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An application of statistical method in an effort to improve the results of high school marking system

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AN APPLICATION OF STATISTICAL METHOD IN AN EFFORT TO IMPROVE THE RESULTS OF A HIGH SCHOOL MARKING SYSTEM

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STATE COLLEGE

AN APPLICATION OF DIFFUSION MODELS IN AN ATTEMPT TO ESTIMATE THE RESULTS OF A HIGH SCHOOL BASEBALL STUDY.

By

F. Wade Williams

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CHAPTER I

INTRODUCTION

A personal motivation for successful achievement in any human activity is adequate activation. This activating stimulus comes to us as individuals and as members of society in a multitude of ways and forms. In the school the principle instrument used to overcome natural human inertia is the mark or grade which issues from the instructor. While there are many educational controversies the decry our dependence on such an arbitrary and artificial stimulus as the grade we are placing the entire reward on the basis of immediate satisfactions or benefits to accrue through the subject matter itself, the fact remains that whether it is logical or entirely irrational, we, as average individuals, need the stimulation of some arbitrary motivation for maximum achievement. Grad time immemorial there has been in use some form of a competitive marking system, and it seems safe to assume that the contributory aspects have far overbalanced any undesirable results. In fact we may, the grading system has become so firmly entrenched in our educational institutions that even though it were considered good judgment to eradicate them, the process would be met with tremendous difficulties and wide opposition.

The general opinion of educators seems to be that our present grading systems and methods are fundamentally sound. At the same time there is common agreement that great evil lies in their misuse and abuse. Administrators of schools systems are generally aware that they have a difficult and delicate task in

training teachers to follow a uniform plan of grading. Many teachers use their grading prerogative as a necessary evil of little consequence. In the one case to be dealt with lightly and in the other to be used as a disciplinary gadget. If our several subjects are going to be assigned equal credits toward graduation, and if we are going to set up certain arbitrary hurdles, the attainment of which is necessary for passing and for college certification, then it is imperative that our teachers classify their students with careful uniformity and regularity by the use of a system of symbols whose values are thoroughly comprehended and applied consistently. In a well managed school system there should be no so called "easy" or "hard" teacher, but rather the work of the different courses should be so collimated and evaluated that a student would do the equivalent amount of work in earning a "B" grade in English as in earning a "B" grade in Economics. Obviously, this is speaking generally since it is perfectly true that individual students have greater interest in some particular subjects or are talented along certain lines. In such cases it is unnecessary to devote an equal amount of time to the study of all subjects.

The problem of securing a just return to the student for his work in all subjects with all teachers in the system, disregarding effects of quantity, personality and attitude, is one of the most serious the school administrators has to solve. The study submitted here is one effort to help solve this problem.

CHAPTER II

THE PROBLEM IN ITS SETTING

The purpose of this study is, then, not to conjure up some radical reasons or to propose some dazzling innovation but to make a careful analysis of the results of the grading system used in the Lenox High School in such a way as to reveal the grading discrepancies. The instrument used is approved statistical method. To give the study specific utilitarian value, the first findings were presented to the teachers involved and appropriate suggestions were made to try to secure a more rational marking system. To be more explicit the grades of the eleven full time teachers of the high school were carefully analyzed in the following manner. The grades for the years 1970, 1971, 1972 were ignored and eliminated and the means and standard deviations were computed according to Henry E. Garrett.(6) The results were then transposed into z-scale form as suggested by Garrett in Chapter II of his book. The tables and graphs were then used as a basis to indicate to the several teachers their tendencies, or non-conformity in maintaining the normal frequency curves of the high school. (It was considered reasonable to assume that in a three year period a late revelation would be made.) Each teacher was shown the results of their marking individually, and suggestions were made, which, if followed, would seem to bring about a more equitable distribution of marks. Later a faculty meeting was devoted primarily to a discussion of the findings from the grades of the three years. Each teacher was given a typed copy of the results and conclusions were offered. It was made clear that in January,

A STATISTICAL STUDY OF THE MARKING SYSTEM OF THE SENIOR HIGH SCHOOL

Teacher	1930 Av.	1930 S.D.	1931 Av.	1931 S.D.	1933 Av.	1933 S.D.	Av. No.
A	76.1	9.9	75.75	10.4	74.34	9.25	139
B	72.7	9.95	73.66	11.15	73.11	11.6	88
C	76.3	8.3	75.00	9.9	76.15	10.75	144
D	73.30	7.3	73.85	7.95	73.45	7.8	135
E	74.95	11.60	77.3	10.95	77.05	10.0	80
F	78.34	8.75	78.85	8.0	79.15	10.35	136
G	77.9	8.2	77.15	8.15	79.80	9.80	96
H	76.05	10.35	77.0	8.35	75.15	11.5	139
I	78.15	14.95	77.14	12.20	78.2	10.1	100
J	77.55	8.7	77.0	8.05	76.34	8.45	115
K	80.81	8.95	78.90	7.15	77.0	8.3	136
Mid. School	76.37	9.8	76.3	9.44	76.42	9.65	1120

A combined distribution
(1120 cases)

f	Inter	Frequency
95-99	41	1
90-94	4	5
85-89	81	15
80-84	7	30
75-79	74	38
70-74	8	20
65-69	2-	8
	1	
60-64	7	4
55-59	2	3
50-54	2	1
45-49	1	1

Av. 77.1 S.D. 8.20

1930	Average Mark Jan.	Average Mark June	S.D. Jan	S.D. June
Seniors	78.9	79.1	7.2	6.7
Juniors	77.04	78.32	8.45	8.6
Sophomores	77.2	78.4	9.8	9.1
Freshmen	76.68	77.18	8.4	8.8

Grand average for girls 77.00
Grand average for boys 76.80

Standard deviation for girls 8.38
Standard deviation for boys 8.6

Key: Av. = average
S.D. = standard deviation
No. = number

[illegible] another examination was to be made for the purpose of discovering if any improvement in the marking situation was forthcoming. As none of the teachers had more than 125 cards to grade, they were cautioned not to expect that absolute conformity to the suggested distribution would be available, or desirable. The emphasis of the meeting and of the personal conferences was on the premise that the accumulated grades of three years would show prevailing grading tendencies and that they should endeavor to modify them in the direction of the suggested distribution. Further evaluation will be found in the chapter dealing with the collection of data.

Instead of championing a new system, it was hoped by this procedure to remedy the import ant of the present system through careful analyses of grades, with a subsequent evaluation by the faculty. In brief then, it was the purpose of this investigation to discover whether the marking system of a high school might be improved by using a simple statistical method as a medium for revealing irregularities. After the irregularities were brought to light, it was anticipated that a brief instructional program with the teachers concerned would foster a more rational use of the marking system.

CHAPTER III

REVIEW OF RELATED LITERATURE

Educators have given considerable attention to the problem of marks and marking systems in all the grades. Many different ideas are expressed in the great quantity of literature on this subject. On the whole there is a general agreement of opinion as to the purpose of marks, the nature of the abuses, and the methods of improvement.

Odell (11) made a thorough investigation of high school marking systems in Illinois. In his survey of 421 schools he found numerous devices being used to symbolize scholastic achievement. Some schools were using the A, B, C, D system; some percent percentage; and some, numbers. One-fourth of the schools considered 70% as a passing mark; nearly three-fourths of the schools took 75% as their passing mark; and one school had 80% as the passing mark. Plus and minus signs after the letters (e.g. B+, B-) were not the rule. Two-thirds of the schools showed some concern about the normal frequency distribution. Odell found that the larger schools had the pivotal and more uniform systems. He was strongly of the opinion that marks should not be given arbitrarily to satisfy the normal frequency curve, but that in every case the allowance should be made for contingent circumstances.

Hale (7) in a study entitled "A Standard of Interpretation of Numerical Grades" expresses somewhat the same thought as Odell. Hale concludes that a rigid marking scale will foster a constrained judgment of the teacher and that the human elements of sympathy and encouragement will be ignored. As a corrective measure Hale advo-

notes that the school office interprets the marks of the various teachers by using a standard table. This is to be done without the teachers' knowledge.

Freeney (12) maintains, with a logical argument, that there is a normal distribution of work in a class only when there is an even or a normal distribution of incentives and a normal distribution of teaching effort. Freeney believes that the marking system should take account of school objectives and indicate the progress toward these objectives.

Barrer (10) brings out in his "Reflections on a New Method of Grading" that the speed of learning is an essential factor, and that there should be some symbol to show how long a time was required for the successful completion of a unit of work. He feels that this system would bring out the "natural best" of the pupils, and that with good teachers the speed of learning would be accelerated.

Henry (8) sees a danger in mechanical grading and confining to any mechanical device. He thinks it necessary to have knowledge of the background of the student to avoid injustice.

Cray (4) found that eighth grade marks were generally higher than marks in high school, and that teachers have wide criteria for marking. As a corrective measure, he lists the following factors to be considered in assigning marks: marks should (a) show native ability and accomplishment; (b) take account of the quality and quantity of accomplishment; (c) show improvement as measured by the objective scale; (d) show evidence of initiative; (e) show evidence of supplementary problems, and (f) show evidence

of ability to think and to organize ideas. Grey defines the passing mark as a mere standard for the teacher's judgment that the pupil has done creditably enough both in amount and quality to progress or to take work in advance, but no better. It is the mark given when in the opinion of the teacher a definite assignment has been perfectly performed.

Bolton (2) differs with Starch (15) as to the variation in teachers' marks. Bolton finds that marks are mostly reliable. Out of 325 ratings he found the average of all variations to be but 5.1%.

Canning (5) shows the positive standard for grading academic work and necessarily a relative standard. Because seniors are a more select group than freshmen he would have different marking standards. He also finds that many teachers avoid awarding the highest marks. To improve conditions, Canning suggests grouping students into ten groups on the basis of relative merit.

Moyer (3) has found in a comparative study of marks from eight high schools in the Connecticut Valley, that the regularity of the marking is quite remarkable and that in each case there exists a normal marking condition. By a normal condition, Moyer means that 68.26% of the marks awarded by a particular school are distributed within the range of the mean, plus the standard deviation and the mean minus the standard deviation. The means in these cases were 76.4% to 77.1% or 10.3%. The range in standard deviations was from 9.5 to 11.1 or 1.6. This investigation brought out the fact that the Agawam High School with a mean of 76.4% had the lowest mean of any school represented in the study. This fact

are considered in determining the ideal distribution of marks for the high school.

Jaggard (9) shows that a five point marking system will develop a central tendency and that if teachers are properly informed on the subject there will result a desirable distribution of marks.

Hunt (13) would conduct an educational campaign with his teachers as to the meaning of marks. He would substitute clear cut statements for obscure literal and numerical symbolism. For example, instead of John's mark in english being 75%, he would say that he can recall 17 out of 20 words in column 3 on the xyrat scale.

Starch (15) in a study of how the variability of marks can be reduced concludes that the marks of each teacher should be analyzed and then there should be a consensus of opinion on a common plan for marking and the acceptance of some definite distribution to which all teachers may adhere.

Symonds (16) lists as the purpose of marks the following:

1. To inform pupils and parents of pupils' achievement
2. as incentives to study
3. to promote competition
4. to determine promotion
5. to determine graduation
6. to help predict pupils' future success
7. to fulfill college requirements
8. to determine honor, credits, etc.
9. to determine participation in extra curricula activities

Hunt (13) gives as reasons for overlooking the marking systems the variability in teachers' marks; the unreliability of teachers' marks; and the inconsistency in the distribution of marks. He would improve this condition by publishing the distribution of

teachers' marks each semester; by discussions in teachers' meetings; by requiring teachers to plot grade each semester; by requiring teachers to rank pupils before assigning marks; by having committee report put word statement for each mark; by using objective tests; and by classifying pupils with general ability tests.

Buck (7) in a study of the marking system found great variance in teachers' marks. By taking 35 teachers at random, he found that some gave no A's while one allowed 1[illegible].3% A's. One teacher failed 3.3% of her class while another failed 55.6%. A like condition is shown by Bliss (1) who carried on an investigation in New Jersey schools. The charts following show his findings. He discovered that one department gave less than .5% A's while another gave 5.1% A's. One department failed 7.2% while another failed 29.6%. In the same department one teacher failed 40% more students than another. Bliss found very few teachers who marked in conformity to a normal distribution.

Table I

School	A	B	C	D	E	F	G	H	I	J	K	L	M
% of failure	16.2	17.	16.	[illegible]	11.	16.2	19.	d.	27.	1[illegible].	8.	15.	14.

These reports by various investigators are indicative of the following trends: the problem of standardization of marking is being studied cooperatively by teachers and administrators, these studies resulting in better understanding and in the adoption or improvement of definite systems of marking; the percentage system of marking is generally being discarded; a five point letter mark-

CHART II

Percentages of Failures by Subjects

Subjects	A	B	C	D	E	F	G	H	I	J	K	L	M
English	22	14	7	16	14	15	8	24	9	8	11	10	8
Latin	36	29	30	18	30	16	10	32	26	18	10	10	14
Mathematics	21	37	6.5	13	25	12	10	26	14	24	21	26	9
French	22	26	20	1	27	6	8	26	24	13	11	14	17
History	14	8	6	13	11	11	9	24	7	6	11	14	7
Physics	11.0	11	29	8	21	4	12	22	15	5	8	12	7

Variations in Percentages of Failures in the Same Department at the Hands of Different Teachers

Chart III

Subjects	Range of Failure in %
History	1.4 - 24.1
German	3.54 - 21.7
Physics	3.75 - 30.6
Latin	.8 - 29.1
French	.09 - 24.3
English	3.75 - 17.53
Art	3.24 - 21.69
Spanish	.00 - 17.6
Italian	8.33 - 24.3
Mathematics	1.01 - 26.8
Greek	.00 - 15.1

ing scale is coming into general use; a tendency to base marks on achievement only is noticed in popularity; teachers are given a more thorough understanding of the purpose and use of marks; greater use is being made of objective tests; some idea of conformity to the normal distribution is being recognized and used as a guide in standardizing the distribution of marks when large numbers are involved.

From the references quoted it seems, that there is ample evidence of a very definite need for the adoption of corrective measures in the use of marking systems.

CHAPTER IV

THE COLLECTION AND INTERPRETATION OF DATA

The marks used in this study were taken from the permanent record cards of the Agawam High School. The symbol A+ covers the interval from 95 thru 99; A from 90 thru 94; B+ from 85 thru 89; B from 80 thru 84; C+ from 75 thru 79; C from 70 thru 74; C- from 65 thru 69; D plus denied effort; D stands for unsatisfactory work. (Percentages are used in the office record cards and the letter symbols are used on the pupil report cards). The tabulation below shows a normal distribution of marks for the Agawam High School and is made the accepted basis for all comparisons which will appear in this study. As can be seen if a

Recommended Distribution

Interval	F	d	Fd	Fd^2
[illegible]	1	4	4	16
90-94	5	3	15	45
85-89	10	2	20	40
80-84	20	1	20	20
[illegible]	[illegible]	0	[illegible]	
[illegible]	[illegible]	-1	-20	20
[illegible]	[illegible]	-2	-10	[illegible]
[illegible]	[illegible]	-3	-12	[illegible]
[illegible]	2	-4	- 8	[illegible]
[illegible]	1	-5	- 5	[illegible]
[illegible]	1	-6	- 6	[illegible]
Total	100		-67	[illegible]

-67 / 100 = -.67

- 6

C = -.06

C = -.[illegible] x 5 = -.[illegible]

C^2 = .[illegible]

[illegible] = 77. -.[illegible] = 77.1

[illegible] = [illegible] -.[illegible] x 5 = [illegible]

Key for all tabulations

F - Percent

f - Frequency of occurrence

d - Deviation from the mean

Fd - Frequency times deviation

Fd^2 - Frequency times deviation squared

C - Correction

M - Arithmetic mean

S.D. - Standard deviation or scatter of cases around the mean.

teacher has 100 students to grade in a subject and conditions are ideal, 1 will be given a 1 or five 90 -95; 6 will receive an A or five 80-84; et cetera. Usually a teacher will not have exactly 100 students in every subject but it is a simple matter to keep the same general ratio of frequencies regardless of the number of students concerned. For example if the teacher should have 145 students in her classes she should have 1 x 1.45 or 1 in the 95-99 level, 5 x 1.45 or 7 in the 85-89 level et cetera. It will be noticed that the mean in this ideal distribution is 77.1 and that the standard deviation is 8.95. In the absence of a preliminary grading of each according to their frequency in the different levels over a period of several years, it was apparent that with a relatively small number of cases to deal with the distribution of marks would not exactly conform to the normal probability curve of chance distribution. With this fact in mind together with a knowledge of the actual conditions involved in the situation it seemed wise to adopt the preceding plan of mark distribution.

