IIIII	6	52.5	24	13	52
42-48.9		0	46.5	0	7	28
35-41.9	II	2	38.5	8	7	28
28-34.9	II	2	31.5	8	5	20
21-27.9		0	24.5	0	3	12
14-20.9	III	3	17.5	12	3	12



Camparison Sheet for Table XIV

The highest score for both groups was 90.
The lowest score for both groups was 20.
The mode for 7A was 52.5.
The mode for 7B was 52.5--with 6 frequencies for both groups.

The Mean, Standard Deviation, and Coefficient of Variation follow.

7A	7B
M--53.6	M--54.5
SD--20.8	SD--20.2
V--38.8	V--37.1

7B has a higher mean than 7A by .9 of a point.
The scatter around the central tendency is slightly better for 7B than for 7A.
The middle 2/3 of 7B scores lie between 34 and 75.
The middle 2/3 of 7A scores lie between 33 and 74.
Both groups scored over almost exactly the same part of the scale.
7B is 95% as variable as 7A.

(a) 32 is 66 2/3% of what number?

$B = \frac{P}{R}$

66 2/3% = 2/3

32 ÷ 2/3
32 x 3/2 = 48

(b) 18 is 15% of what number?

$B = \frac{P}{R}$

15% = .15

$$.15\overline{)18.00}\quad 120$$
15
30
30

(c) If 300% of a number is 21, what is 100% of it?

$B = \frac{P}{R}$

300% = 3

$$3\overline{)21}\quad 7$$
21

On March 17th, the first written test was given to both groups. It was as follows:

1. 18 is 75% of what number?
2. 60% of a number is 24. What is the number?
3. 37½% of a number is 36. Find the number.
4. 63 is 14 2/7% of a number. What is 100% of it?
5. When 6% of a number is 30, what is the whole number?
6. $500 is 25% of what amount?
7. Find the number of which 15 is 30%.
8. 15% of a number is 45. Find the number.
9. If 150% of a number is 18, what is 100% of it?
10. Find the number of which 324 is 9%.

See Table XV with Graph and Comparison sheet which follow immediately.

The tests were returned the next day for correction, and help was given where needed. On March 19th, another written test on Case III was given to both groups. It was:

1. What per cent of 84 is 96?
2. Find 35 % of $2.80.

March 17, 1943 7A XV A Table and Graph

A Frequency Polygon showing distribution of scores in a lesson of 10 examples - Type III in Percentage. No time-limit was set but all finished the assignment within 40 minutes. Two absences.

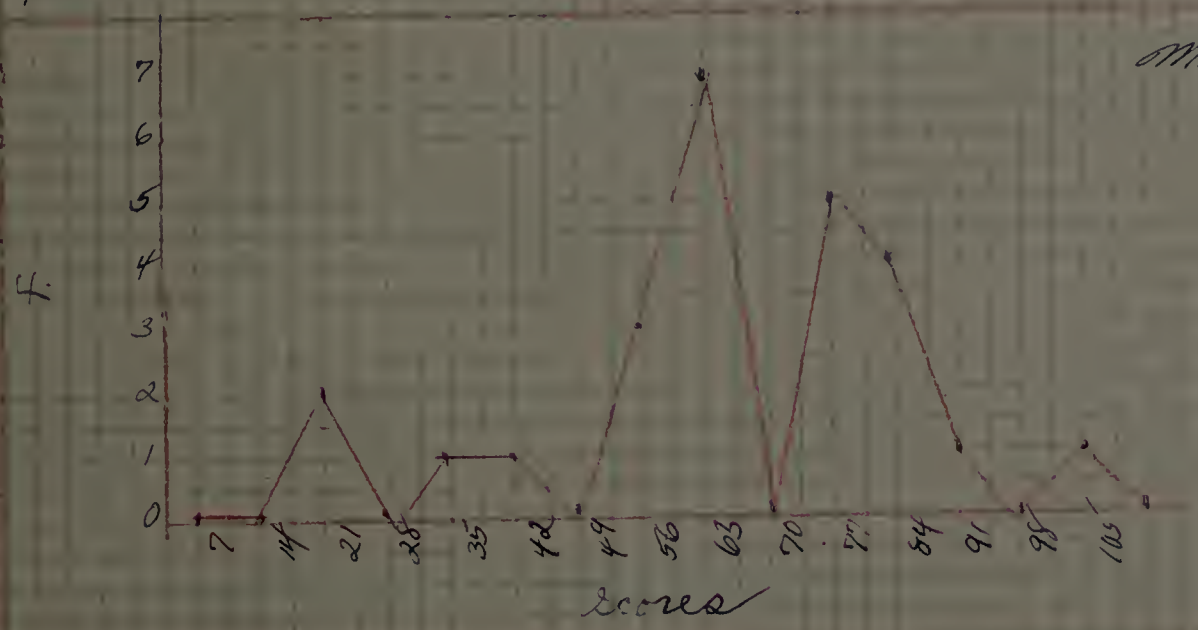
Interval = 7
Highest Score = 100
Lowest Score - 20

Scores

70	60	70	70	20
60	50	60	60	50
70	20	30	80	40
70	60	80	60	100
60	50	70	80	80

Class Interval	Freq. Tally	Freq. No.	Midpoints	Percentages H=25	Cumulative Freq.	Cumulative % 's
98-104.9	/	1	101.5	4	25	100
91-97.9		0	94.5	0	24	96
84-90.9	/	1	87.8	4	24	96
77-83.9	////	4	80.5	16	23	92
70-76.9	//// /	5	73.5	20	19	76
63-69.9		0	66.5	0	14	56
56-62.9	//// ///	7	59.5	28	14	56
49-55.9	///	3	52.5	12	7	28
42-48.9		0	45.5	0	4	16
35-41.9	/	1	38.5	4	4	16
28-34.9	/	1	31.5	4	3	12
21-27.9		0	24.5	0	2	8
14-20.9	//	2	17.5	8	2	8