Table I gives the distribution of marks of the entire high school for the second term ending in January, 1930 in so far as the major courses were concerned. One-credit courses were not included in this study. It will be seen that the mean was 78.27, the standard deviation 9.5, and the mode (test point level showing the greatest frequency) was in the 75 thru 79.5 group. Graph I is a graphic representation of these same findings. The red line represents the actual distribution of data and the green line represents the corrected or computed distribution already ex-

TABLE I

Total Marks of All Students at Midyear 1930

X	F	d	fd	fd²
26-30	1	4	4	6
60-64	60	3	180	540
55-59	115	2	230	460
50-54	190	1	190	190
70-79	368	0	760	
70-74	297	-1	-297	297
65-69	80	-2	-160	320
60-64	65	-3	-195	585
55-59	25	-4	-100	400
50-54	30	-5	-150	750
45-49	29	-6	-174	1044
40-44	1	-7	- 7	49
	1100		-773	4077

$$\bar{d} = \frac{-773}{1100} = -.703$$

$$C = -.703 \times 5 = -3.52$$

$$\bar{x} = 77.5 - 3.52 = 74.02$$

$$\sigma^2 = .063$$

$$\therefore \sigma = \frac{4077}{1100} - .703^2 \times 5 = 1.5$$

plained. As is shown on the graph the school average is .02% below the theoretical average and the mode points are five points apart. Of particular interest is the plateau region between the 75 to 80 lines. The appearance of this irregularity furnished a further challenge to carefully analyse the entire marking situation in an effort to discover the reason or reasons for this abrupt falling off of frequency at the 75 to 80 level which should naturally be the modal point.

Table II and Graph II show the distribution of marks for the school term ending in January 1931. The condition is quite similar to that of the preceding year. The difference between the actual average and the theoretical average is .8%. The modes fall on the same lines as did the modes of the preceding year. The plateau region while still more in evidence is less pronounced. In brief then there has been no noteworthy change in the distribution of marks for the year 1931.

GRAPH 1

Total Scores in 1930

Interval	F
95 - 99	1
90 - 94	62
85 - 89	115
80 - 84	229
75 - 79	223
70 - 74	297
65 - 69	65
60 - 64	45
55 - 59	25
50 - 54	23
45 - 49	23
40 - 44	1
	1109

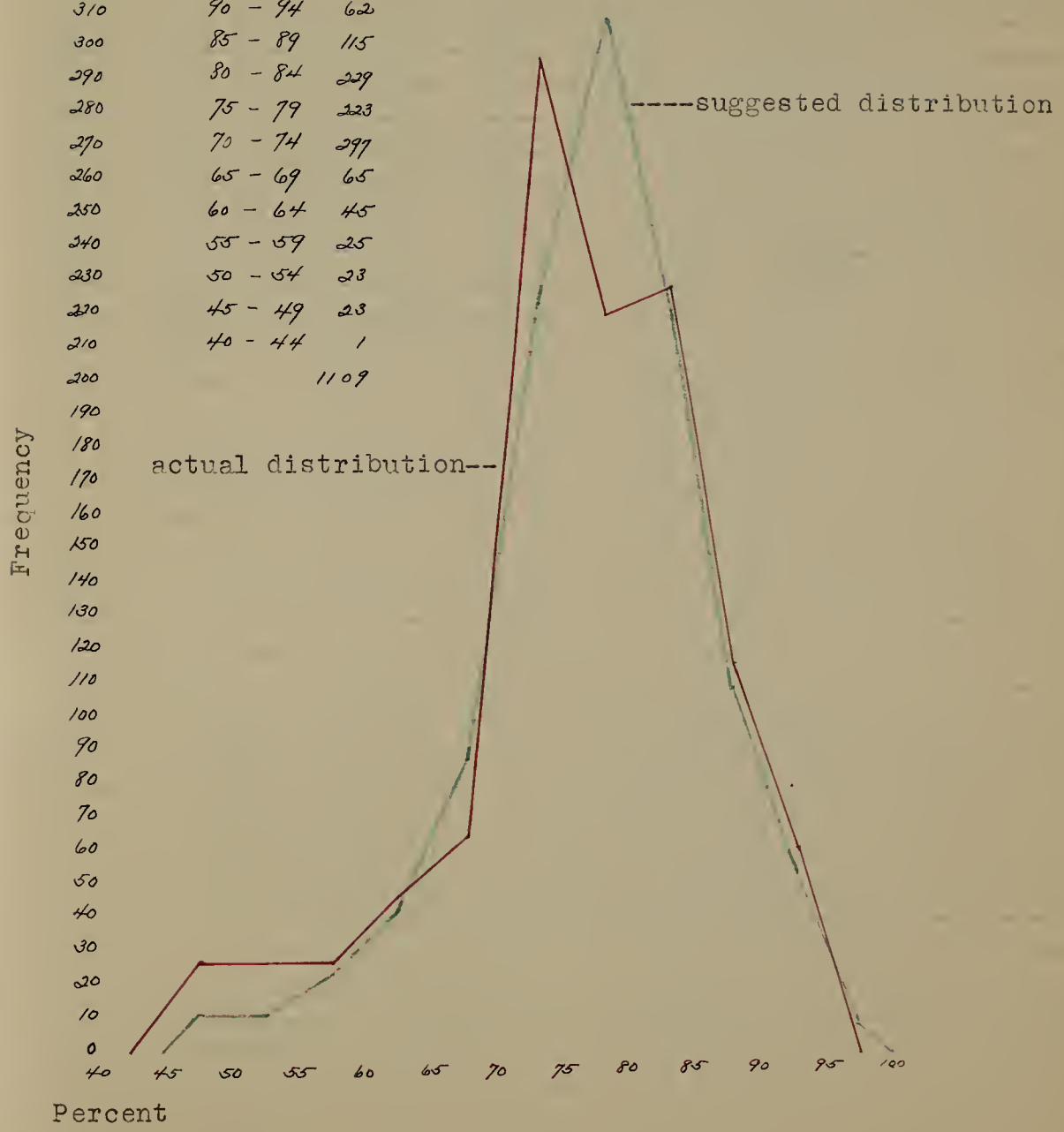


Table VI

Total Scores for All Students in Midyear 1941

X	f	d	fd	fd^2		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]	71	[illegible]	[illegible]	[illegible]	-1050	C = - [illegible] = - .[illegible]
[illegible]	138	[illegible]	[illegible]	[illegible]	748	
[illegible]	[illegible]	1	[illegible]	[illegible]	-302	C = 1.[illegible] x [illegible] = -1.[illegible]
[illegible]	[illegible]		748			
[illegible]	[illegible]	-1	-[illegible]	[illegible]		C^2 = .[illegible]
[illegible]	[illegible]	-[illegible]	-[illegible]	[illegible]		
[illegible]	[illegible]	-3	-[illegible]	486		A = 77.[illegible] - 1.[illegible] = 7[illegible].[illegible]
[illegible]	[illegible]	-4	-[illegible]	[illegible]		
[illegible]	[illegible]	-5	-100	500		S. D. = [illegible] - .[illegible] x [illegible] = [illegible].[illegible]
[illegible]	120	-6	-120	720		
[illegible]	7	-7	- 7	147		
	1124		-1050	[illegible]		

GRAPH 2

Total Scores in 1931

Interval	F
95 - 99	4
90 - 94	71
85 - 89	138
80 - 84	240
75 - 79	241
70 - 74	284
65 - 69	122
60 - 64	54
55 - 59	27
50 - 54	20
45 - 49	20
40 - 44	3
	1224

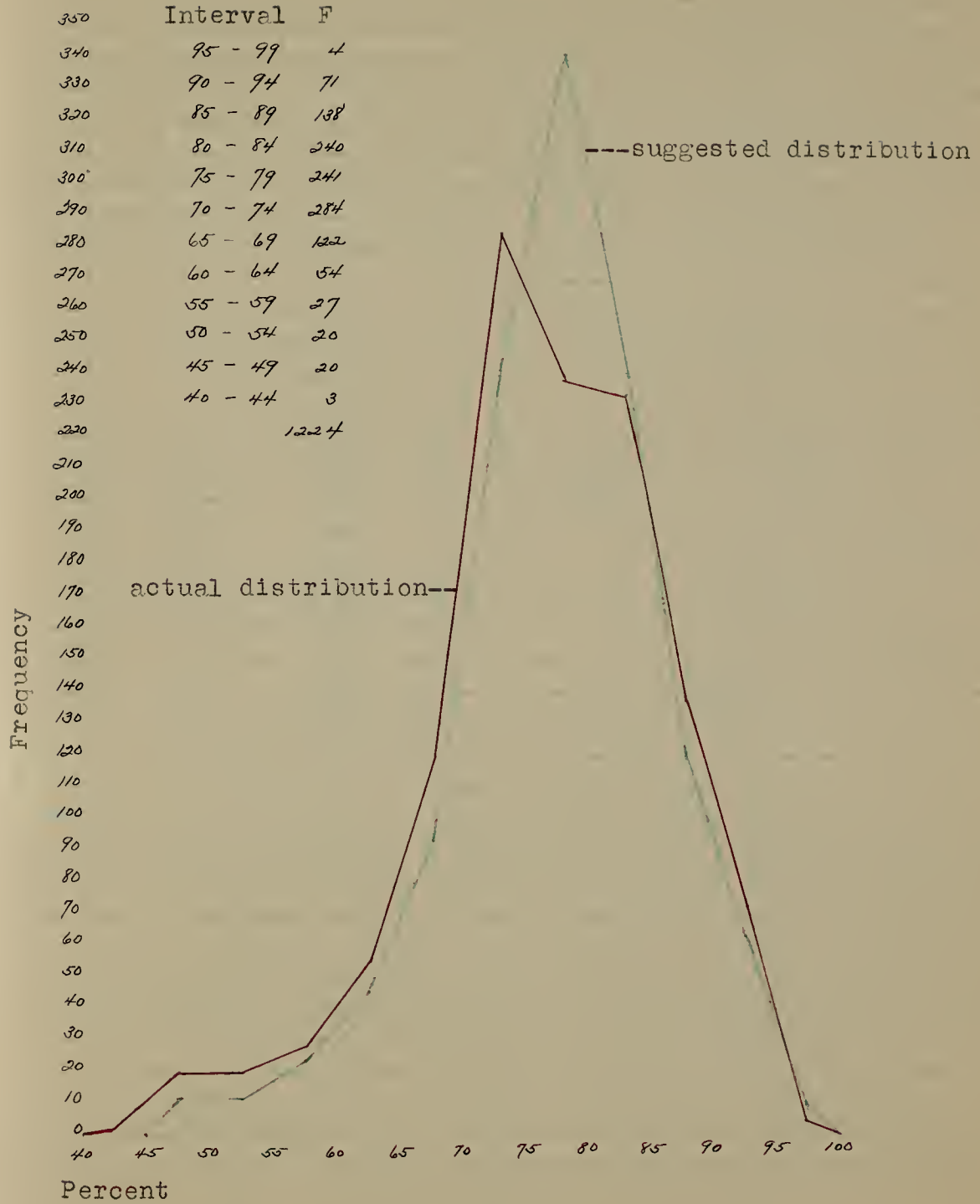


Table III and Graph III reveal a distribution of marks very much like that of the two preceding years. The difference between the actual average and the theoretical average is 1.85%, which is considerably greater than that of either of the two preceding years. The mode points are unchanged. The plateau region is practically identical with that shown in Graph II. The polygon shows a more pronounced negative skewness, that is there are more marks registering in the lower percentages.

TABLE III

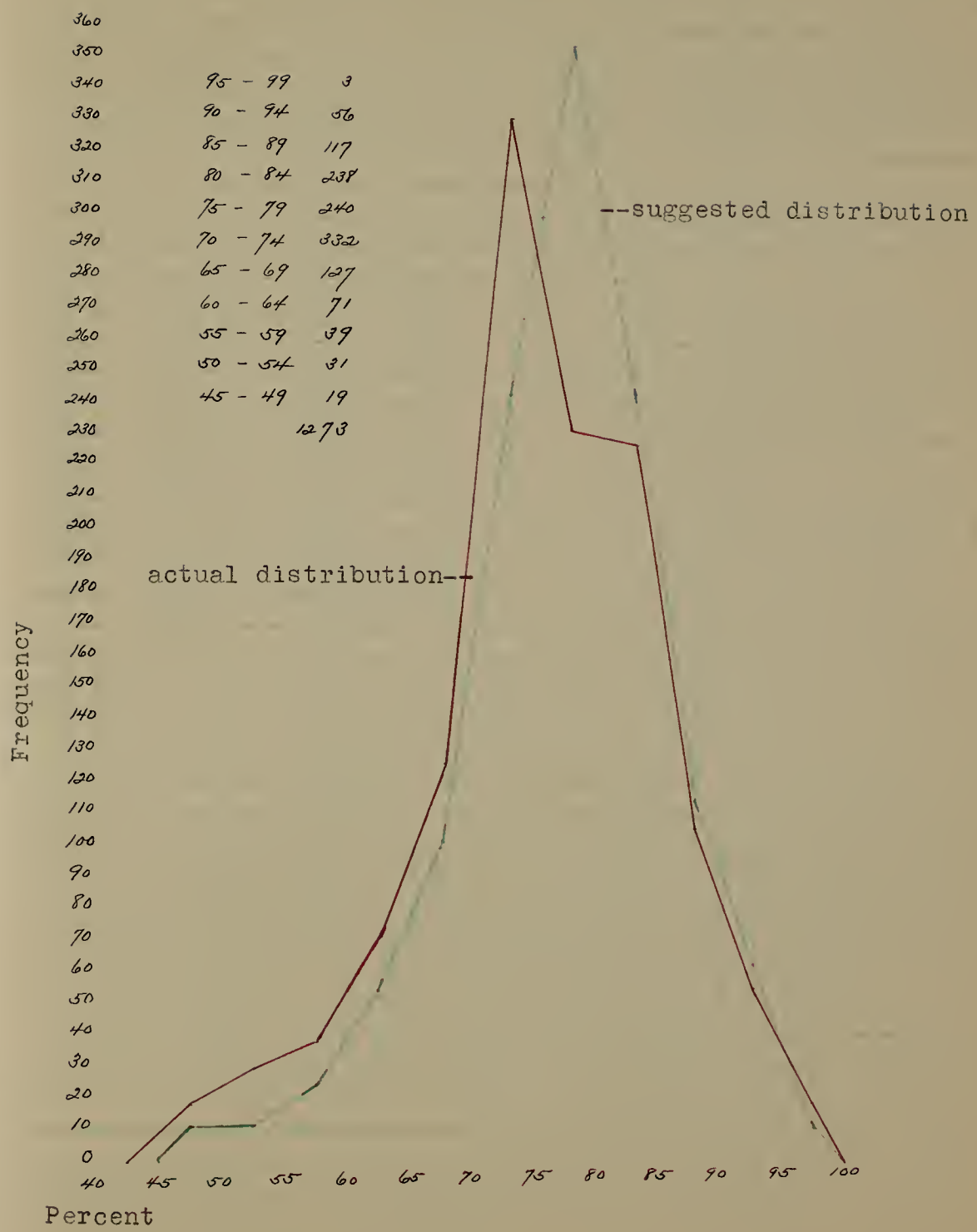
Total Scores for All Students at Milyear 1932

P	F	d	Fd	Fd^2		
95-99	3	4	12	48		
90-94	56	3	168	504	-1334	C = $\frac{-672}{1573}$ = -.440
85-89	117	2	234	468	662	
80-84	238	1	238	238	- 672	
75-79	340	0	662			C = -.440 x 5 = -2.20
70-74	338	-1	-338	338		
65-69	137	-2	-274	548		C^2 = .303
60-64	71	-3	-213	639		
55-59	39	-4	-156	624		A = 77.5 - 2.20 = 75.30
50-54	31	-5	-155	775		
45-49	19	-6	-114	684		S. D. = $\frac{4830}{1573}$ - .303 x 5 = 2.48
	1573		-1334	4830		

The prevailing weaknesses as brought forth from the yearly computations seem to be: (a) the actual distribution is skewed to the right or negatively, (b) the mode has persisted at the 70-75% level and when it should be at the 75-80% level according to the standard frequency polygon, (c) the falling off in frequency at the 75-80% level has produced a plateau region which deviates from the normal curve considerably, (d) the average grade for the school has continued slightly lower than the theoretical average of 77.1%. It must be remembered that to this point the

GRAPH 3

Total Scores in 1932



teachers were not informed of this study of the distribution of their marks.

In going into a more detailed analysis of the marks, those of the four classes were considered separately for one year (1931). Table IV and Graph IV show how the freshman marks compare with the recommended distribution. It will be seen that the

TABLE IV

Showing Distribution of Freshman Marks - Taken January 1931

	f	d	fd	fd^2
95-99	1	4	4	16
90-94	18	3	54	162
85-89	30	2	60	120
80-84	75	1	75	75
75-79	74	0	193	
70-74	101	-1	-101	101
65-69	27	-2	- 54	108
60-64	11	-3	- 33	99
55-59	6	-4	- 24	96
50-54	4	-5	- 20	100
45-49	3	-6	-18	108
	350		-330	985

-330
103
-37

$C = -\frac{37}{350} = -.106$

$C = -.106 \times 5 = -.53$

$C^2 = .03$

$A = 77.5 - .53 = 76.97$

$S. D. = \frac{985}{350} - .03 \times 5 = 2.4$

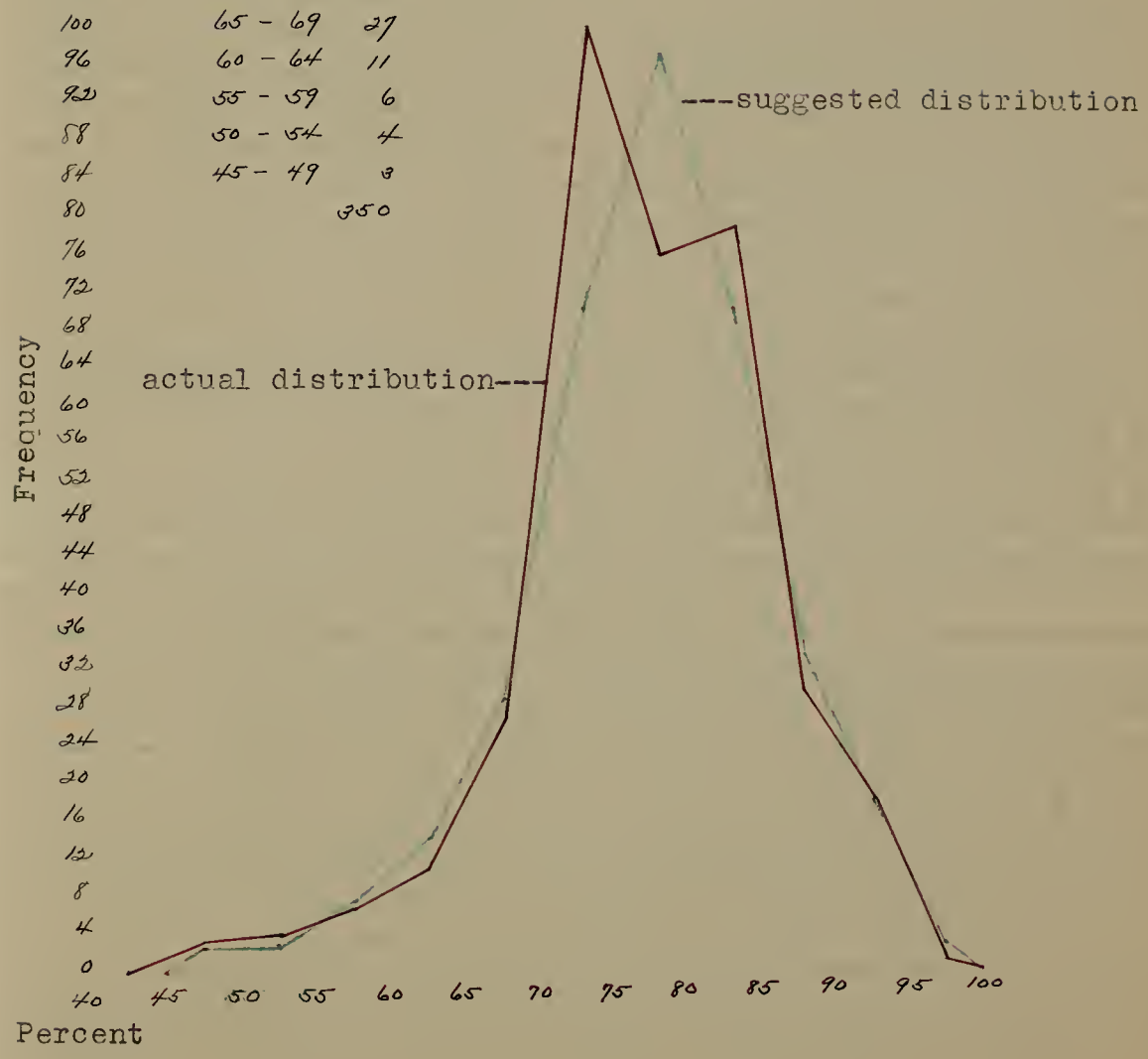
average mark for this group is definitely lower than the theoretical average, and the mode for the group is conspicuous on the 70 through 74½ level. Except for the upper part of the polygon there is a close approximation to the desired form. The negative skewness is not surprising knowing that freshmen marks furnished the raw material. Obviously, the freshmen class would represent a less select group of students, than the upper classmen.

Table V and Graph V show the distribution of marks from the sophomore class in January, 1931. In comparing these results with those of the freshmen we will discover that there are fewer cases represented at the mode and quite a few more marks registering in the higher percentages. The result of this shifting

GRAPH 4

Freshmen Scores

Interval	F
95 - 99	1
90 - 94	18
85 - 89	30
80 - 84	75
75 - 79	74
70 - 74	101
65 - 69	27
60 - 64	11
55 - 59	6
50 - 54	4
45 - 49	3
	350



was to raise the average mark of the class to 77.39%. The plateau persists. The exaggerated mode of the freshmen group has been

TABLE V

Show Distribution of Sophomore Marks - Taken January 1931

p	F	D	Fd	Fd^2
95-99	2	4	8	32
90-94	25	3	75	225
85-89	28	2	56	112
80-84	39	1	39	39
75-79	41	0	178	
70-74	60	-1	-60	60
65-69	21	-2	-42	84
60-64	8	-3	-24	72
55-59	7	-4	-28	112
50-54	3	-5	-15	75
45-49	0	-6		
40-44	2	-7	-14	98
	236		-183	909

-183
178
- 5

$C = -\frac{5}{236} = -.021$

$C = -.021 \times 5 = -.11$

$C^2 = 0$

$A = 77.5 - .11 = 77.39$

S. D. $= \frac{909}{236} - 0 \times 5 = 9.8$

eliminate and there is a more general scattering of marks as indicated by the increase of the standard deviation from 8.4 to 9.8. The failure of this class to show an equally good conformity to the ideal of the school may be due to the fact that the class is more than 100 less in number than the freshmen class which of course permits greater variation in distribution. For the most part those who dropped out of school were the less successful students and this fact is clearly shown on the graph.

Table VI and Graph VI show the distribution of the marks from the Junior class taken in January 1931. This group is decidely superior to the two lower classes. Many of the poorer students have dropped out for various reasons and the remaining ones show the benefit of another year of maturity. The average for the class is 1.92% higher than the theoretical average and the mode has shifted 10 points into the higher percentages. Here the

GRAPH 5

Sophomore Scores.

Interval	F
95 - 99	2
90 - 94	25
85 - 89	28
80 - 84	39
75 - 79	41
70 - 74	60
65 - 69	21
60 - 64	8
55 - 59	7
50 - 54	3
45 - 49	0
40 - 44	2
	236

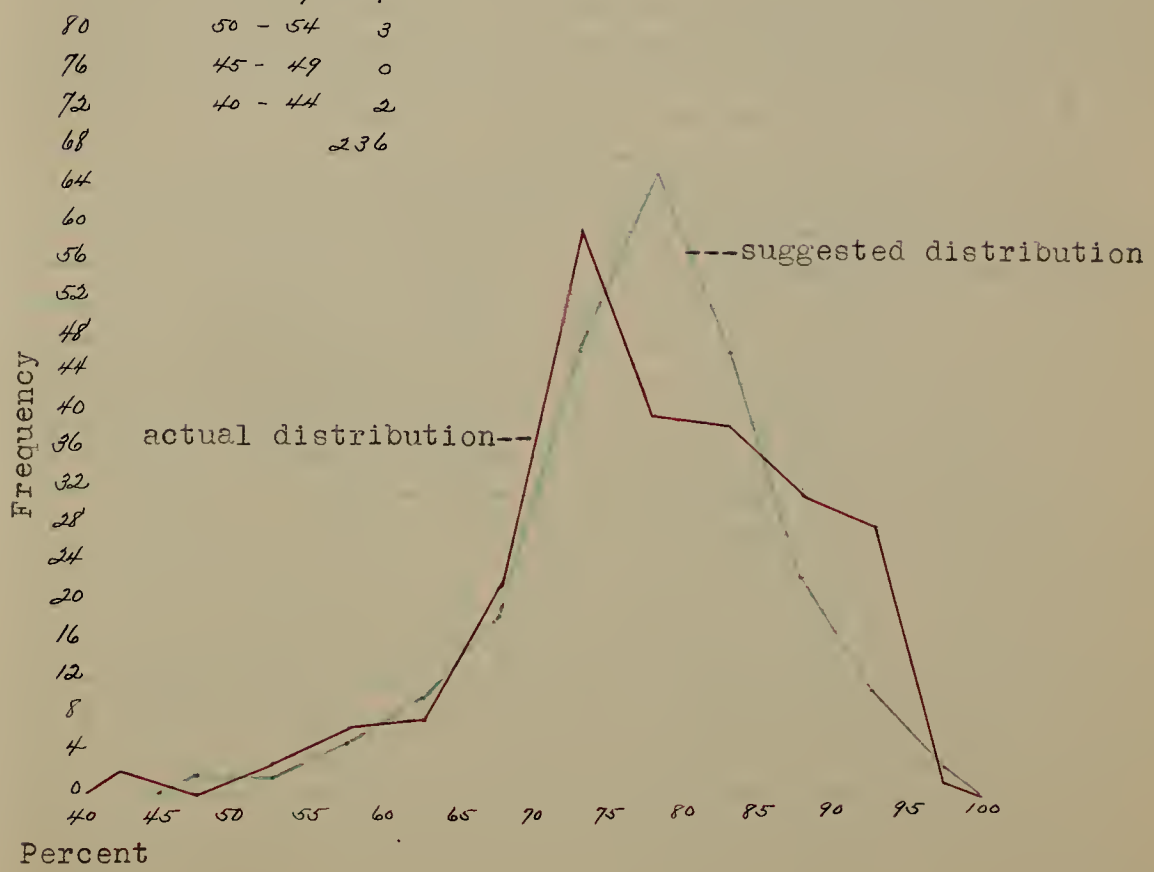


TABLE VI

Showing Distribution of Junior Works - Taken January 1931

P	T	d	Fd	Fd^2		
90-94	2	4	8	32		
85-89	15	3	45	135	333	C = $\frac{75}{347}$ - .303 C^2 = .09
80-84	34	2	68	136	-123	
75-79	73	1	73	73	75	
70-74	49	0	305			C = .303 x 5 = 1.52
70-74	51	-1	-51	51		
65-69	12	-2	-24	48		A = 77.5 ± 1.52 = 79.02
60-64	5	-3	-15	45		
55-59	0	-4	- 0			S. D. = $\frac{727}{347}$ ±1.00 x 5 = 8.45
50-54	4	-5	-20	100		
45-49	3	-6	-18	108		
	247		-138	727		

plateau is reversed but the abrupt falling off in frequency at the 75 thru 79 level continues.

Table VII and Graph VII show the distribution of works from the Senior class taken January, 1931. As with the Juniors, the

TABLE VII

Showing Distribution of Senior Work - Taken January 1931

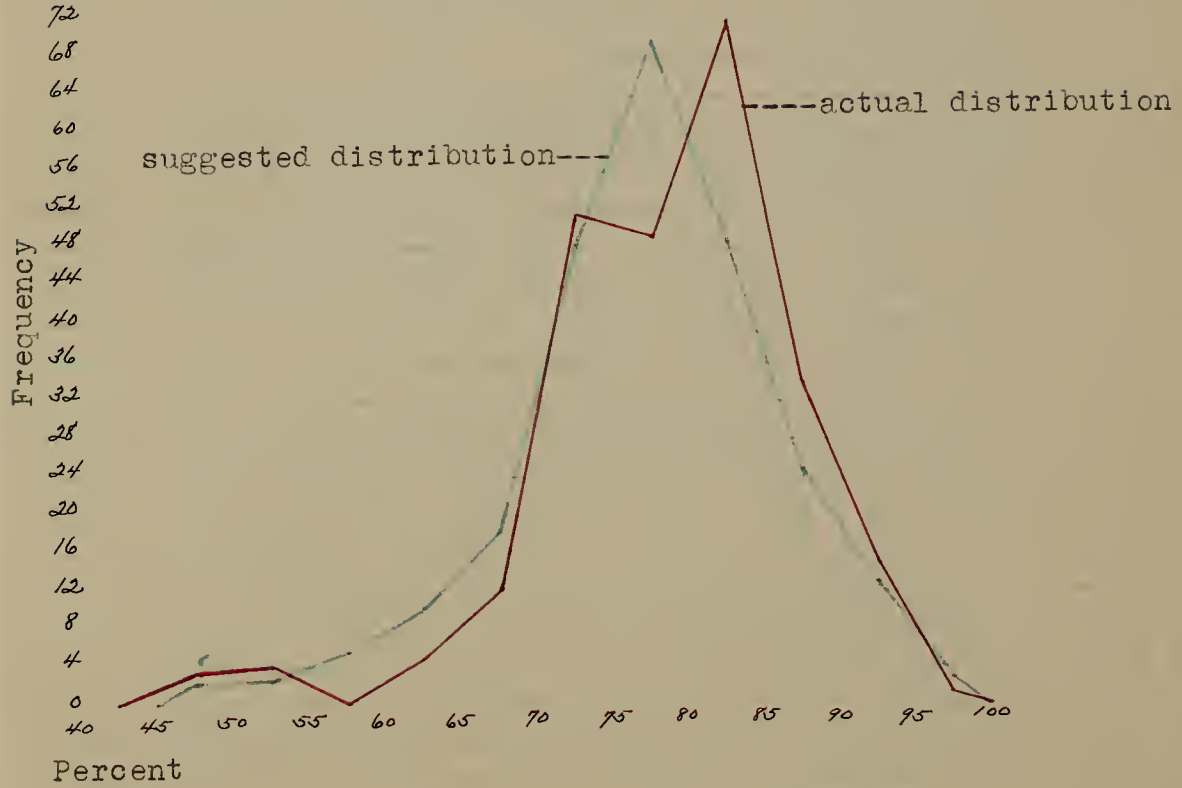
P	T	d	Fd	Fd^2		
90-94	14	3	42	126	182	C = $\frac{69}{238}$ =.29 C^2 = .084
85-89	26	2	78	162	-113	
80-84	64	1	64	64	69	
75-79	42	0	182			C = .29 x 5 = 1.45
70-74	30	-1	-30	30		
65-69	27	-2	-54	108		A = 77.5 ± 1.45 = 78.95
60-64	3	-3	- 9	27		
	238		-113	527		S. D. = $\frac{527}{238}$ - .084 x 5 = 7.3

Senior class shows up as a more select group than the two lower classes of students. Their average is higher, the mode is ten points higher than that of the two lower classes, and the standard deviation is the lowest of the four classes being but 7.3. This indicates that there is less spread or scattering of marks from the mean. This group has the greatest number of cases ranging in

GRAPH 6

Junior Scores

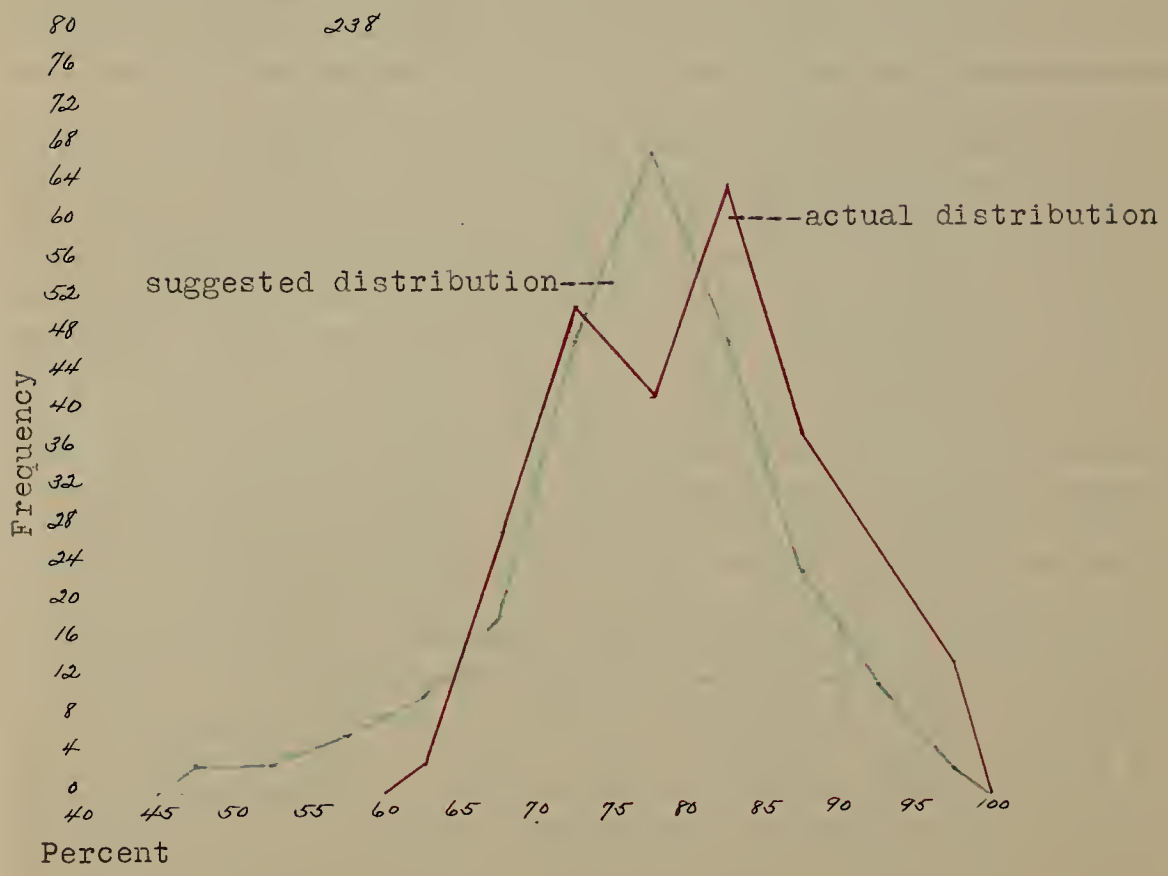
Interval	F
95 - 99	2
90 - 94	15
85 - 89	34
80 - 84	72
75 - 79	49
70 - 74	51
65 - 69	12
60 - 64	5
55 - 59	0
50 - 54	4
45 - 49	3
	247



GRAPH 7

Senior Scores

Interval	F
90 - 94	14
85 - 89	38
80 - 84	64
75 - 79	42
70 - 74	50
65 - 69	27
60 - 64	3
	238



the highest percentage levels and the polygon shows a definite positive skewness. The precipitous drop on the C+ line remains and is unaccountable.