March, 7A



Math 7B March 17, 1943 XV B Table and Graph

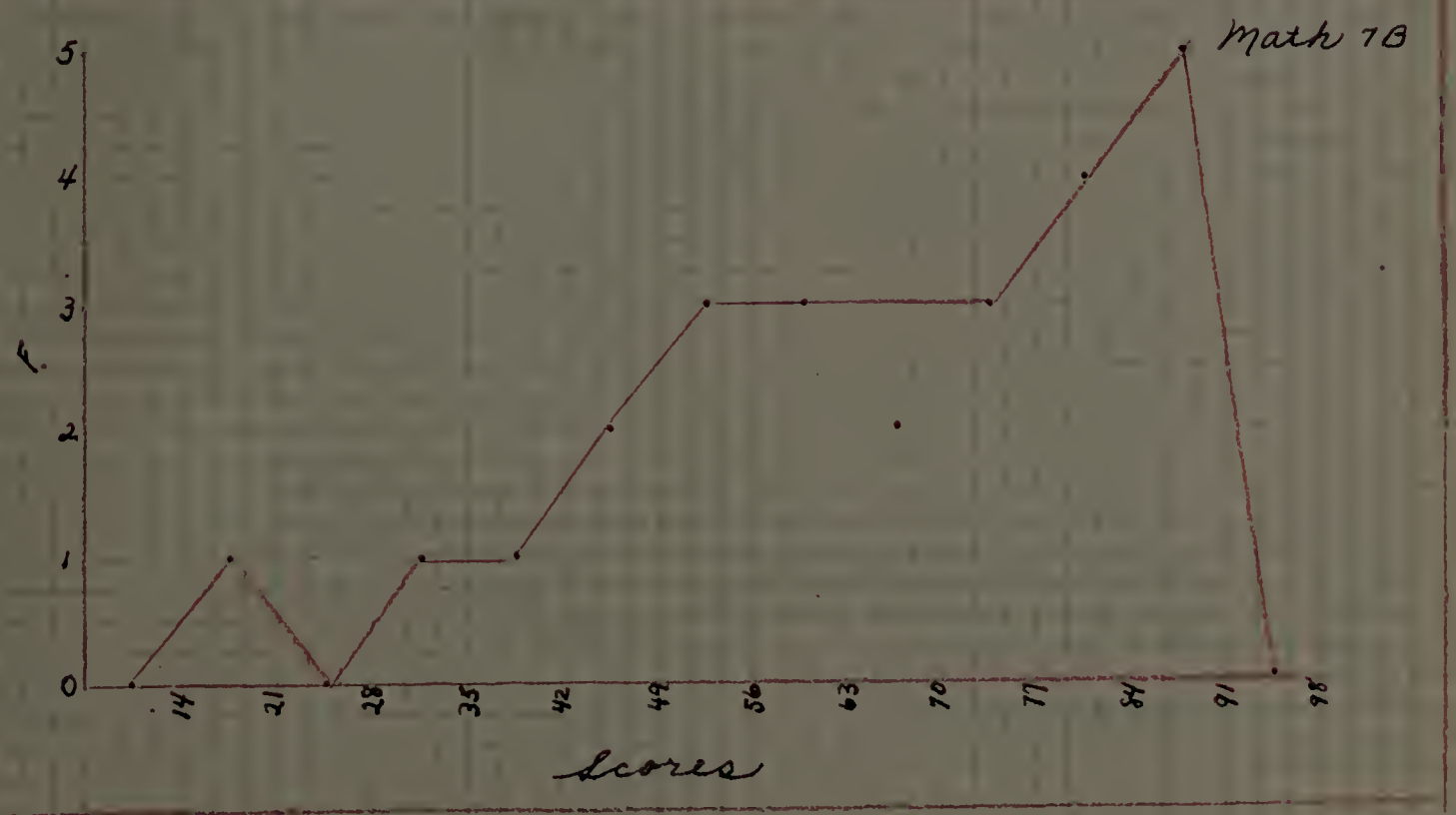
A frequency Polygon showing distribution of scores in a lesson of 10 examples - Type III in percentage. No limit on time was set but all finished the assignment within 40 minutes. There were no absences

Interval = 7
Highest score = 90
Lowest score = 20

Scores

30	45	90	65	70
90	80	65	70	20
60	80	60	80	40
45	90	90	65	50

Class Interval	Freq. Tally	Freq. no.	Midpoints	% 's N = 25	Cumulatives Freq.	Cumulatives % 's
84-90.9	⧻ I	5	87.5	20	25	100
77-83.9	⧻	4	80.5	16	20	80
70-76.9	III	3	73.5	12	16	64
63-69.9	II	2	66.5	8	13	52
56-62.9	III	3	59.5	12	11	44
49-55.9	III	3	52.5	12	8	32
42-48.9	II	2	45.5	8	5	20
35-41.9	I	1	38.5	4	3	12
28-34.9	I	1	31.5	4	2	8
21-27.9		0	24.5	0	1	4
14-20.9	I	1	17.5	4	1	4



Comparison Sheet for Table XV

The highest score for 7A was 100 while for 7B it was 90.
The lowest score in both groups was 20, making a range of 80 for 7A and 70 for 7B.
The mode for 7A was 59.5, while for 7B it was 87.5, with 7 and 5 frequencies respectively.

The Mean, Standard Deviation, and Coefficient of VAriation follow.

7A	7B
M--61.3	M--65.1
SD--20.2	SD--19.1
V--32.9	V--29.4

7B has a higher mean than 7A by 3.8 points. In other words, 7B scores tend to scatter more around their central tendency than do 7A scores.
The middle 2/3 of 7B scores lie between 46 and 84.
The middle 2/3 of 7A scores lie between 41 and 82.
The scatter for 7B is better, especially on the lower end of the scale.
7B is 89% as variable as 7A.

3. 216 is what per cent of 300?
4. 16 2/3% of a number is 12. What is the number?
5. Find 3.9% of $216.
6. 240 is 37½% of what number?
7. 180 is what percent of 210?
8. 16% of a number is 2080. What is the whole number?
9. What is 108% of 960?
10. Find 180% of $200.

This lesson was a combination of all three cases. It was constructed by me.

See Table XVI with graph and Comparison sheet which follow immediately.

Class interruptions for such activities as movies, tuberculin tests and readings, combined with poor attendance made it necessary to postpone the final test until April 1st.

The final test for both groups was a standard test. It was the Compass Diagnostic Tests--Test XIV--Basic Facts in Percentage--Form A. I chose this particular test because the authors are the same as for our textbook. Also, remedial and corrective measures are provided, and are based on the findings of the diagnostic testing. Too, the time limit was good--38 minutes for the whole test. Grade and age norms are included with the test. Finally, the tests were easy to score and were inexpensive.

There was one absence from each group when the final test was given. Since they were not to return to school until after the spring vacation, it was not possible to wait for them. One had scarlet fever, while the other had pneumonia. Both had A ratings for the experiment so the fianal results were not materially affected.