This investigation of class marks shows clearly that teachers must consider the classification of their students and govern their use of the recommended distribution of marks accordingly. A teacher of Freshmen would have a slightly different distribution of marks than a teacher of Juniors or Seniors yet both would be using the same general standard. As all of the teachers concerned in this investigation had students from two or more different classes it was of course impossible to set up a criterion for each teacher depending on the classification of her students.

These four tables (VIII, IX, X, XI) show the averages and standard deviations for the same four classes as were considered in January 1931, but the following tables are based on June or final marks. It will be noted that the June marks are generally somewhat higher than the January marks. This fact too must be kept in mind in a careful analysis of marks. The only satisfactory explanation for this increase seems to be that teachers mark "harder" in January in an effort to keep students working as much as possible throughout the year. Then again in June there is always a group of students which is allowed a passing mark as a reward for diligence and application rather than for absolute scholarship. This practice would contibute toward making the June mean higher than the January mean. Perhaps, too, teachers are in a more amiable frame of mind in June due to pleasant contempla-

TABLE VIII

Showing Distribution of Freshmen Marks - Taken June 1931

P	F	d	Fd	Fd2	
95-99	4	4	16	64	
90-94	20	3	60	180	
85-89	31	2	62	124	
80-84	70	1	70	70	
75-79	73	0	208		-230
70-74	108	1	108	108	208
65-69	16	-2	-32	64	-22
60-64	16	-3	-48	144	
55-59	5	-4	-20	80	
50-54	3	-5	-15	75	
45-49	0	-6			
40-44	1	-7	-7	49	
	347		-230	958	

$C = -\frac{22}{347} = -.063$ $C^2 = .004$

$C = -.063 \times 5 = -.32$

$A = 77.5 - .32 = 77.18$

S. D. $= \frac{958}{347} - .004 \times 5 = 8.3$

Table IX

Showing Distribution of Sophomore Marks - Taken June 1931

P	F	d	Fd	Fd2	
95-99	1	4	4	16	
90-94	30	3	90	270	
85-89	21	2	42	84	180
80-84	44	1	44	44	-146
75-79	47	0	180		34
70-74	61	-1	-61	61	
65-69	15	-2	-30	60	
60-64	9	-3	-27	81	
55-59	1	-4	-4	16	
50-54	2	-5	-10	50	
45-49	0	-6			
40-41	2	-7	-14	98	
	333		-146	780	

$C = \frac{34}{233} = .15$ $C^2 = .023$

$C = .15 \times 5 = .75$

$A = 77.5 + .75 = 78.25$

S. D. $= \frac{780}{233} - .023 \times 5 = 9.1$

Table X

Scoring Distribution of Junior Girls - Taken June 1931

X	f	d	fd	fd²
95-99	2	4	12	48
90-94	11	3	33	99
85-89	37	2	74	148
80-84	71	1	71	71
75-79	40	0	130	
70-74	10	-1	-10	10
65-69	15	-2	-30	60
60-64	8	-3	-24	72
55-59	3	-4	-12	48
50-54	1	-5	-5	100
45-49	4	-6	-24	144
	384		-145	794

C = 40/384 = .10 C² = .010

C = .10 x 3 = .30

M = 77.5 - .30 = 77.20

S. D. = 794/384 - .35 = 2 = 2.8

Table XI

Scoring Distribution of Senior Girls - Taken June 1931

X	f	d	fd	fd²		
95-99	0					
90-94	13	3	39	117		C = 72/343 = .21 C² = .1
85-89	49	2	98	196		
80-84	81	1	81	81	176	
75-79	80	0	176		111	C = .21 x 3 = 1.6
70-74	99	-1	-99	99	77	
65-69	6	-2	-12	24		M = 77. + 1.6 = 78.1
60-64	0	-3				
	341		-101	497		S. D. = 497/341 - .3 x 3 = 6.7

tions of vacation.

Table XII shows in compact form the findings of the last ten

TABLE XII

1931	Average January	Average June	S. D. January	S. D. June
Seniors	78.95	79.10	7.3	6.7
Juniors	79.02	78.45	8.45	8.6
Sophomores	77.39	78.25	9.8	9.1
Freshmen	76.68	77.18	8.4	8.3

pages. It is interesting to note again the gradual increase in the class means. Beginning with a Freshmen mean of 77.18 there is a consistent gain in the means of the higher classes building up to 79.1 for the Senior class. It is apparent too from the tabulation that the June marks averaged somewhat higher in almost every instance. The range of the deviations is small. The Senior class with a deviation of but 6.7 shows the greatest homogeneity. It is hard to explain why the Freshmen should have a lower deviation than the Sophomores or Juniors, but such is the result in this particular study.

Tables XIII and XIV show that when boys' marks were taken together and the girls' marks were taken together, the girls' marks were generally higher. The average mark for the girls was 2.5 higher than that of the boys. The deviations were practically the same. In analyzing a teacher's marks the investigator must consider whether the teacher has a majority of boys or girls in his classes and then modify his conclusions accordingly.

Having completed the synopsis of the marks of the high school for three consecutive years, the four classes, the girls and boys and the January and June marks we will now carefully analyze each

TABLE XIII

Showing Distribution of Girls Marks - Taken June

F	f	d	fd	fd^2
95-99	5	4	20	80
90-94	54	3	162	486
85-89	88	2	176	352
80-84	136	1	136	136
75-79	116	0	513	
70-74	157	-1	-157	157
65-69	20	-2	- 60	120
60-64	13	-3	- 39	117
55-59	4	-4	- 16	64
50-54	3	-5	- 15	75
45-49	6	-6	- 36	216
	630		-317	1796

513
-317
196

$C = \frac{196}{630} = \frac{98}{315} = .31$

$C^2 = .09$

$C = .31 \times 5 = 1.55$

$A = 77.5 + 1.55 = 79.05$

$S.D. = \frac{1796}{630} - .09 \times 5 = 5.70$

TABLE XIV

Showing Distribution of Boys Marks - Taken June

F	f	d	fd	fd^2
95-99	1	4	4	16
90-94	19	3	57	171
85-89	34	2	68	136
80-84	83	1	83	83
75-79	92	0	301	
70-74	137	-1	-137	137
65-69	24	-2	- 48	96
60-64	10	-3	- 30	90
55-59	4	-4	- 16	64
50-54	4	-5	- 20	100
45-49	8	-6	- 48	288
	410		-399	1380

-399
301
78

$C = -\frac{78}{410} = \frac{39}{205} = -.19$

$C = -.19 \times 5 = -.95$

$A = 77.5 - .95 = 76.55$

$S.D. = \frac{1380}{410} - .036 \times 5 = 5.5$

teacher's contribution to this situation in an effort to discover the grading characteristics of each teacher. Having revealed the irregularities brought to light to the several teachers involved and having tendered appropriate suggestions, the subsequent term's marks will be graphically shown on the same group chart. This composite picture will indicate any changes in mark distribution, will show with a fair degree of accuracy whether there is improvement along the suggested lines.

The solid red line will represent the actual distribution of marks of a particular teacher over the three year period taken. The dotted red line will represent the distribution of marks of the same teacher for the term following the instructional period previously mentioned. The solid green line and the dotted green line will represent the theoretical distribution for the three year period and trial term respectively.

While the following tabulations and graphs are easily interpreted, sample specimens will be discussed in some detail.

For the three year period tables IV, VI, VII and Graph VIII indicate that teacher J had a reasonably good distribution of marks for her classes. As her classes were made up of students from all four grades and included about equal numbers of boys and girls we would expect a fairly close approximation to the school frequency polygon. This graph and one other were the only two in the entire series for the high school to have its modal point on the outline where it normal should be. In every other case the mode appears either on the "C" line or "B" line. The relatively high

TABLE [illegible]
[illegible] 1930

f	f'	d	fd	fd²	
60-64	7	5	35	175	
65-69	17	4	68	272	
70-74	19	3	57	171	-137
75-79	23	2	46		74
80-84	21	1	21	21	-63
85-89	14	0	0	0	
90-94	6	-1	-6	6	
95-99	1	-2	-2	4	
100-104	4	-3	-12	36	
105-109	2	-4	-8	32	
	114		-107	747	

$M = -\frac{107}{114} = -.94 \quad \sigma^2 = .$

$C = -.94 \times 1 = -1.$

$A = 77.5 - 1.$

$\sigma = \frac{747}{114} - 0.8 \times 1 = 9.$

TABLE XVI
[illegible] 1931

f	f'	d	fd	fd²	
60-64	5	5	25	125	
65-69	17	4	68	272	
70-74	25	3	75	225	
75-79	24	2	48		72
80-84	21	1	21	21	-63
85-89	14	0	0	0	
90-94	6	-1	-6	6	
95-99	1	-2	-2	4	
100-104	1	-3	-3	9	
105-109	1	-4	-4	16	
110-114	1	-5	-5	25	
115-119	4	-6	-24	144	
120-124	3	-7	-21	147	
	144		-[illegible]	[illegible]	

$M = \frac{-[illegible]}{144} = -.$ $\sigma^2 = .$

$C = -. \times 1 = -1.$

$A = 77.$ [illegible]

$\sigma = \frac{[illegible]}{144} - [illegible] = 10.$

TABLE [illegible]
[illegible] 1932

f	f'	d	fd	fd²	
[illegible]	1	5	15	75	
[illegible]	11	4	44	176	
[illegible]	21	3	63	189	
75-79	22	2	44		66
80-84	20	1	20	20	-60
85-89	16	0	0	0	
90-94	6	-1	-6	6	
95-99	2	-2	-4	8	
100-104	1	-3	-3	9	
105-109	1	-4	-4	16	
110-114	1	-5	-5	25	
115-119	1	-6	-6	36	
	146		-[illegible]	561	

$M = \frac{-[illegible]}{146} = -.$ $\sigma^2 = .$

$C = -. \times 1 = -1.$

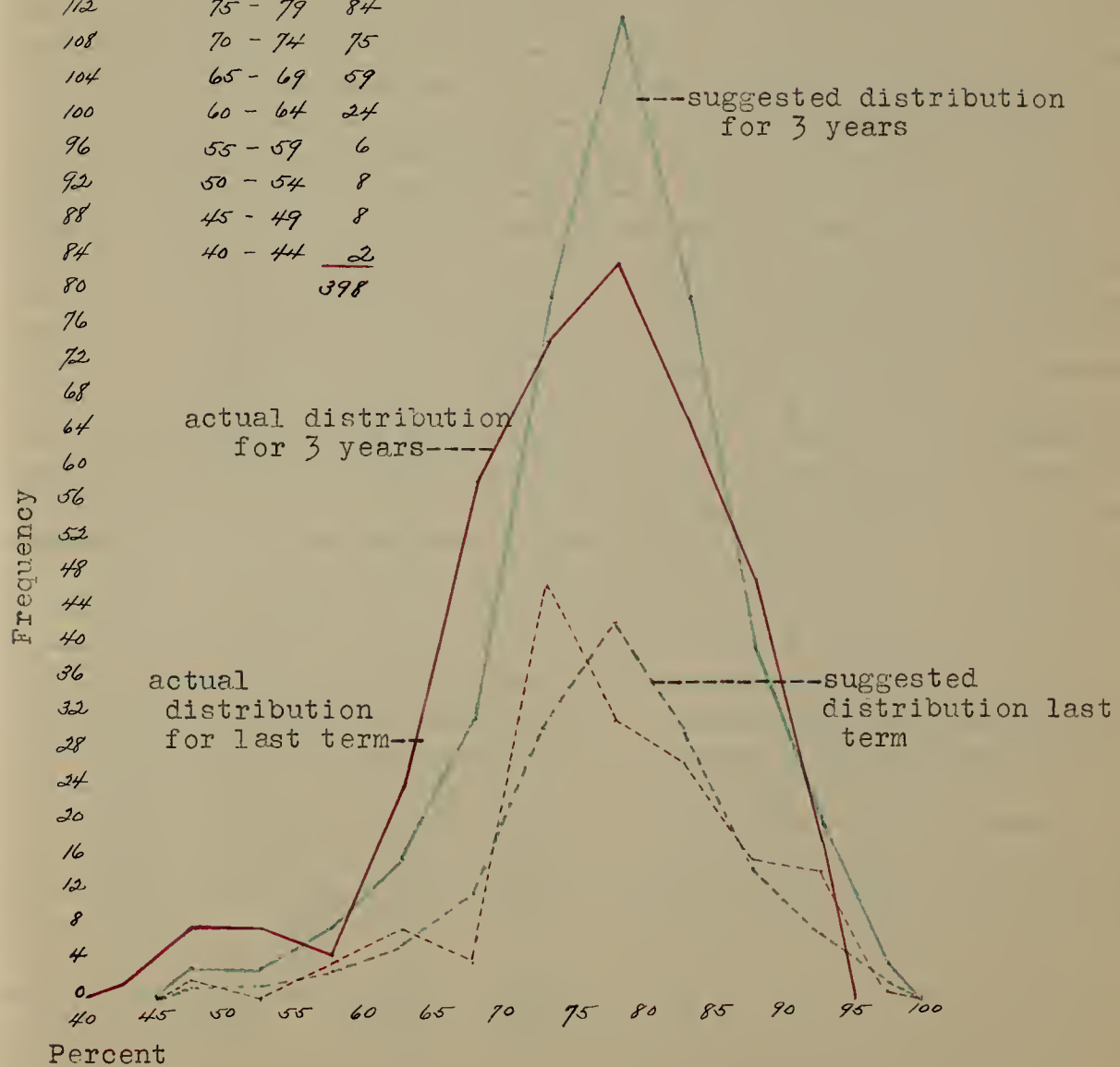
$A = 77. - 1. = 75.$

$\sigma = \frac{561}{146} - . \times 1 = 3.$

GRAPH 8

Teacher A

Interval	F
90 - 94	18
85 - 89	48
80 - 84	66
75 - 79	84
70 - 74	75
65 - 69	59
60 - 64	24
55 - 59	6
50 - 54	8
45 - 49	8
40 - 44	2
	398



frequency of marks between 60 and 70% accounts for the slight negative skewness. It will be noted that this teacher assigned no mark above 94% for the three year period even though 396 marks were assigned. The mean for this teacher averages consistently lower than the school mean. With 107 marks below passing (70%) it is not strange that the deviation should be fairly high, especially when we consider the fact that several marks are in the low forties.

The dotted red line on the graph, and Table XVIII show the result of the simple instructional program for Teacher A. What improvement in mark distribution there may be is negligible. While there are more marks in the higher categories and fewer very low marks, there has been a 6 point drop in the modal point. The most outstanding result of this study for Teacher A was the material increase of the average mark to 77.47%. The irregularity of the dotted red line is due, of course, to the fact that the number of marks considered was relatively small.

TABLE XVIII

X	F	x	fx	fx²
0-49	1	-6	-6	36
50-54	14	-5	-70	350
55-59	16	-4	-64	256
60-64	17	-3	-51	153
65-69	25	-2	-50	100
70-74	46	-1	-46	46
75-79	5	0	0	0
80-84	3	+1	+3	3
85-89	4	+2	+8	16
90-94	0	+3		
95-99	3	+4	+12	48
	134		-216	1008

$$C = \frac{1}{134} \times -.216 \qquad C^2 = .$$

$$Cx = -. \times 6 = -.$$

$$\bar{x} = 77. - . = 77.$$

$$\therefore \sigma = \frac{\quad}{134} - 0 \times 1 = 9$$

Tables XIX, XX, XXI, XXII and Graph 9 furnished the basis for the following comments.