March 19, 1943 TA 60 Table and Graph. XVI A

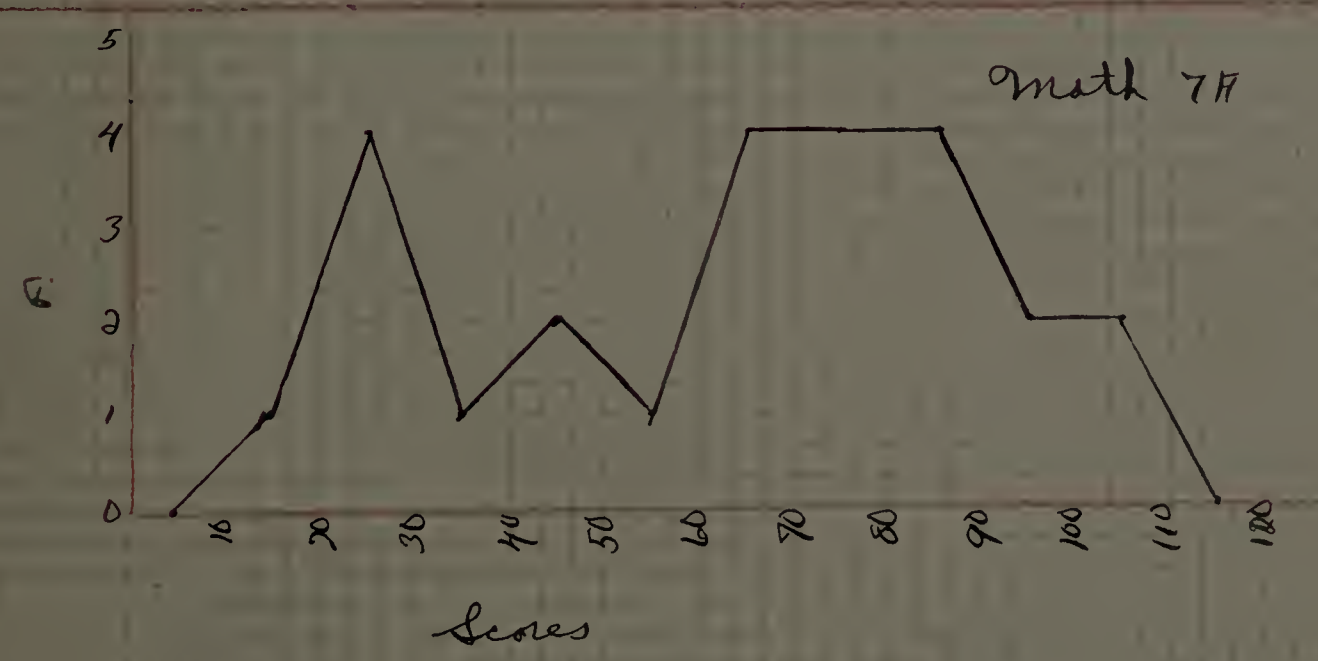
A Frequency Polygon showing a distribution of scores in a lesson of 10 examples, made of Types I, II, III in Percentage. No time limit was set but none required more than 50 minutes.

Interval = 10
Highest Score = 100
Lowest Score = 10

Scores

45	90	65	80	10
70	20	20	70	60
90	40	60	70	20
80	80	100	20	100
50	60	30	80	70

Class Interval	Freq. Tally	Freq. Nos.	Midpoints	Percentage H=25	Cumulative Freq.	Cumulative %
100 - 109.9	II	2	105.5	8	25	100
90 - 99.9	II	2	95.5	8	23	92
80 - 89.9	IIII	4	85.5	16	21	84
70 - 79.9	IIII	4	75.5	16	17	68
60 - 69.9	IIII	4	65.5	16	13	52
50 - 59.9	I	1	55.5	4	9	36
40 - 49.9	II	2	45.5	8	8	32
30 - 39.9	I	1	35.5	4	6	24
20 - 29.9	IIII	4	25.5	16	5	20
10 - 19.9	I	1	15.5	4	1	4
0 - 9.9		0	5.5	0	0	0



March 19, 1943 67B

Table and Graph XVI B

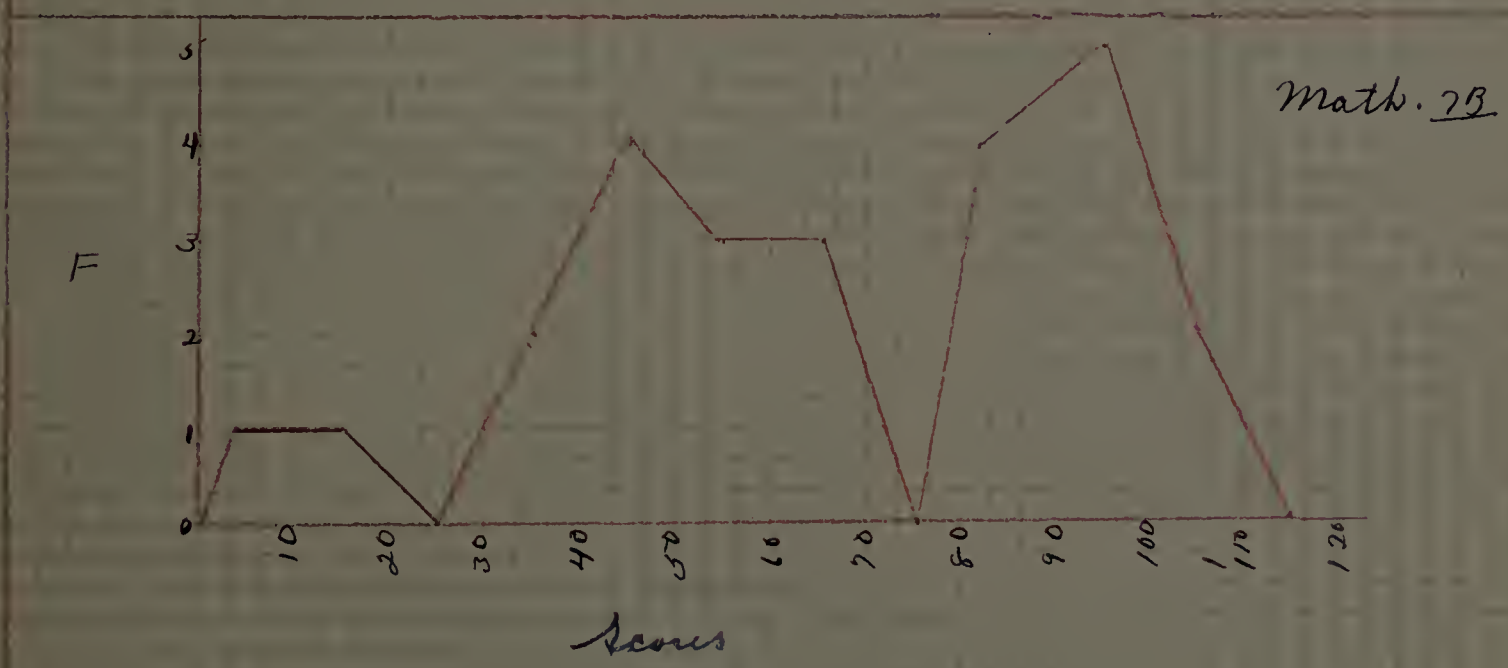
A Frequency Polygon showing distribution of scores in a lesson of 10 examples made up of Types I, II, and III in Percentage. No time limit was set but no one required more than 50 minutes.

Interval = 10
Highest Score = 100
Lowest Score = 0

Scores

30	40	100	55	10
90	80	100	90	0
60	55	60	90	80
10	85	90	85	40
45	90	40	50	30

Class Interval	Freq. Tally	Freq. No.	Midpoints	Percentages N=25	Cumulative Freq.	Cumulatives 70's
100 – 109.9	II	2	105.5	8	25	100
90 – 99.9	𝍸 I	5	95.5	20	23	92
80 – 89.9	𝍸	4	85.5	16	18	72
70 – 79.9		0	75.5	0	14	56
60 – 69.9	III	3	65.5	12	14	56
50 – 59.9	III	3	55.5	12	11	44
40 – 49.9	𝍸	4	45.5	16	8	32
30 – 39.9	II	2	35.5	8	4	16
20 – 29.9		0	25.5	0	2	8
10 – 19.9	I	1	15.5	4	2	8
0 – 9.9	I	1	5.5	4	1	4



Comparison Sheet for Table XVI

The highest score in both groups was 100.
The lowest score in 7A was 10 while in 7B it was 0.
In 7A, the modes were 25.5, 65.5, 75.5, and 85.5--each mode had 4 frequencies. In 7B, the mode was 95.5 with 5 frequencies.

The Mean, Standard Deviation, and Coefficient of Variation of both groups follow.

7A	7B
M--63.9	M--66.7
SD--26.6	SD--27.6
V--41.6	V--41.4

The mean for 7B is 2.8 points higher than it is for 7A.
By comparing the sigmas, 7B scores tend to scatter more around their central tendency than do 7A scores.
The middle 2/3 of 7B scores lie between 38 and 94.
The middle 2/3 of 7A scores lie between 37 and 91.
Both groups scored over almost exactly the same part of the scale.
7B is 99% as variable as 7A.

Both groups scored over almost the same part of the scale.
7B is 81% as variable as 7A.
8% of 7B and 4% of 7A scored above the grade norms for H8.
42% of 7B and 29% of 7A scored below the grade norms for H7.
7B did more examples on this test than did 7A, but 7A was more accurate than 7B.
The time allowance was 10 minutes.

For total scores, 54% of 7B and 50% of 7A scored above the grade norms for H8. 8% in both groups scored below the grade norm for H7. 92% of each group scored above the norms for age equivalents.
According to grade and age norms, both 7A and 7B did very well on this test.

Test XIV – The Basic Facts in Percentage: Form A Table and Graph

Part I – Equivalent Fraction, Decimal and Per Cent Relations

Time allowance was 15 minutes.

7A Interval = 3
Highest score = 57
Lowest Score 37

7B Interval = 3
Highest Score = 57
Lowest Score = 39

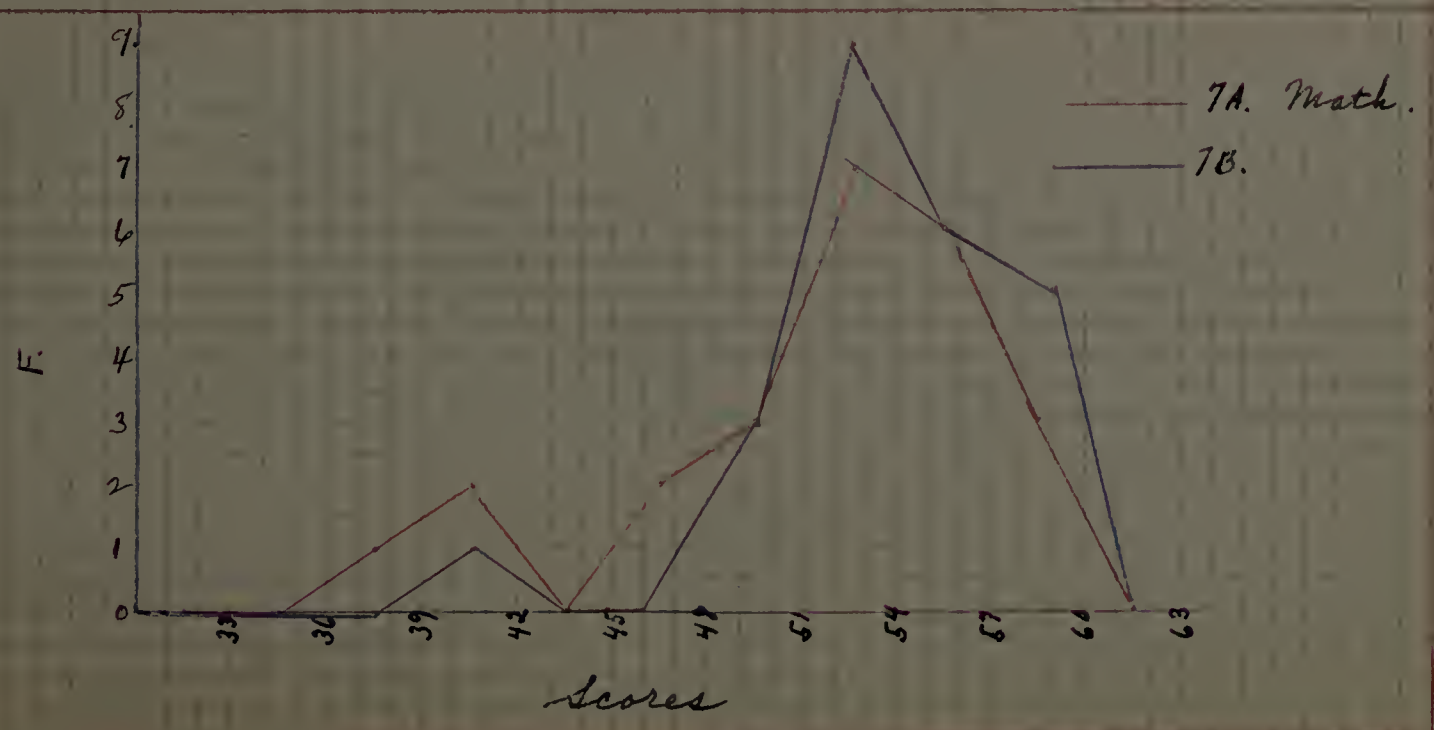
Scores

54	37	57	55	49
52	52	53	54	53
52	45	41	54	57
49	57	56	56	46
	52	40	50	53

Scores

57	53	48	57	50
53	54	51	52	57
53	57	56	55	53
54	50	39	57	53
	55	57	56	52

7A Class Interval	Frequency Tally	Frequency No.	Midpoints Mdpts = ll + ½	Percentages N = 24 ½4 × 100 = 4⅙%	Cumulative Frequencies	Cumulative Percentages
57–60.9	III	3	58.5	12½	24	100
54–56.9	𝍸 II	6	55.5	25	21	87½
51–53.9	𝍸 III	7	52.5	29⅙	15	62½
48–50.9	III	3	49.5	12½	8	33⅓
45–47.9	II	2	46.5	8⅓	5	20⅚
42–44.9		0	43.5	0	3	12½
39–41.9	II	2	40.5	8⅓	3	12½
36–38.9	I	1	37.5	4⅙	1	4⅙
7B 57–60.9	𝍸 I	5		20⅚	24	100
54–56.9	𝍸 II	6		25	19	79⅙
51–53.9	𝍸 𝍸 I	9		37½	13	54⅙
48–50.9	𝍸	3		12½	4	16⅔
45–47.9		0		0	1	4⅙
42–44.9		0		0	1	4⅙
39–41.9	I	1		4⅙	1	4⅙
36–38.9		0		0	0	0