TABLE XIX

Teacher B 1930

P	f	d	fd	fd²	
90-94	1	4	4	16	
85-89	10	3	30	90	
80-84	9	2	18	36	69
75-79	17	1	17	17	-65
70-74	[illegible]	0	69		4
65-69	7	-1	-7	7	
60-64	9	-2	-18	36	
55-59	4	-3	-12	36	
50-54	2	-4	-8	32	
45-49	4	-5	-20	100	
	93		-65	370	

$C = \frac{4}{93} = .04 \qquad c^2 = .0016$

$C = .04 \times 5 = .2$

$A = 72.5 + .2 = 72.7$

$S.D. = \frac{370}{93} - .0016 \times 5 = 9.97$

TABLE XX

Teacher B 1931

P	f	d	fd	fd²	
90-94	1	4	16	64	
85-89	15	3	45	135	95
80-84	13	2	[illegible]	[illegible]	-73
75-79	20	1	20	20	22
70-74	20	0	95		
65-69	8	-1	-8	8	
60-64	3	-2	-6	12	
55-59	5	-3	-15	45	
50-54	6	-4	-24	96	
45-49	4	-5	-20	100	
	95		-73	484	

$C = \frac{22}{95} = .232 \qquad c^2 = .053$

$C = .232 \times 5 = 1.16$

$A = 72.5 + 1.16 = 73.66$

$S.D. = \frac{484}{95} - .053 \times 5 = 11.15$

TABLE XVI

December 3 1935

D	F	d	fd	fd^2	
[illegible]	6	4	24	96	
[illegible]	11	3	33	99	100
[illegible]	[illegible]	2	44	88	-21
72-73	13	1	13	13	79
74-75	17	0	0		
[illegible]	17	-1	-17	17	
[illegible]	[illegible]	-2	-16	32	
[illegible]	4	-3	-12	36	
[illegible]	3	-4	-12	48	
[illegible]	7	-5	-35	175	
	107		-21	671	

$C = \frac{13}{107} = .121 \quad C^2 = .014$

$C = .121 \times 5 = .61$

$M = 74.5 + .61 = 74.11$

$\sigma. D. = \frac{671}{107} - .014 \times 5 = 11.5$

TABLE XVII

December 7 1935

D	F	d	fd	fd^2	
[illegible]	3	[illegible]	0	27	
[illegible]	17	[illegible]	34	68	
[illegible]	[illegible]	1	[illegible]	[illegible]	
72-73	93	0	71		
74-75	[illegible]	-1	-24	24	
[illegible]	18	-2	-36	72	
[illegible]	15	-3	-39	108	
[illegible]	[illegible]	-4	-4	16	
[illegible]	1	-5	-5	25	
	144		-113	341	

$C = \frac{41}{144} = -.284 \quad C^2 = .08$

$C = -.284 \times 5 = -1.42$

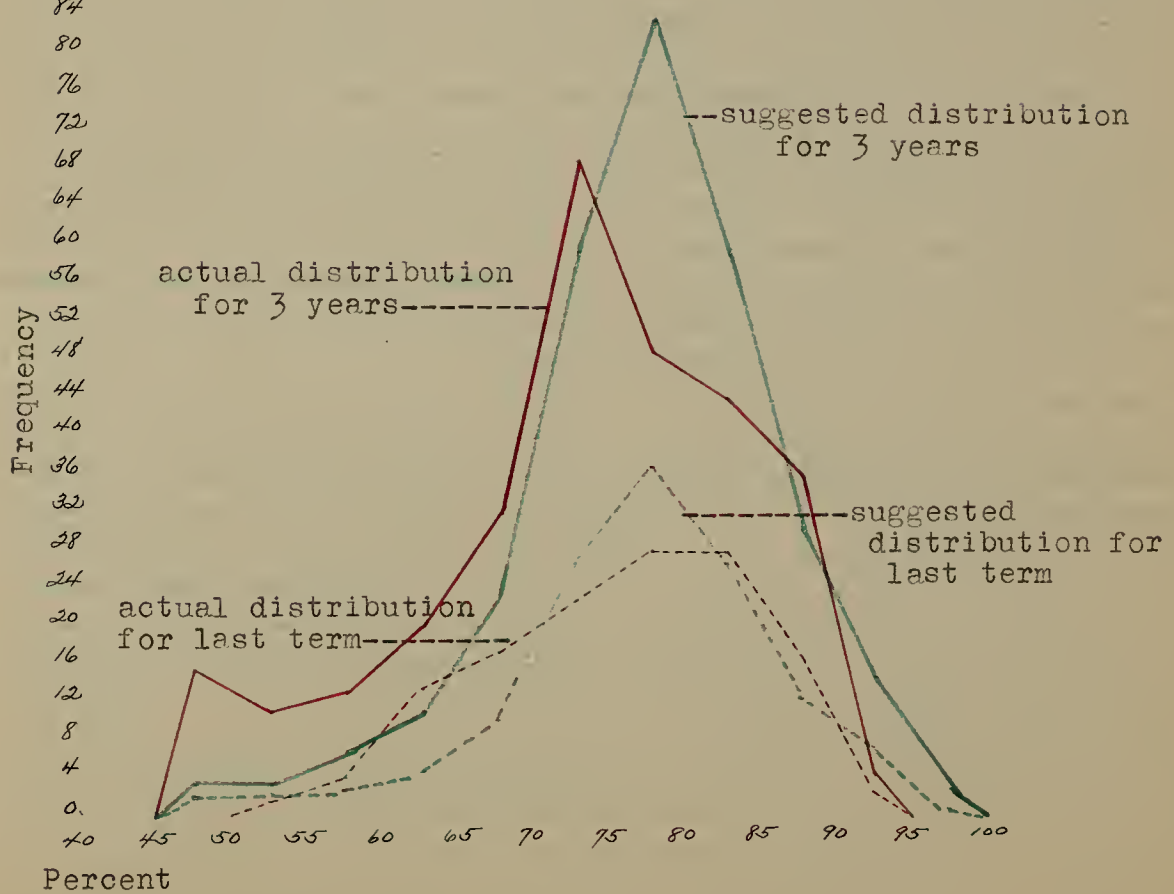
$M = 77.5 - 1.42 = 76.08$

$\sigma. D. = \frac{324}{144} - .08 \times 5 = 6.4$

GRAPH 9

Teacher B

Interval	F
90 - 95	6
85 - 89	36
80 - 84	44
75 - 79	49
70 - 74	69
65 - 69	32
60 - 64	20
55 - 59	13
50 - 54	11
45 - 49	15
	295



The majority of the students of Teacher 3 were freshmen, and as the subject was algebra it is readily comprehensible why thy mean is so low. Here again none of the students were given a mark above 94% and a large number received marks from 45 to 70%. For years 1931 and 1932 Teacher 3's deviation was over 11 which was 3 points over the school deviation. The mode is on the "0" line and is thereby in keeping with the majority of cases, but 5 points too low in comparison to the ideal schedule previously mentioned. (Chapter I)

Teacher 3 responded to the instructional program to some extent. The median was raised about 10 and the mode was shifted to a higher level. Very likely with but 134 marks to consider and these largely freshmen, the distribution represented by the red dotted line is as near normal as practicable.

The three year accumulation of marks of Teacher 3 was shown by Tables XXIII, XXIV, XXV, XXVI and Graph 10 was fairly well concentrated at the "0" level and quite a number of marks appear

TABLE XXIII
Teacher 3 1930

f	fc	d	fd	fd²		
90-94	3	3	1	3		
85-89	11	2	22	44	-37	$\theta = -\frac{37}{127} = -.34$ $\sigma^2 = .$
80-84	27	1	27	27	11	
75-79	49	0	0		-26	
70-74	41	-1	-41	41		$\theta = -.$ $= -1.$
65-69	4	-2	-8	16		
60-64	3	-3	-9	27		$\sigma = 77.$ - 1. = 76.
55-59	5	-4	-20	80		
50-54	1	-5	-5	25		
45-49	7	-6	-42	252		$\sigma.\ \sigma. = \frac{407}{127} - .$ $\sigma =$ .3
40-44	1	-7	-7	49		
	127		-97	407		

Teacher C 1951

X	F	d	fd	fd²		
60-64	6	3	18	54		
65-69	8	2	16	32	-110	$\delta = -\frac{23}{110} = -.209$ $\sigma^2 = .76$
70-74	16	1	16	16	90	
75-79	58	0	0		-20	
80-84	27	-1	-27	27		$\delta = -.209 \times 6 = -1.25$
85-89	7	-2	-14	28		
90-94	11	-3	-33	99		$\bar{x} = 77.5 - 1.25 = 76.25$
95-99	2	-4	-8	32		
100-04	3	-5	-15	75		
105-09	1	-6	-6	36		$\sigma_x = \frac{660}{110} - .076 \times 6 = 5.9$
110-14	1	-7	-7	49		
	110		-110	660		

Teacher C 1953

X	F	d	fd	fd²		
60-64	10	4	40	160		
65-69	17	3	51	153	-110	$\delta = -\frac{84}{110} = -.764$ $\sigma^2 = .375$
70-74	40	2	80	160	84	
75-79	31	1	31	31	-26	
80-84	27	0	0	0		
85-89	14	-1	-14	14		$\delta = -.764 \times 1 = -1.27$
90-94	6	-2	-12	24		
95-99	3	-3	-9	27		$\bar{x} = 77.5 - 1.27 = 76.23$
100-04	1	-4	-4	16		
105-09	0	-5	0	0		
110-14	1	-6	-6	36		$\sigma_x = \frac{660}{110} - .076 \times 1 = 10.7$
	150		-110	660		

[illegible]

November 1 1929

X	F	d	fd	fd²
80-84	2	3	6	18
75-79	13	2	26	52
70-74	28	1	28	28
65-69	24	0	0	0
60-64	10	-1	-10	10
55-59	8	-2	-16	32
50-54	5	-3	-15	45
45-49	4	-4	-16	64
40-44	1	-5	-5	25
	115		-42	274

$C = \frac{-42}{115} = -.364 \quad C^2 = ?$

$C = -.364 \times 5 = -1.82$

$\bar{x} = 67. - 1.82 = 65.18$

$\sigma = \frac{274}{115} - .364^2 \times 5^2 = 8.0$

in the lower levels. The mode is pronounced. The majority of the students of this teacher were either Freshmen or Sophomores and this fact accounts for the slight negative skewness.

The dotted lines of Graph 10 indicate a desirable effect from the instructional progress for Teacher D. Although the mode is 5 points too low, the general conformation of the polygon is good.

The three year distribution of marks of Teacher D is shown in Tables XXVII, XXVIII, XXIX, XXX.

TABLE XXVII

Teacher D 1930

X	F	d	fd	fd²		
80-84	1	4	4	16		
75-79	6	3	18	54	67	$C = \frac{19}{130} = .146 \quad C^2 = .036$
70-74	14	2	28	56	-45	
65-69	30	1	30	30	19	$C = .146 \times 5 = .73$
60-64	20	0	0			
55-59	21	-1	-21	21		$\bar{x} = 67.5 + .73 = 72.23$
50-54	8	-2	-16	32		
45-49	1	-3	-3	9		
40-44	1	-4	-4	16		$\sigma = \frac{354}{130} - .036 \times 5^2 = 7.5$
35-39	2	-5	-10	50		
	130		-45	353		

GRAPH 10

Teacher C

Interval	F
90 - 94	21
85 - 89	35
80 - 84	62
75 - 79	75
70 - 74	125
65 - 69	13
60 - 64	17
55 - 59	14
50 - 54	10
45 - 49	5
40 - 44	0
	379

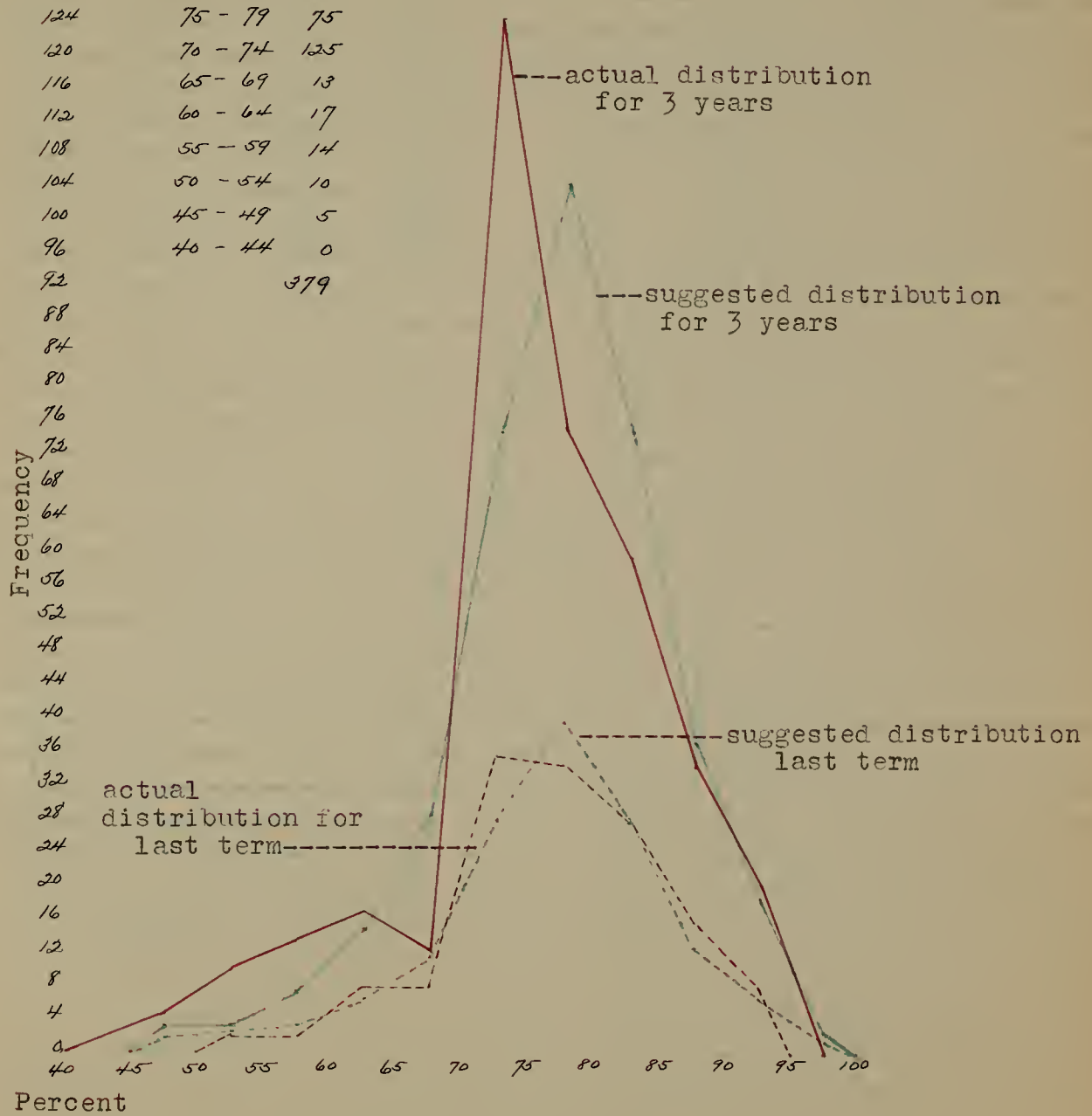


TABLE XXVIII

Teacher D 1931

P	F	d	Fd	Fd²		
[illegible]	1	4	4	16		
[illegible]	7	3	21	63	84	$D = \frac{1}{142} = .01$ $D^2 = .001$
[illegible]	30	2	60	120	-78	
75-79	17	1	17	17	4	$C = .03 \times 3 = .11$
70-74	51	0	0			
[illegible]	33	-1	-33	33		$M = 72.5 \pm .1 = 72.6$
[illegible]	14	-2	-28	56		
[illegible]	5	-3	-15	45		$\sigma. D = \frac{356}{142} - .001 \times 3 = 1.96$
[illegible]	4	-4	-16	64		
	142		-71	356		

TABLE XXIX

Teacher D 1932

P	F	d	Fd	Fd²		
[illegible]	1	4	4	16		
[illegible]	4	3	12	36	-70	$D = -\frac{5}{140} = -.036$ $D^2 = .0004$
80-84	18	2	36	72	66	
75-79	14	1	14	14	-4	$C = -.036 \times 1 = -.078$
70-74	47	0	0			
[illegible]	8	-1	-8	8		$M = 72.5 - .078 = 72.42$
[illegible]	17	-2	-34	68		
[illegible]	4	-3	-12	36		$\sigma. D. = \frac{218}{140} - .0004 \times 4 = 7.8$
[illegible]	4	-4	-16	64		
	140		-70	318		

TABLE XXX

Teacher D 1933

90-94	1	4	4	16
85-89	10	3	30	90
80-84	15	2	30	60
75-79	27	1	27	27
70-74	52	0	91	
65-69	27	-1	-27	27
60-64	13	-2	-26	52
55-59	3	-3	- 9	27
	148		-62	299

$C = \frac{29}{148} = .196$ $\quad C^2 = .036$

$C = .196 \times 5 = 9.8$

$A = 72.5 + .98 = 73.48$

S. D. $\frac{299}{148} - .036 \times 5 = 7$

The frequency polygon of Teacher D (Graph 11) shows a pronounced negative skewness. The curve is at the passing level and contains an abnormally large number of cases. The mean is approximately 5 points lower than the expected mean and 4 points lower than the mean for the high school. The scattering of marks around the mean is considerably restricted as the deviation is but slightly over 7 as compared to the school deviation which is 9. This condition can be justified somewhat in that this teacher works with freshmen almost entirely and the mean for freshmen groups habitually averages 2 points lower than that of upper classes.