Test XIV - The Basic Facts in Percentage: Form A. Table and Graph

Part II - Expressing Area in Per cents

Time Allowance was 4 minutes

7A
Interval = 1
Highest score = 12
Lowest score = 6

Scores

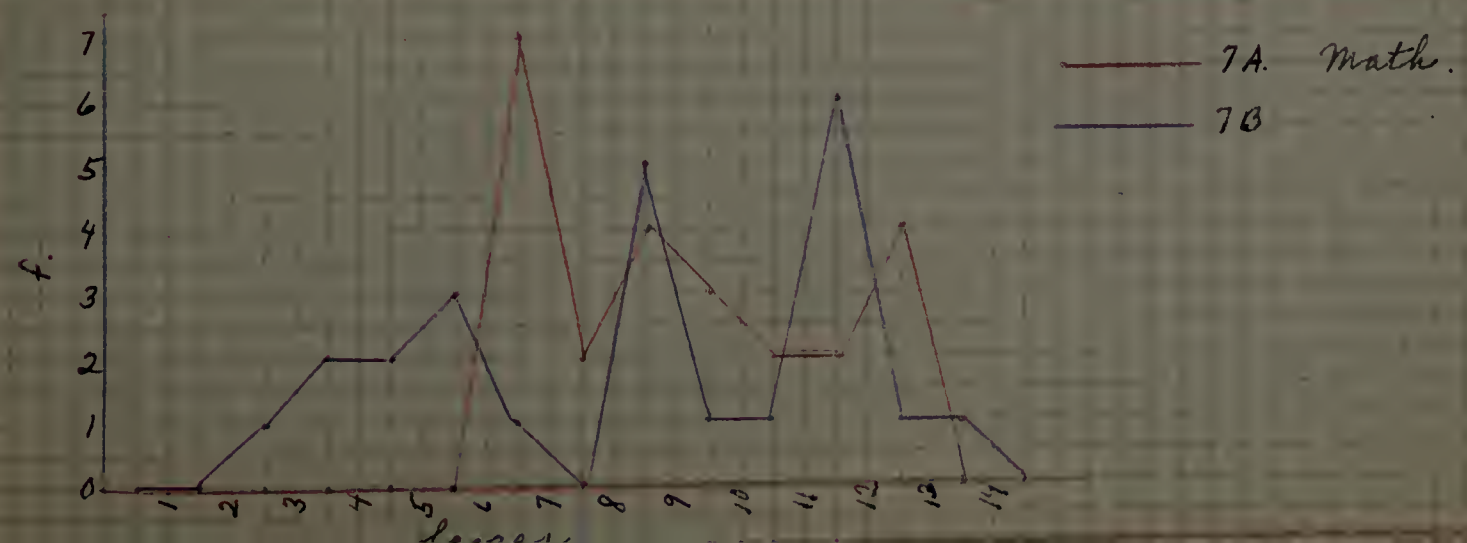
12	7	6	9	8
8	11	6	10	9
6	12	7	8	11
6	8	12	9	10
	12	6	6	6

7B
Interval = 1
Highest score = 13
Lowest score = 2

Scores

8	3	3	5	5
4	11	5	6	11
8	12	11	8	4
11	11	8	11	9
	10	2	13	8

7B Class Interval	Freq. Tally	Freq. No.	Midpoints	Percentages N = 24	Cumulative Frequency	Cumulative Percentages
13	I	1	13.5	4 1/6	24	100
12	I	1	12.5	4 1/6	23	95 5/6
11	HHII	6	11.5	25	22	91 2/3
10	I	1	10.5	4 1/6	16	66 2/3
9	I	1	9.5	4 1/6	15	62 1/2
8	HHI	5	8.5	20 5/6	14	58 1/3
7		0	7.5	0	9	37 1/2
6	I	1	6.5	4 1/6	9	37 1/2
5	III	3	5.5	12 1/2	8	33 1/3
4	II	2	4.5	8 1/3	5	20 5/6
3	II	2	3.5	8 1/3	3	12 1/2
2	I	1	2.5	4 1/6	1	4 1/6
7A. 13		0	13.5			
12	HH	4	12.5	16 2/3	24	100
11	II	2	11.5	8 1/3	20	83 1/3
10	II	2	10.5	8 1/3	18	75
9	III	3	9.5	12 1/2	16	66 2/3
8	HH	4	8.5	16 2/3	13	54 1/6
7	II	2	7.5	8 1/3	9	37 1/2
6	HHIII	7	6.5	29 1/6	7	29 1/6



Comparison Sheet

Test XIV--Basic Facts in Percentage

Part I--Equivalent Fraction, Decimal, and Per cent Relations

7A	7B
M--51.5	M--53.6
SD--5.58	SD--3.96
V--10.8	V--7.4

7B has a higher mean than 7A by 2.1 points.
7B scores cluster more around their central tendency than 7A scores.
The middle 2/3 of 7B scores lie between 49.6 and 57.5.
The middle 2/3 of 7A scores lie between 45.9 and 57.5.
Both groups scored over almost exactly the same part of the scale.
To compare the variability of the groups, 7B is 69% as variable as 7A.
In comparing the two groups with grade norms, I find that 96% of 7B is above the norm for H8 (end-year norms). 7A is 83 1/3% above the norm for H8. Since this is a diagnostic test, no remedial work is necessary for this part of the test. Both groups finshed the test in half the time allowed. (15 min.)

Part II--Expressing Areas in Per Cents.

7A	7B
M--8.5	M--7.4
SD--4.25	SD--3.64
V--50	V--49

7A has a higher mean than 7B by 1.1 points.
7A scores cluster more around their central tendency than 7B scores.
The middle 2/3 of 7A scores lie between 4.3 and 12.8.
The middle 2/3 of 7B scores lie between 3.8 and 11.1.
Both groups scored over nearly the same part of the scale.
7B is 98% as variable as 7A.
42% of 7B and 46% of 7A scored above the grade norms for H8.
37½% of 7B and 29% of 7A scored below the grade norms for H7.
Both groups had so much more time for Part I than they needed, they were unprepared for the short time allowed for part II.
The time allowance was 4 minutes.
Remedial work is needed for about 25% of both classes.

Test XIV – The Basic Facts in Percentages: Form A Table and Graph

Part III – Choosing Correct Solutions in Percentage

Time allowance was 4 minutes.

7A Interval = 1

Highest score = 12

Lowest score = 2

7B Interval = 1

Highest score = 13

Lowest score = 1

Scores

8	7	4	6	9
6	4	9	12	2
9	10	10	6	6
7	4	10	11	9
	2	5	3	9

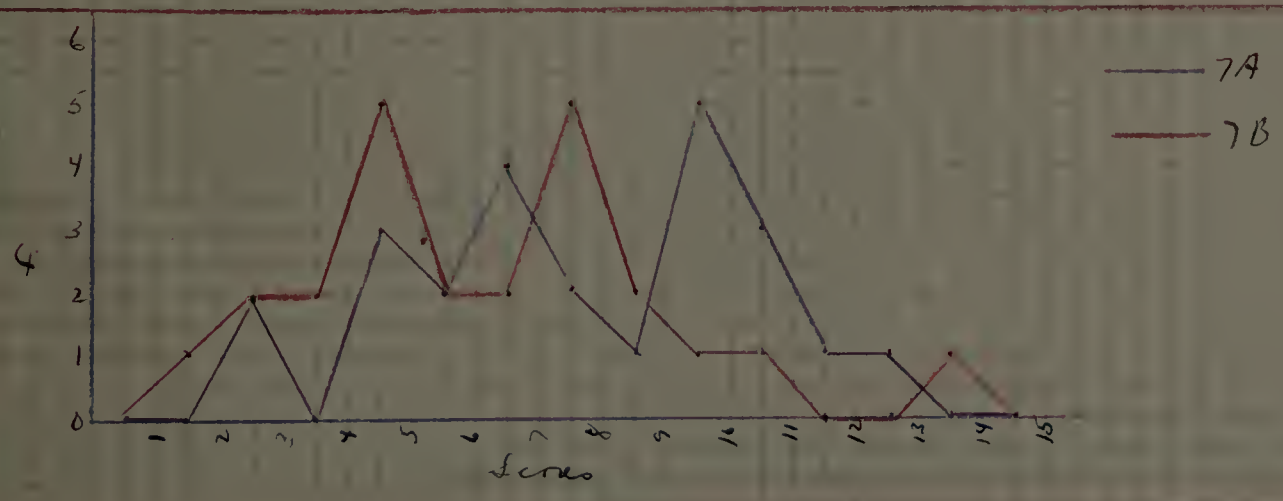
1	4	8	7	4
4	9	6	3	7
8	13	10	3	2
7	5	4	6	7
	5	2	1	4

7A

Class Interval	Freq. Tally	Freq. No.	Mid-points	Percentages N=24	Cumulative Freq.	Cumulative %'s.
13		0	13.5	0	24	100
12	I	1	12.5	4 1/6	24	100
11	I	1	11.5	4 1/6	23	95 5/8
10	III	3	10.5	12 1/2	22	91 2/3
9	HH I	5	9.5	20 5/6	19	79 1/6
8	I	1	8.5	4 1/6	14	58 1/3
7	II	2	7.5	8 1/3	13	54 1/6
6	HH	4	6.5	16 2/3	11	45 5/16
5	II	2	5.5	8 1/3	7	29 1/6
4	III	3	4.5	12 1/2	5	20 5/6
3		0	3.5	0	2	8 1/3
2	II	2	2.5	8 1/3	2	8 1/3
1		0	1.5	0	0	0

7B

13	I	1	4 1/6	24	100
12		0	0	23	95 5/8
11		0	0	23	95 5/8
10	I	1	4 1/6	23	95 5/8
9	I	1	4 1/6	22	91 2/3
8	II	2	8 1/3	21	87 1/2
7	HH I	5	20 5/6	19	79 1/6
6	II	2	8 1/3	14	58 1/3
5	II	2	8 1/3	12	50
4	HH I	5	20 5/6	10	41 2/3
3	II	2	8 1/3	5	20 5/6
2	II	2	8 1/3	3	12 1/2
1	I	1	4 1/6	1	4 1/6



Test XIV – The Basic Facts in Percentage — Table and Graph

Part IV – Easy Work in Percentage

Time allowance was 5 minutes.

7A
Interval = 1
Highest score = 14
Lowest score = 3

7B
Interval = 1
Highest score = 15
Lowest score = 3

Scores

12	5	7	9	9
6	3	5	8	8
4	10	5	7	5
3	4	14	4	8
	8	6	5	4

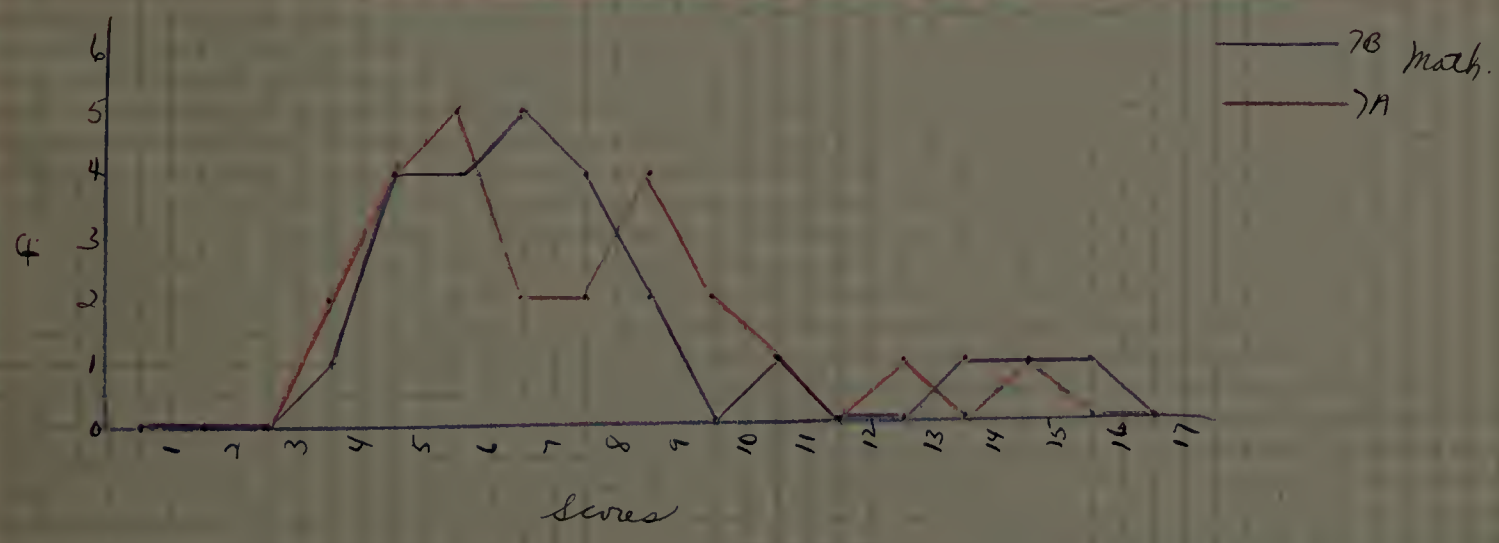
6	4	7	7	5
3	5	6	5	7
6	15	8	6	4
14	7	5	8	4
	10	6	13	4

7A

Class Interval	Freq. Tally	Freq. No.	Midpoint	Percentage N = 24 $\frac{1}{24} \times 100 = 4\frac{1}{6}$	Cumulative Freq.	Cumulative Percentages
15		0	15.5	0	24	100
14	1	1	14.5	$4\frac{1}{6}$	24	100
13		0	13.5	0	23	$95\frac{5}{8}$
12	1	1	12.5	$4\frac{1}{6}$	23	$95\frac{5}{8}$
11		0	11.5	0	22	$91\frac{2}{3}$
10	1	1	10.5	$4\frac{1}{6}$	22	$91\frac{2}{3}$
9	11	2	9.5	$8\frac{1}{3}$	21	$87\frac{1}{2}$
8	1HT	4	8.5	$16\frac{2}{3}$	19	$79\frac{1}{6}$
7	11	2	7.5	$8\frac{1}{3}$	15	$62\frac{1}{2}$
6	11	2	6.5	$8\frac{1}{3}$	13	$54\frac{1}{6}$
5	1HT1	5	5.5	$20\frac{5}{6}$	11	$45\frac{5}{6}$
4	1HT	4	4.5	$16\frac{2}{3}$	6	25
3	11	2	3.5	$8\frac{1}{3}$	2	$8\frac{1}{3}$