Teacher D responded to the instructional program to a slight degree as can be seen by referring to the dotted lines of the graph. The same tendencies persist, as with the other teachers but the frequency polygon is practically normal in shape--the deficiency at the 0-4 level having been overcome.

The three year distribution of marks of Teacher D as shown by Tables XXII, XXIII, XXIV and Graph 12 was next uncon-

GRAPH 11

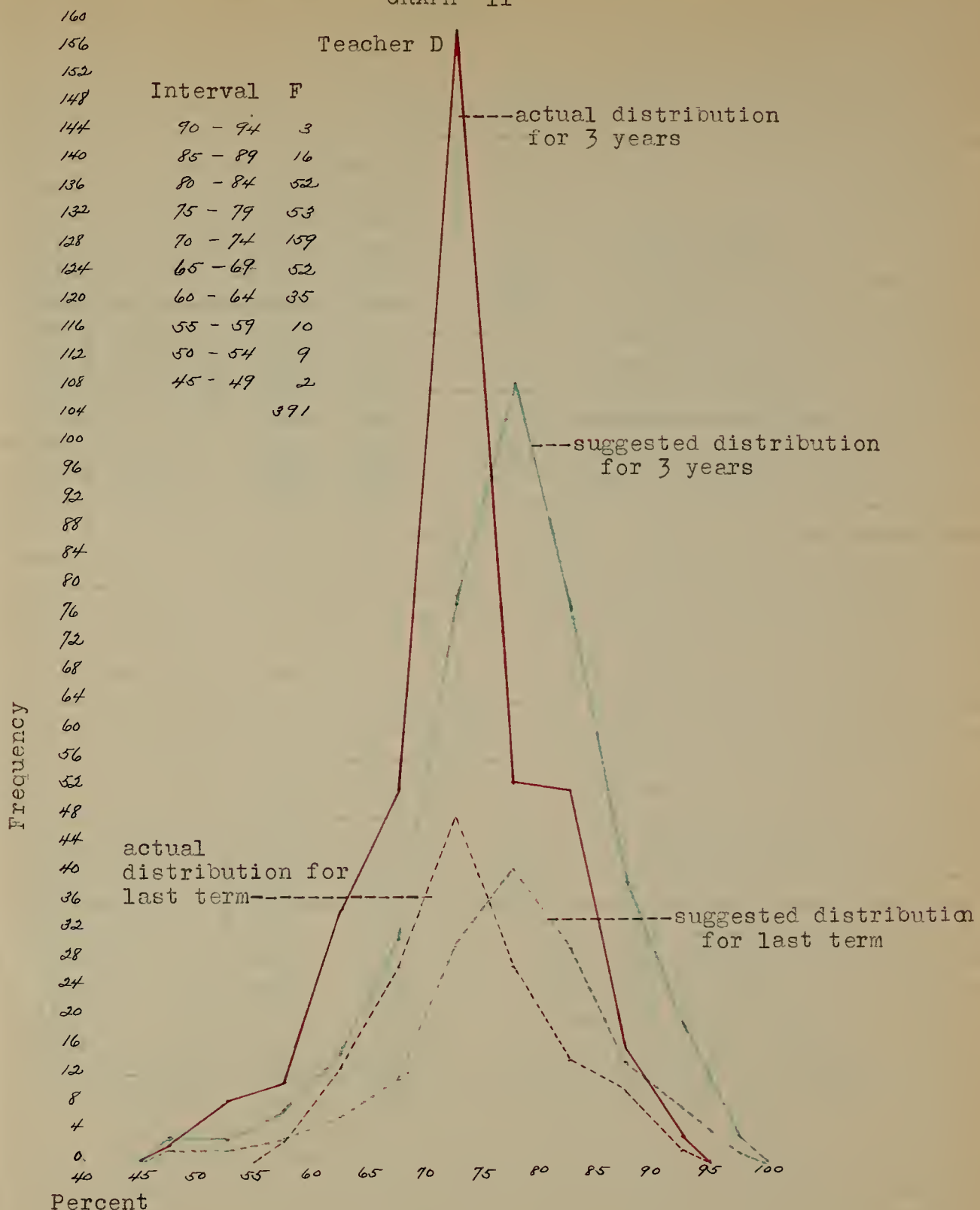

Teacher D
Interval F
90 - 94 3
85 - 89 16
80 - 84 52
75 - 79 53
70 - 74 159
65 - 69 52
60 - 64 35
55 - 59 10
50 - 54 9
45 - 49 2
391
----actual distribution for 3 years
---suggested distribution for 3 years
actual distribution for last term----------
---------suggested distribution for last term
Frequency
160 156 152 148 144 140 136 132 128 124 120 116 112 108 104 100 96 92 88 84 80 76 72 68 64 60 56 52 48 44 40 36 32 28 24 20 16 12 8 4 0
40 45 50 55 60 65 70 75 80 85 90 95 100
Percent

TABLE XXXI

Teacher [illegible] 1930

P	F	d	Fd	Fd^3
90-94	6	4	32	128
85-89	5	3	15	45
80-84	6	2	12	34
75-79	8	1	8	8
70-74	16	0	67	
65-69	8	-1	- 8	8
60-64	11	-2	-22	44
55-59	3	-3	- 9	27
50-54	3	-4	-12	48
45-49	2	-5	-10	50
	70		-61	382

67
-61
6

$C = \frac{6}{70} = .09$

$c^2 = .008$

$C = .09 \times 5 = .45$

$A = 72.5 \pm .45 = 73.95$

S.D. = $\frac{382}{70} - .008 \times [illegible] = 11.65$

TABLE XXXII

Teacher E 1931

P	F	d	Fd	Fd^2
90-94	12	3	36	108
85-89	9	2	18	36
80-84	13	1	13	13
75-79	3	0		
70-74	21	-1	-21	21
65-69	7	-2	-14	28
60-64	5	-3	-15	45
55-59	2	-4	- 8	32
50-54	0	-5	- 0	0
45-49	2	-6	-12	72
	74		-70	386

-70
67
- 3

$C = -\frac{3}{74} = -.04$

$c^2 = .002$

$C = -.04 \times 5 = -.2$

$A = 77.5 - .2 = 77.3$

S.D. = $\frac{386}{74} - .002 \times 5 = 10.96$

TABLE XXXIII

Teacher X 1932

F	f	d	fd	fd^2
90-94	4	3	12	36
85-89	12	2	24	48
80-84	19	1	19	19
75-79	14	0	55	
70-74	22	-1	-22	22
65-69	9	-2	-18	36
60-64	5	-3	-15	45
55-59	8	-4	-32	128
50-54	3	-5	-15	75
	96		-102	409

-102
55
- 47

$C = -\frac{47}{96} = -.49$

$C^2 = .24$

$C = -.49 \times 5 = -2.45$

$A = 77.5 - 2.45 = 75.05$

$S.D. = \frac{409}{96} - .24 \times 5 = 10$

TABLE XXXIV

Teacher Z 1933

F	f	d	fd	fd^2
90-94	4	3	12	36
85-89	11	2	22	44
80-84	16	1	16	16
75-79	17	0	0	
70-74	17	-1	-17	17
65-69	11	-2	-22	44
60-64	5	-3	-15	45
55-59	1	-4	- 4	16
50-54	3	-5	-15	75
45-49	1	-6	-6	36
	86		-79	339

$C = -\frac{29}{86} = -.337$

$C^2 = 116$

$C = -33.7 \times 5 = -1.69$

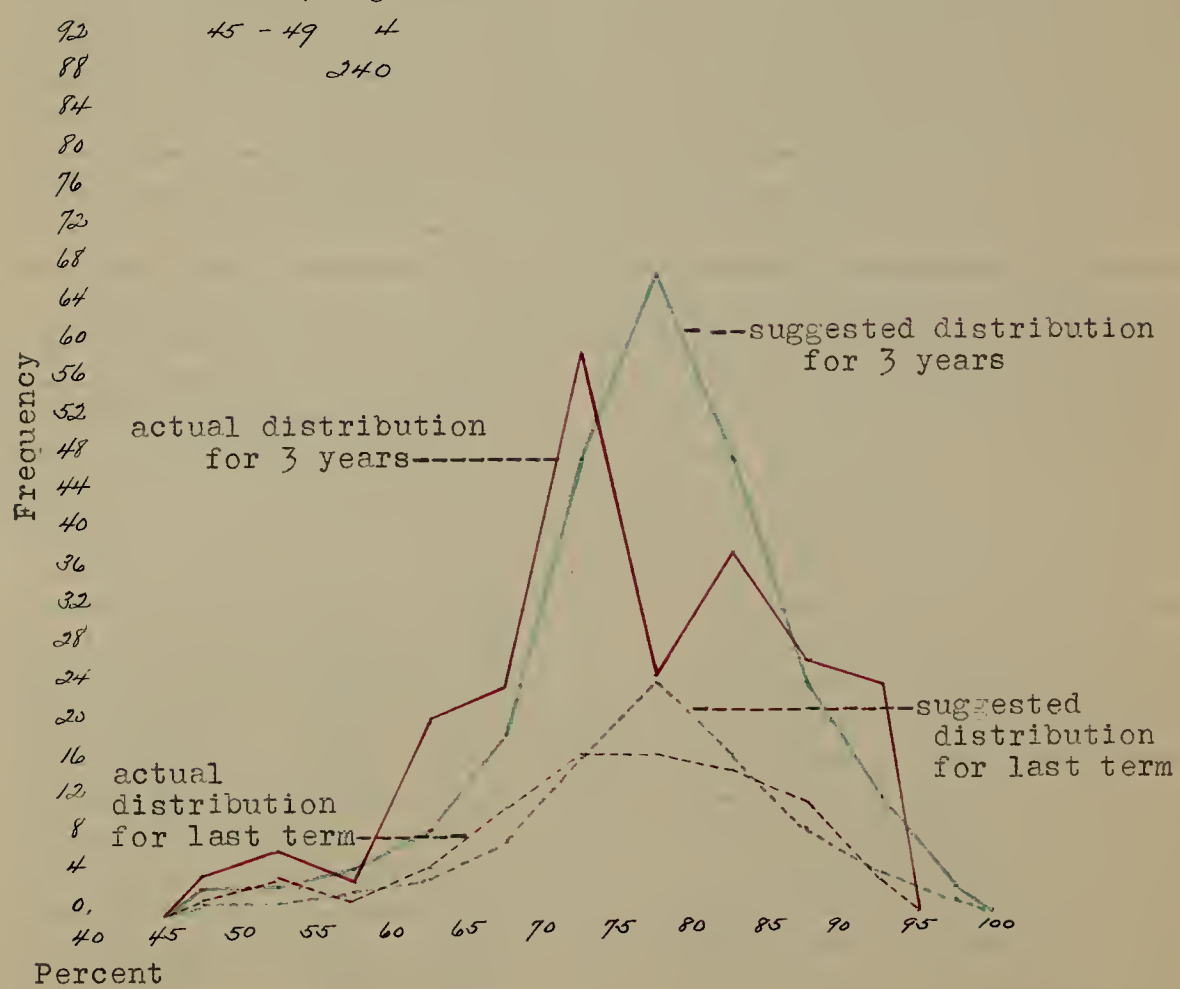
$A = 77.5 - 1.69 = 75.81$

$S.D. = \frac{320}{86} - .116 \times 5 = 9.3$

GRAPH 12

Teacher E

Interval	F
90 - 94	24
85 - 89	26
80 - 84	38
75 - 79	25
70 - 74	59
65 - 69	24
60 - 64	21
55 - 59	3
50 - 54	6
45 - 49	4
	240



ventional. The polygon has a tendency to be bimodal with a marked diminution of frequency at the 75 thru 79 level. There is also an abnormally large number of marks registering in the lower percentages. The means for the three years average about normal but the deviation is about a point too high.

The response to the marking suggestions is apparent in the dotted lines. Except for the flattening at the apex of the frequency polygon the distribution is fairly good. This teacher has all of the students of French and perhaps this accounts for her abnormal distribution of marks as French offers considerable difficulty to many students. It seems to be true that in the languages there is a greater fluctuation in student achievement. Why this is so is not made evident in this study.

Note Tables XXXV, XXXVI, XXXVII, XXXVIII and Graph 15.

The three year distribution of marks of Teacher F was commendable. As she had classes made up of girls, and as these girls were for the most part from the upper grades it is quite

TABLE XXXV

Teacher F 1930

P	F	d	Fd	Fd^2		
90-94	7	3	21	63		
85-89	10	2	20	40	76	$C = \frac{38}{109} = .348$ $C^2 = .123$
80-84	36	1	36	36	-38	
75-79	28	0	76		38	
70-74	21	-1	-21	21		$C = .348 \times 5 = 1.74$
65-69	0	-2				
60-64	1	-3	- 3	9		$A = 77.5 + 1.74 = 79.24$
55-59	2	-4	- 8	32		
50-54	3	-5	-15	75		
45-49	2	-6	-12	72		$S.D. = \frac{347}{109} - .123 \times 5 = 8.75$
	109		-38	347		

TABLE XXXVI

Teacher F 1931

P	F	d	Fd	Fd^2
90-94	9	3	27	81
85-89	31	2	62	124
80-84	39	1	39	39
75-79	32	0	128	
70-74	13	-1	-13	13
65-69	12	-2	-24	48
60-64	2	-3	- 6	18
55-59	2	-4	-8	32
50-54	1	-5	- 5	25
45-49	1	-6	- 6	36
	142		-66	416

128 − 62 = 66

$C = \frac{66}{142} = .464$

$C^2 = .213$

A C = .464 x 5 = 2.32

A = 77.5 + 2.32 = 79.82

S.D. = $\frac{416}{142} - .213 \times 5 = 8.2$

TABLE XXXVII

Teacher F 1932

P	F	d	Fd	Fd^2
90-94	6	3	18	54
85-89	21	2	42	84
80-84	30	1	30	30
75-79	90	0	90	
70-74	27	-1	-27	27
65-69	10	-2	-30	40
60-64	6	-3	-18	54
55-59	7	-4	-28	112
50-54	3	-5	-15	75
45-49	3	-6	-18	108
	133		-126	584

90 − 126 = −36

$C = -\frac{36}{133} = -.27$

$C^2 = .073$

C = -.27 x 5 = -1.35

A = 77.5 - 1.35 = 76.15

S.D. = $\frac{584}{133} - .073 \times 5 = 10.35$

TABLE XXXVIII

Teacher F 1933

90-94	11	3	33	99
85-89	26	2	52	104
80-84	37	1	37	37
75-79	19	0	112	
70-74	22	-1	-22	22
65-69	12	-2	-24	48
60-64	13	-3	-39	117
55-59	5	-4	-20	80
50-54	2	-5	-10	50
45-49	3	-6	-18	108
	140		-133	665

$C = \frac{21}{140} = .105 \qquad C^2 = .01$

$C = -.105 \times 5 = -.525$

$A = 77.5 - .53 = 76.97$

$S. D. = \frac{665}{140} - .01 \times 5 = 10.8$

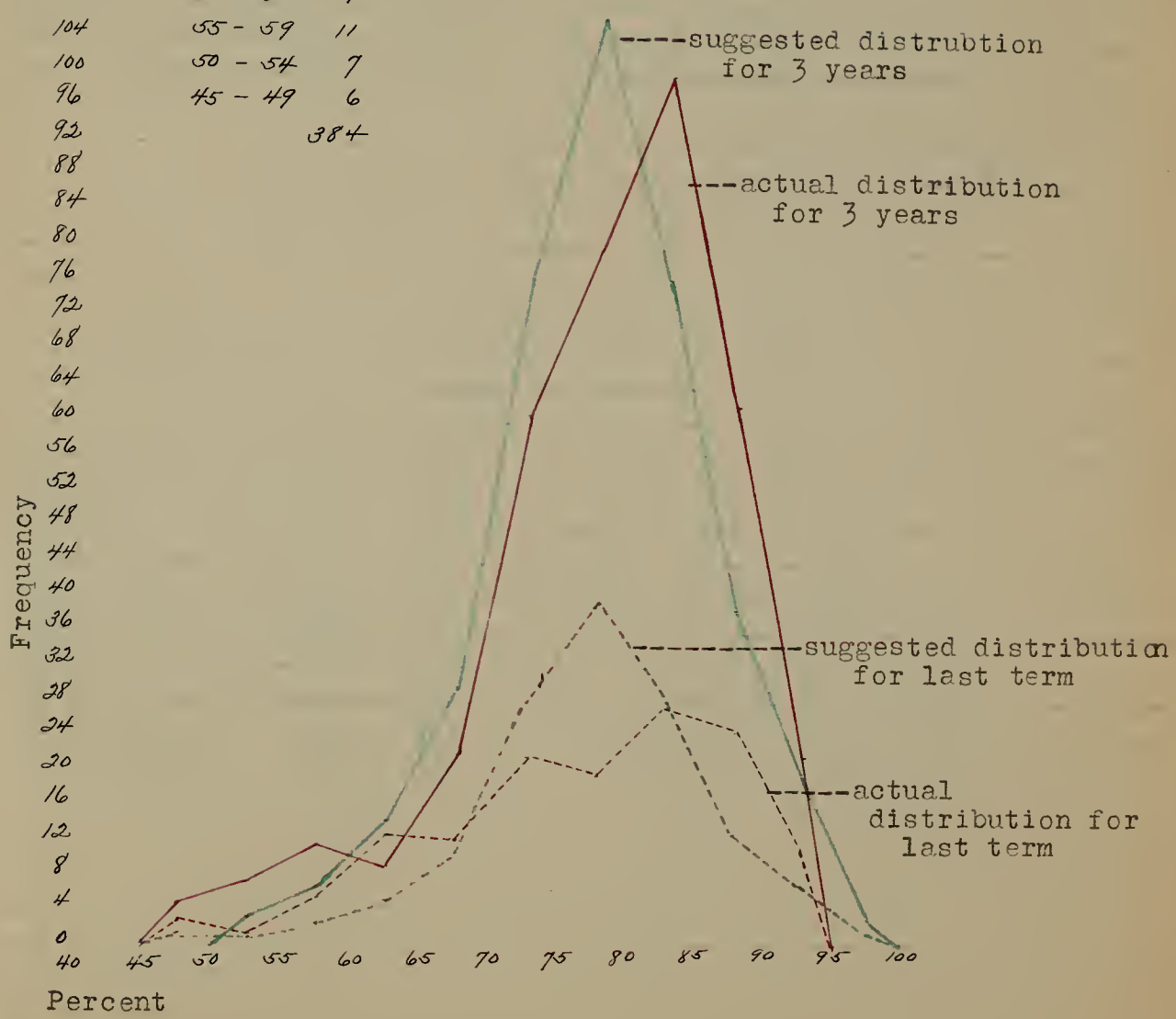
natural test her frequency polygon should show a decided positive skewness as it has been shown that girls average higher than boys in their school work. Her mean is higher than that of most of the other teachers. More marks fall into the 80-84% level than into any other. This is unusual, as ordinarily all the other graph modes were down on the 70-74% level. Out of the 364 marks given during the 2 year period none were higher than 94%, and 55 marks were below the passing grade