7B

Class Interval	Freq. Tally	Freq. No.	Midpoint	Percentage N = 24 $\frac{1}{24} \times 100 = 4\frac{1}{6}$	Cumulative Freq.	Cumulative Percentages
15	1	1	15.5	$4\frac{1}{6}$	24	100
14	1	1	14.5	$4\frac{1}{6}$	23	$95\frac{5}{8}$
13	1	1	13.5	$4\frac{1}{6}$	22	$91\frac{2}{3}$
12		0	12.5	0	21	$87\frac{1}{2}$
11		0	11.5	0	21	$87\frac{1}{2}$
10	1	1	10.5	$4\frac{1}{6}$	21	$87\frac{1}{2}$
9		0	9.5	0	20	$83\frac{1}{3}$
8	11	2	8.5	$8\frac{1}{3}$	20	$83\frac{1}{3}$
7	1HT	4	7.5	$16\frac{2}{3}$	18	75
6	1HT1	5	6.5	$20\frac{5}{6}$	14	$58\frac{1}{3}$
5	1HT	4	5.5	$16\frac{2}{3}$	9	$37\frac{1}{2}$
4	1HT	4	4.5	$16\frac{2}{3}$	5	$20\frac{5}{6}$
3	1	1	3.5	$4\frac{1}{6}$	1	$4\frac{1}{6}$



Test XIK – Basic Facts in Percentage: Form A — Table and Graph
Part V — Harder Work in Percentage
Time allowance was 10 minutes.

7A
Interval = 1
Highest score = 7
Lowest score = 0

Scores

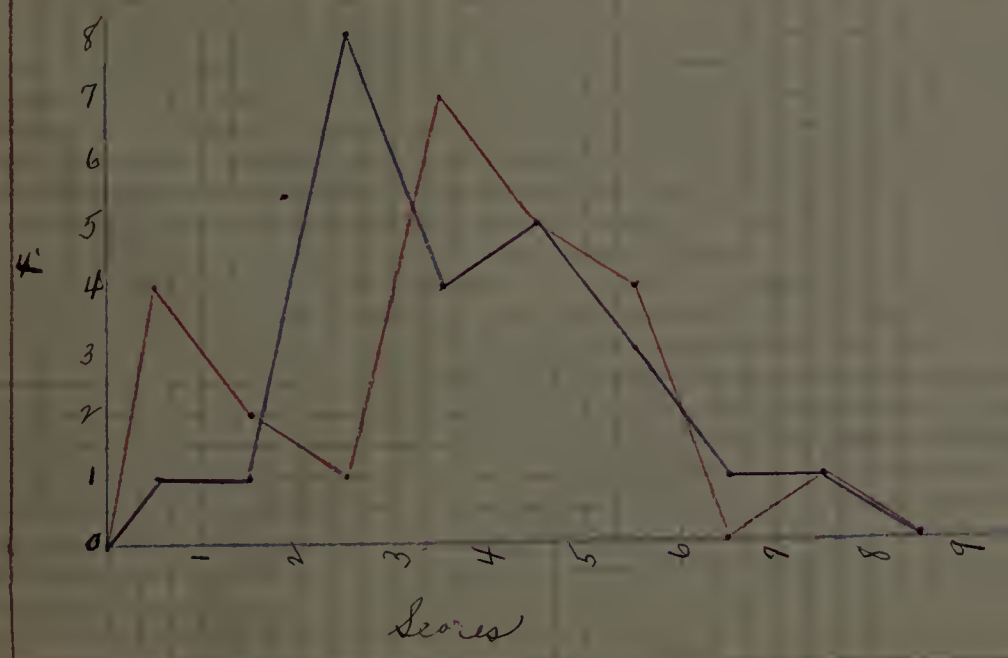
0	5	4	3	5	5	3	1
4	0	3	0	5	0	4	1
4	3	1	3	4	2	3	3

7B
Interval = 1
Highest score = 7
Lowest score = 0

Scores

2	2	5	1	3	5	3	3
4	6	5	2	4	7	0	2
4	3	4	2	4	2	2	2.

	Class Interval	Freq. Tally	Freq. No.	Midpoints Mdpt. = ll + 1/2	Percentage N = 24; 1/24 × 100 = 4 1/6 %	Cumulative Freq.	Cumulative Percentages
7A	7	I	1	7.5	4 1/6	24	100
	6		0	6.5	0	23	95 5/8
	5	HH	4	5.5	16 2/3	23	95 5/8
	4	HH I	5	4.5	20 5/6	19	79 1/6
	3	HH III	7	3.5	29 1/6	14	58 1/3
	2	I	1	2.5	4 1/6	7	29 1/6
	1	II	2	1.5	8 1/3	6	25
	0	HH	4	.5	16 2/3	4	16 2/3
7B	7	I	1	7.5	4 1/6	24	100
	6	I	1	6.5	4 1/6	23	95 5/8
	5	III	3	5.5	12 1/2	22	91 2/3
	4	HH I	5	4.5	20 5/6	19	79 1/6
	3	HH	4	3.5	16 2/3	14	58 1/3
	2	HH HH	8	2.5	33 1/3	10	41 2/3
	1	I	1	1.5	4 1/6	2	8 1/3
	0	I	1	.5	4 1/6	1	4 1/6



Test XIV Basic Facts in Percentage - Form A — TABLE AND GRAPH

Total Scores for both groups compared

Time allowance for whole test was 38 minutes

7A

Interval = 5

Highest score = 97

Lowest score = 57

Scores

91	71	57	86	86	73	78	57
73	74	77	88	83	78	97	87
74	96	70	66	66	65	70	77

7B

Interval - 5

Highest score = 91

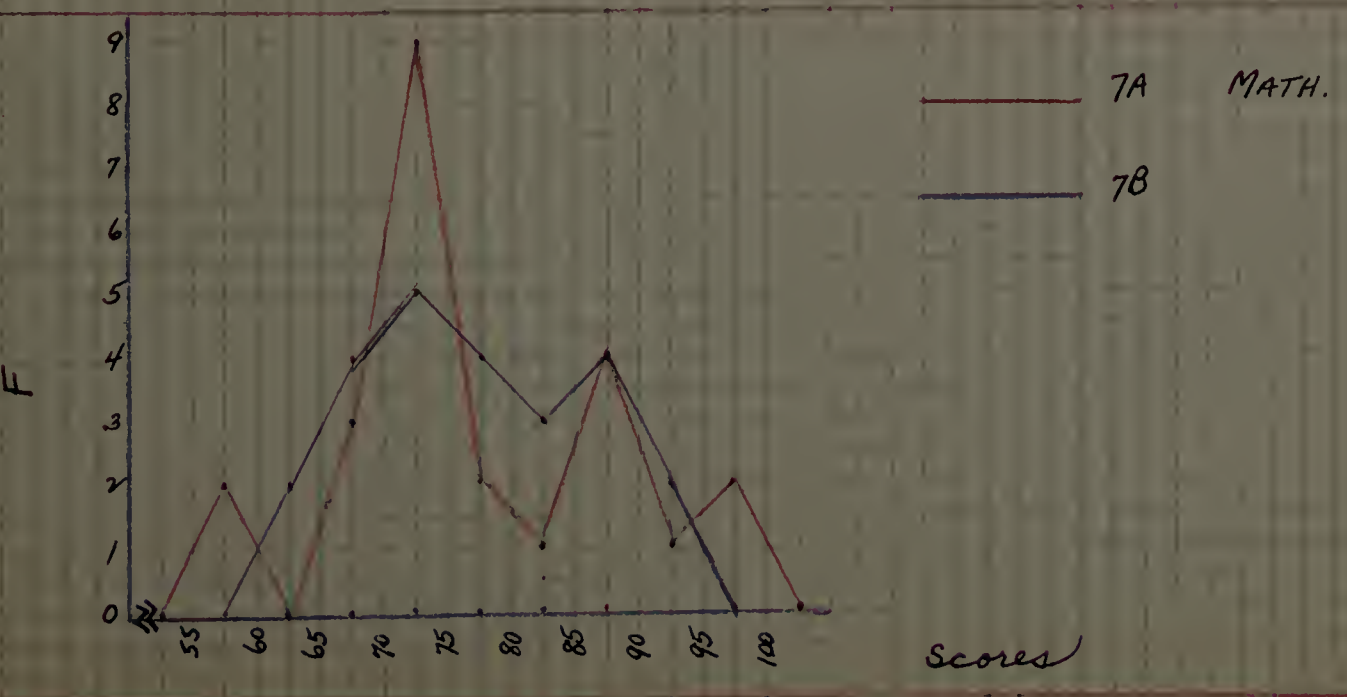
Lowest score = 60

Scores

77	65	69	81	67	88	60	91
70	84	70	70	89	77	63	73
78	91	87	76	65	84	85	70

7A Class Interval	Frequency Tally	Frequency No.	Midpoints	Percentages N=24	Cumulative Frequencies	Cumulative Percentages
95 - 99.9	II	2	97.5	8 1/3	24	100
90 - 94.9	I	1	92.5	4 1/6	22	91 2/3
85 - 89.9	⧻	4	87.5	16 2/3	21	87 1/2
80 - 84.9	I	1	82.5	4 1/6	17	70 5/6
75 - 79.9	II	2	77.5	8 1/3	16	66 2/3
70 - 74.9	⧻ ⧻ I	9	72.5	37 1/2	14	58 1/3
65 - 69.9	III	3	67.5	12 1/2	5	20 5/6
60 - 64.9		0	62.5	0	2	8 1/3
55 - 59.9	II	2	57.5	8 1/3	2	8 1/3

7B						
95 - 99.9		0	97.5	0	24	100
90 - 94.9	II	2	92.5	8 1/3	24	100
85 - 89.9	⧻	4	87.5	16 2/3	22	91 2/3
80 - 84.9	III	3	82.5	12 1/2	18	75
75 - 79.9	⧻	4	77.5	16 2/3	15	62 1/2
70 - 74.9	⧻ I	5	72.5	20 5/6	11	45 5/6
65 - 69.9	⧻	4	67.5	16 2/3	6	25
60 - 64.9	II	2	62.5	8 1/3	2	8 1/3
55 - 59.9		0	57.5	0	0	0



Part III--Choosing Correct Solutions in Percentage.

7A	7B
M--7.08	M--5.66
SD--2.72	SD--2.75
V--38.4	V--48.6

7A has a higher mean than 7B by 1.4 points.
7A scores scatter more around their central tendency than do 7B scores.
The middle 2/3 of 7A scores lie between 4.4 and 9.8.
The middle 2/3 of 7B scores lie between 2.9 and 8.4.
7A is better than 7B by 1.5 points on both ends of the scale.
7A is 79% as variable as 7B.
22% of 7B and 46% of 7A scored above the grade norms for H8.
50% of 7B and 29% of 7A scored below the grade norms for H7.
The time allowance was 4 minutes.
7B needs more practice in recognizing the types of percentage.

Part IV--Easy Work in Percentage.

7A	7B
M--6.62	M--6.88
SD--2.8	SD--3.1
V--42.3	V--45

7B has a higher mean than 7A by .26 of a point.
The scatter around the central tendency is slightly better for 7B than for 7A.
The middle 2/3 of 7A scores lie between 3.8 and 9.4.
The middle 2/3 of 7B scores lie between 3.8 and 9.9.
Both groups scored over almost exactly the same part of the scale.
7A is 94% as variable as 7B.
25% of 7B and 37½% of 7A scores are above the grade norms for H8. 46% of 7A and 37½% of 7B scored below the grade norms for H7. Remedial work in 7A is needed.
The time allowance was 5 minutes.

Part V--Harder Work in Percentage.

7A	7B
M--3	M--3.2
SD--1.85	SD--1.01
V--61.7	V--50.1

7B has a slightly higher mean than 7A.
The middle 2/3 of 7A scores lie between 1.15 and 4.85.
The middle 2/3 of 7B scores lie between 1.59 and 4.81.

CONCLUSION

In review and in generalization, the following statements might be made. I have found from this study that pupils in 7A, the experimental group, have become more interested in arithmetic, have learned to rely upon memory and training to a greater extent, and have a greater under standing of the values and uses of arithmetic. The fact that no text was used by the class was responsible for the most part. The class appreciated its responsibility. They made every effort to be present in school; they were more attentive in class; they learned to ask intelligent questions, to diagnose their own weaknesses, and to apply corrective measures with a minimum of help from me. They were happy to be free of homework, and learned to make the best use of class time in order not to need outside assignments.

Both groups did equally well. Because that is true, the hour of homework per week which 7B had should be changed to an hour of supervised study. Necessary drill for slow pupils could be given under ideal conditions and with expert help. Also, attention could be given those who could do more advanced work by supplying them with suitable materials and teacher guidance.

7A has become more self-reliant, but 7B has developed

more speed, due to the extra drill which the homework afforded. 7A was, per pupil, more accurate than 7B.

Absence did not play a telling role in this experiment. Both groups were about equal, 7A having had 145 absences compared with 157½ for 7B.

Finally, arithmetic is more interesting to the teacher and more meaningful to the pupils when it is taught without the use of a text. It places more responsibility upon the pupils and results in a more complete and lasting knowledge. As for homework, I should assign it only if the pupil desires it, or if more drill than the study hour affords is needed. Such a plan would take care of the very slow and the advanced pupil.

7A has done as well as 7B. Therefore, the so-called necessities--textbooks and homework--are not really essential to the teaching of arithmetic in the junior high school.

BIBLIOGRAPHY

Ruch, Knight, Studebaker--Study Arithmetics, Gr. 7
Chapters 2, 3, 4, and 8.
Scott, Foresman and Company, New York 1942

De Groat and Young--Iroquois New Standard Arithmetics, Gr. 7
Iroquois Publishing Company, Inc.
New York 1939

Gilmartin and Russell--Advanced Problems in Arithmetic
Newson and Company
New York 1930

Garrett--Statistics in Psychology and Education
Longmans, Green and Company
New York 1931

Approved: Walter S. Eisenmonger

S. Welles

Date: May 8, 1943