The instructional program seemed to work to a disadvantage in the case of Teacher F. The red dotted line of Graph 13 represents the scattering of Teacher F's 140 marks following the instruction. The outline of the polygon is quite irregular and has a tendency to assume trimodal aspects. The deviation has increased noticeably and the mean is somewhat lower. The falling off in frequency at the 84 line is unaccountable as the recommended distribution calls for a modal representation at that point. The result in this case must be called negative. Dy

GRAPH 13

Teacher F

Interval	F
90 - 94	22
85 - 89	62
80 - 84	104
75 - 79	80
70 - 74	61
65 - 69	22
60 - 64	9
55 - 59	11
50 - 54	7
45 - 49	6
	384



that should be is not apparent.

Note Tables XXXIX, XL, XLI, XLII and Graph 14.

TABLE XXXIX

Teacher G 1930

P	F	d	Fd	Fd^2		
90-94	1	3	3	9	39	$C = \frac{15}{65} \cdot \frac{3}{15} = .23$
85-89	7	2	14	28	-24	
80-84	22	1	22	22	15	$C^2 = .053$
75-79	15	0	39			
70-74	17	-1	-17	17		$C = .23 \times 5 = 1.15$
65-69	2	-2	- 4	8		
60-64	1	-3	- 3	9		$A = 77.5 + 1.15 = 78.65$
	65		-34	93		$S.D. = \frac{93}{65} - .053 \times 5 = 5.85$

TABLE XL

Teacher G 1931

P	F	d	Fd	Fd^2		
90-94	3	3	9	27		
85-89	7	2	14	28	-49	$C = -\frac{5}{75} = -.066$
80-84	21	1	21	21	44	
75-79	16	0	44		5	$S^2 = .005$
70-74	15	-1	-15	15		
65-69	8	-2	-16	32		$C = -.07 \times 5 = -.35$
60-64	2	-3	- 6	18		
55-59	3	-4	-12	48		$A = 77.5 - .35 = 77.15$
50-54	0					$S.D. = \frac{189}{75} - .005 \times 5 = 6.15$
	75		-49	189		

TABLE XLI

Teacher G 1933

P	F	d	Fd	Fd^2		
95-99	0	4	0	0	33	$C = \frac{6}{63} = .08$ $c^2 = .006$
90-94	1	3	3	9	28	
85-89	7	2	14	28	5	
80-84	16	1	16	16		$C = .08 \times 5 = .40$
75-79	17	0	33			
70-74	18	-1	-18	18		$A = 77.5 \& .4 = 77.9$
65-69	2	-2	- 4	8		
60-64	2	-3	- 6	18		$S.D. = \frac{97}{63} - .006 \times 5 = 6.2$
	63		-38	97		

TABLE XLII

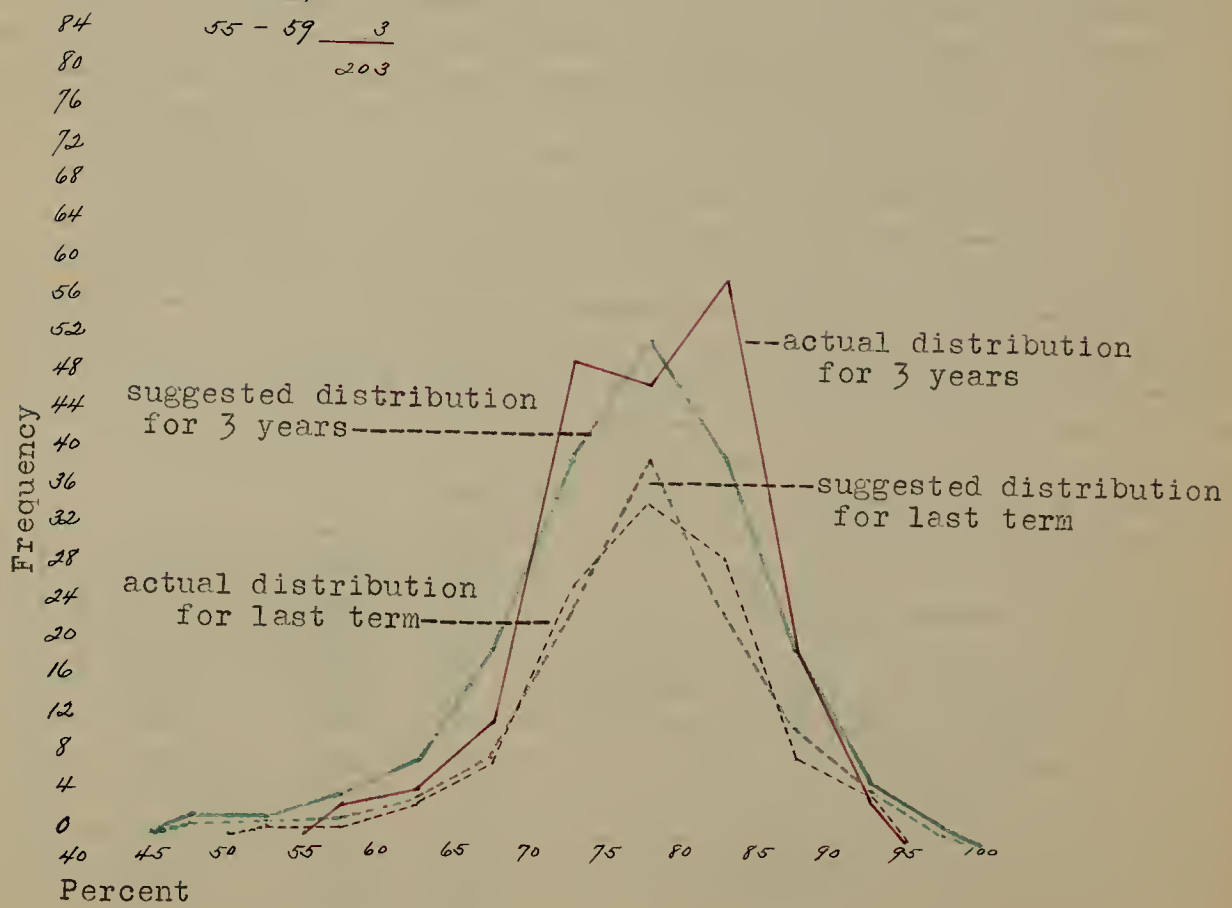
Teacher G 1933

P	F	d	Fd	Fd^2	
90-94	6	3	18	54	
85-89	9	2	18	36	$C = 0$
80-84	29	1	29	29	
75-79	30	0			$C = 0$
70-74	26	-1	-26	26	
65-69	9	-2	-18	36	$A = 77.5$
60-64	4	-3	-12	36	
55-59	1	-4	- 4	16	$S.D. = \frac{258}{120} - 0 \times 5 = 7.3$
50-54	1	-5	- 5	25	
	120		-65	258	

GRAPH 14

Teacher G

Interval	F
90 - 94	5
85 - 89	21
80 - 84	59
75 - 79	48
70 - 74	50
65 - 69	12
60 - 64	5
55 - 59	3
	203



The marking of Teacher G shows up favorably on the graph. For the three year period there is a slight positive skewness of the frequency polygon and also a falling off in frequency at the σ1 level. At the time these marks were given Teacher G had mostly upper classmen so that the positive skewness is accounted for in that it has been shown that upper classmen average higher in their marks than freshmen or sophomores. The deviation has continued low.

The distribution of marks following the instructional program shows a close approximation to the recommended distribution. The mean of 77.5 is but .4 higher than the recommended mean. This graph represents the nearest approach to the school distribution of marks.

Note Tables XLIII, XLIV, XLV, XLVI and Graph 15.

The distribution of marks of Teacher H presents no new situation. The three year distribution resembles closely the school distribution with its C line modal point and 75-80 plateau region.

TABLE XLIII

Teacher W 1930

F	f	d	fd	fd^2		
90-94	6	3	18	54		$C = -\frac{32}{106} = -.296$ $C^2 = .09$
85-89	15	2	30	60	-101	
80-84	21	1	21	21	69	
75-79	19	0	69		-32	$C^2 = -.296 \times 5 = 1.48$
70-74	27	-1	-27	27		
65-69	4	-3	- 8	16		$A = 77.6 - 1.48 = 76.02$
60-64	7	-3	-21	63		
55-59	4	-4	-16	64		
50-54	1	-5	- 5	35		S.D. $= \frac{474}{108} - .09 \times 5 = 10.35$
45-49	4	-6	-24	144		
	108		-101	474		

TABLE XLIV

Teacher H 1931

P	F	d	Fd	Fd^2		
95-99	4	4	16	64		
90-94	5	3	15	45	-73	
85-89	6	2	12	24	63	
80-84	20	1	20	20	-10	
75-79	23	0				
70-74	21	-1	-21	21		
65-69	11	-2	-22	44		
60-64	6	-3	-18	54		
55-59	0	-4	0	0		
50-54	0	-5	0	0		
45-49	2	-6	-12	72		
	98		-73	344		

$C = -\frac{10}{98} = -.1 \qquad C^2 = .01$

$C = -.1 \times 5 = -.5$

$A = 77.5 - .5 = 77$

$S.D. = \frac{344}{98} - .01 \times 5 = 9.$

TABLE XLV

Teacher H 1933

P	F	d	Fd	Fd^2		
95-99	2	4	8	32		
90-94	6	3	18	54	-166	
85-89	6	2	12	24	58	
80-84	30	1	30	30	-108	
75-79	19	0	58			
70-74	33	-1	-33	33		
65-69	16	-2	-32	64		
60-64	6	-3	-18	54		
55-59	3	-4	-12	48		
50-54	7	-5	-35	175		
45-49	6	-6	-36	216		
	124		-166	730		

$C = -\frac{108}{124} = -.87 \qquad C^2 = .757$

$C = -.87 \times 5 = -4.35$

$A = 77.5 - 4.35 = 73.15$

$S.D. = \frac{730}{124} - .757 \times 5 = 11.3$

TABLE XLVI

Teacher H 1933

P	F	d	Fd	Fd^2
95-99	2	4	8	32
90-94	3	3	15	45
85-89	15	2	30	60
80-84	20	1	20	20
75-79	27	0	73	
70-74	42	-1	-42	42
65-69	13	-2	-26	52
60-64	10	-3	-30	90
55-59	3	-4	-12	48
50-54	1	-5	- 5	25
45-49	2	-6	-12	72
	140		-137	486

$C = -\frac{54}{140} = -.385$ $\quad C^2 = .144$

$C = -.385 \times 5 = -1.92$

$A = 77.5 - 1.92 = 75.58$

$S.D. = \frac{486}{140} - .144 \times 5 = 9.1$

The last term's distribution of marks shows clearly the effect of a large number of underclassmen. The mean is low and the polygon is skewed negatively. The chief benefit of the study to Teacher H seems to be the smoothing out of the plateau section.

Note Tables XLVII, XLVIII, XLIX, L and Graph 16.

Teacher I resembles Teacher H in her assignment of marks. As she teaches Latin and Geometry we might expect a more jagged frequency polygon as these subjects are difficult for many stu-

TABLE XLVII

Teacher I 1930

P	F	d	Fd	Fd^2
95-99	1	4	4	16
90-94	13	3	39	117
85-89	11	2	22	44
80-84	16	1	16	16
75-79	8	0	81	
70-74	7	-1	- 7	7
65-69	0	-2	0	0
60-64	0	-3	0	0
55-59	6	-4	-24	96
50-54	8	-5	-40	200
45-49	5	-6	-30	180
	75		-101	676

-101
81
- 20

$C = \frac{20}{75} = -.267$ $\quad C^2 = .073$

$C = -.267 \times 5 = -1.34$

$A = 77.5 - 1.34 = 76.16$

$S.D. = \frac{676}{75} - .073 \times 5 = 14.95$

GRAPH 15

Teacher H

Interval	F
95 - 99	6
90 - 94	17
85 - 89	27
80 - 84	61
75 - 79	61
70 - 74	81
65 - 69	31
60 - 64	19
55 - 59	7
50 - 54	8
45 - 49	12
	330

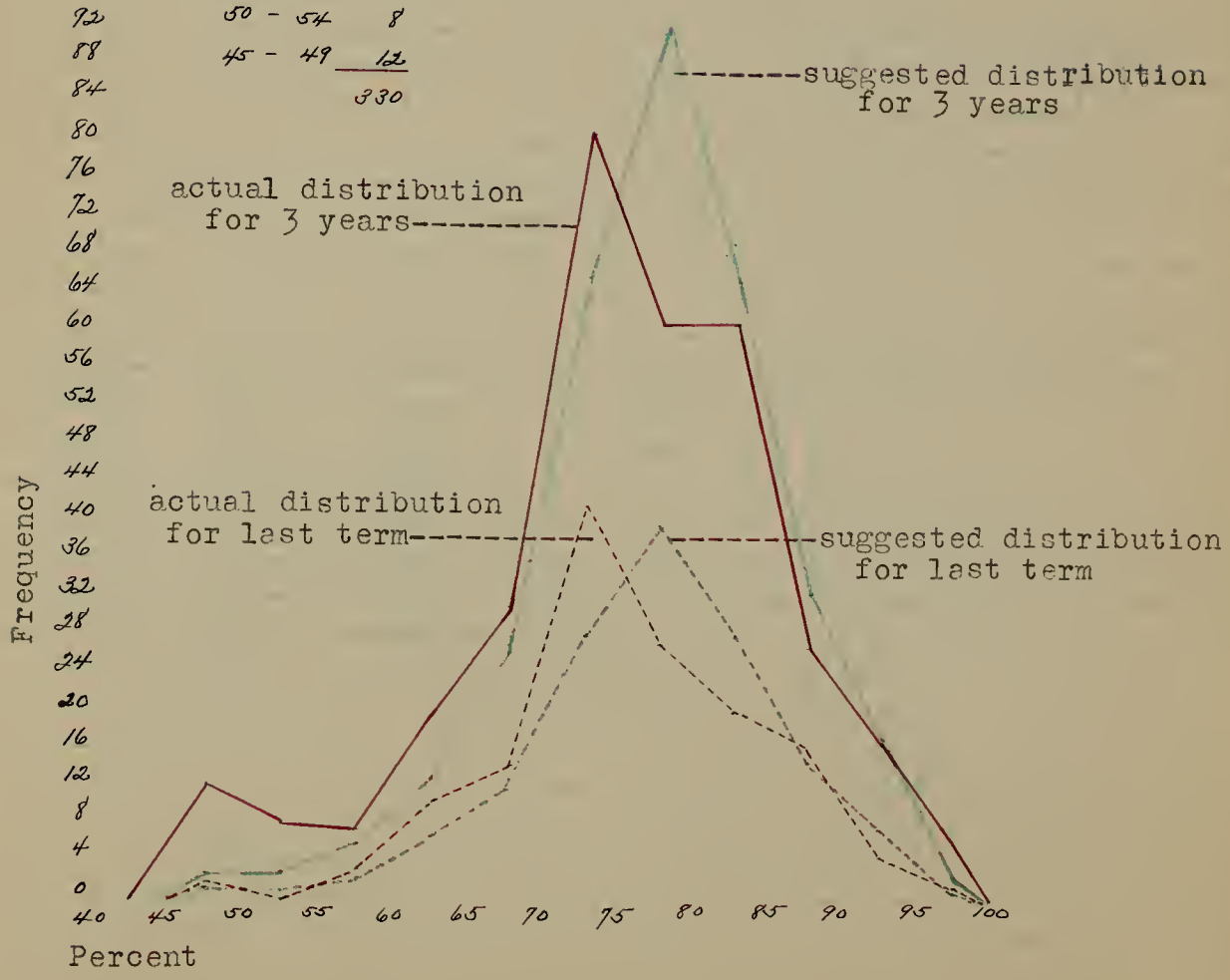


TABLE XLVIII

Teacher I 1931

P	F	d	Fd	Fd²		
90-94	19	3	57	171		
85-89	19	2	38	76	-118	C = $\frac{8}{111}$ = -.072 C² = .005
80-84	15	1	15	15	110	
75-79	12	0	110		-9	
70-74	17	-1	-17	17		C = -.072 x 5 = -.36
65-69	12	-2	-24	48		
60-64	6	-3	-18	54		A = 77.5 - .36 = 77.14
55-59	1	-4	-4	16		
50-54	5	-5	-25	125		S. D. = $\frac{701}{111}$ - .005 x 5 = 12.18
45-49	5	-6	-30	180		
	111		-118	703		

TABLE XLIX

Teacher I 1932

P	F	d	Fd	Fd²		
95-99	1	4	4	16		
90-94	16	3	48	144	79	C = $\frac{12}{105}$ = .11 C² = .011
85-89	14	2	28	56	-77	
80-84	19	1	19	19	33	
75-79	16	0	09			C = .11 x 5 = 1.05
70-74	17	-1	-17	17		
65-69	12	-2	-24	48		A = 77.5 + 1.05 = 78.55
60-64	6	-3	-18	54		
55-59	3	-4	-8	33		S. D. = $\frac{436}{105}$ - .044 x 5 = 10.1
50-54	2	-5	-10	50		
	105		-77	436		

TABLE L

Teacher I 1933

P	F	d	Fd	Fd^2
95-99	2	4	8	32
90-94	16	3	48	144
85-89	19	2	38	76
80-84	21	1	21	21
75-79	21	0	115	
70-74	15	-1	-15	15
65-69	10	-2	-20	40
60-64	6	-3	-18	54
55-59	7	-4	-28	112
50-54	3	-5	-15	75
45-49	3	-6	-18	108
	123		-114	677

C = 0

C = 0

A = 77.5

$$\sigma = \frac{677}{123} - 0 \times \text{[illegible]} = 11.7$$

dents. Here again we find three modal points and a high deviation. With 70 marks out of 291 in the below passing region, this is not surprising.

Teacher I seems to have made considerable improvement in her assignment of marks during the last term because of the instructional program. While the deviation is much too high and there is practically no apex to the polygon, the abrupt fluctuations have been eliminated and the distribution of marks assumes more normal proportions. Why teachers of French, Latin and English should have such irregular manifestations is an interesting enigma. Possibly the greater degree of subjectivity of these subjects accounts for some of the wide divergences.

Note Tables LI, LII, LIII, LIX and Graph 17.

The marks issuing from Teacher J take on a decided bimodal aspect in their scattering around the mean. The frequency polygon rather than assuming normal conformation has a marked concavity at the 75-79 level which should be the modal point. The devia-

GRAPH 16

Teacher I

Interval	F
95 - 99	2
90 - 94	48
85 - 89	44
80 - 84	50
75 - 79	36
70 - 74	41
65 - 69	24
60 - 64	12
55 - 59	9
50 - 54	15
45 - 49	10
	291

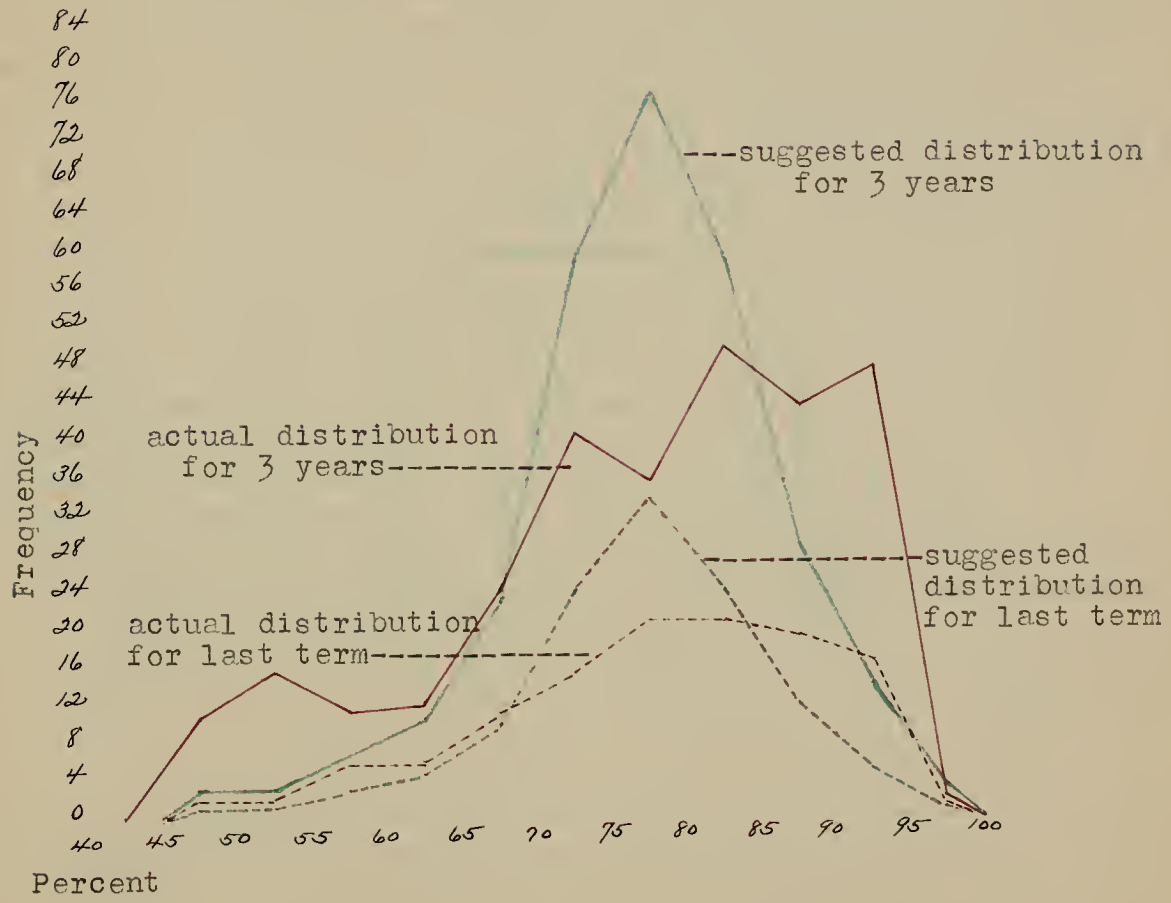


TABLE II

Teacher J 1930

T	F	d	Fd	Fd^2		
[illegible]	7	[illegible]	14	[illegible]		
[illegible]	37	1	37	37	51	C = $\frac{8}{105}$ = .076 C^2 = .006
75-79	30	0	51		-43	
70-74	[illegible]	-1	-[illegible]	23	8	C = .076 x [illegible] = .38
[illegible]	[illegible]	-2	-10	20		
[illegible]	2	-3	-6	18		A = 77.8 + .38 = 77.[illegible]
[illegible]	1	-4	-4	16		
	105		- 43	143		S. D. = $\frac{143}{105}$ - .006 x [illegible] = [illegible].8

TABLE III

Teacher J 1931

T	F	d	Fd	Fd^2		
[illegible]	8	[illegible]	16	[illegible]		
85-89	37	1	[illegible]	37	-67	C = - $\frac{14}{134}$ = -.1 C^2 = .01
75-79	37	0	53		[illegible]	
70-74	[illegible]	-1	-39	39	-14	C = -.1 x [illegible] = -.[illegible]
[illegible]	12	-2	-[illegible]	48		
60-64	0	-3	0	0		A = 77.[illegible] - .5 = 77
[illegible]	1	-4	-4	16		
	134		-67	172		S. D. = $\frac{172}{134}$ - .1 x [illegible] = [illegible]

TABLE LIII

Teacher J 1932

P	F	d	Fd	Fd^2		
[illegible]	7	2	14	28		
[illegible]	34	1	34	34	-101	$C = \frac{-53}{135} = -.39$ $C^2 = .153$
75-79	23	0	48		48	
70-74	47	-1	-47	47	-53	C = -.393 x 5 = - 1.96
[illegible]	20	-2	-40	80		A = 77.5 - 1.96 = 75.54
60-64	2	-3	-6	18		
[illegible]	2	-4	-8	[illegible]		S. D. = $\frac{[illegible]}{135}$ -.156 x 5 = 0.[illegible]
	135		-101	[illegible]		

TABLE LIV

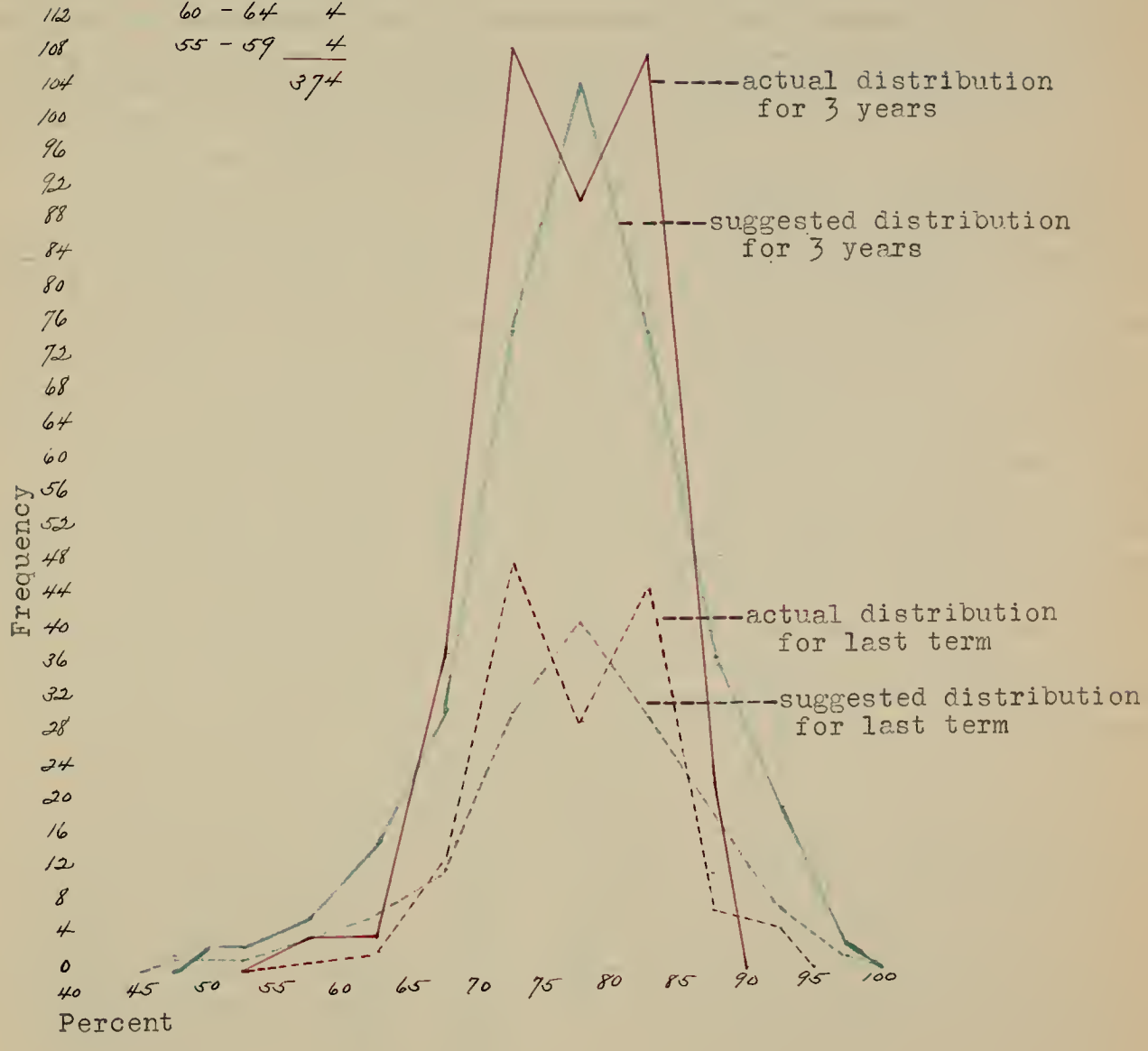
Teacher J 1933

P	F	d	Fd	Fd^2	
[illegible]	6	3	18	[illegible]	
[illegible]	6	2	12	24	$C = \frac{14}{150} = .093$ $C^2 = .008$
[illegible]	45	1	45	45	
75-79	[illegible]	0	73		C = -.093 x 5 = -.47
70-74	48	-1	-48	48	
[illegible]	14	-2	-28	56	A = 77.5 - 4.7 = 77.03
[illegible]	3	-3	-9	18	
[illegible]	1	-4	-4	16	S. D. = $\frac{[illegible]}{150}$ -.[illegible] x 5 = 0.[illegible]
			-86	[illegible]	

GRAPH 17

Teacher J

Interval	F
85 - 89	22
80 - 84	108
75 - 79	90
70 - 74	109
65 - 69	37
60 - 64	4
55 - 59	4
	374



tion is uncommonly low being approximately 6 while the school deviation is 9.

The dotted lines showing the distribution of marks for the term following the instructional program are strikingly similar in general outline. The undesirable characteristics are still pronounced. The classes under this teacher represent a fairly accurate cross section of the student body. It is clear that this teacher failed to understand the significance of the study and continued to assign marks as heretofore.

Tables LV, LVI, LVII, LVIII and Graph 18 reveal a normal marking practice for Teacher K. Both the three year and last term frequencies are without serious deviation or irregularity. While the mode is somewhat exaggerated the condition is not serious in so much as the mode point falls on the "C+" line.

Excepting the decrease in frequency at the 85-89 level the 1933 distribution of marks is almost the exact duplicate of the three year distribution. It would seem that Teacher K simply continued to assign his marks as heretofore.

TABLE LV

Teacher K 1930

f	F	d	fd	fd²	
90-94	13	3	39	117	
85-89	17	2	34	68	103
80-84	20	1	20	20	-34
75-79	31	0	102		69
70-74	20	-1	-20	20	
65-69	2	-2	-4	8	
	111		- 33	251	

$C = \frac{69}{111} = .621 \quad C^2 = .384$

$C = .621 \times 5 = 3.11$

$A = 77.5 + 3.11 = 80.61$

$S. D. = \frac{251}{111} - .384 \times 5 = 6.85$

TABLE LVI

Teacher K 1931

X	F	d	Fd	Fd^2		
90-94	9	3	27	81		
85-89	11	2	22	44	70	$C = \frac{30}{101} - .297$ $\quad C^2 = .09$
80-84	21	1	21	21	-40	
75-79	30	0	70		30	$C = .297 \times 5 = 1.49$
70-74	24	-1	-24	24		
65-69	3	-2	-6	12		$A = 77.5 + 1.49 = 78.99$
60-64	2	-3	-6	18		
55-59	1	-4	-4	16		$\sigma. D. = \frac{216}{101} - .09 \times 5 = 7.15$
	101		-40	216		

TABLE LVII

Teacher K 1933

X	F	d	Fd	Fd^2		
90-94	3	3	9	27		
85-89	6	2	10	20	-44	$C = -\frac{11}{109} = -.1$ $\quad C^2 = .01$
80-84	13	1	13	13	33	
75-79	32	0	32		-11	$C = -.1 \times 5 = -.5$
70-74	31	-1	-31	31		
65-69	3	-2	-6	12		$A = 77.5 - .5 = 77$
60-64	2	-3	-6	18		
	109		-43	121		$\sigma. D. = \frac{121}{109} - .01 \times 5 = 7.3$

TABLE LVIII

Teacher N 1933

X	F	d	fd	fd²
[illegible]	6	5	10	24
[illegible]	8	2	16	32
[illegible]	25	1	25	25
70-75	41	0	0	
70-74	33	-1	-33	33
[illegible]	2	-2	-4	8
[illegible]	3	-3	-9	15
[illegible]	1	-4	-4	16
[illegible]	1	-5	-5	[illegible]
	139		-28	331

$C = \frac{17}{139} = .13$ $\quad \sigma^2 = .017$

$C = .13 \times 5 = .65$

$A = 77.5 + .65 = 78.15$

$\sigma. D. = \frac{331}{139} - .017 \times 5 = 4.8$

Table LIX and Graph 19 show the result of the marks for the school term ending January 1933. These marks followed the instructional period and show whether the teachers have responded to the facts brought out in the investigation of the three year period. In comparison this outcome with those representing the marking situation for the years 1930, 1931, 1932 it will be observed that the general distribution of marks remains practically

TABLE LIX

High School January 1933

X	F	d	fd	fd²
[illegible]	5	4	20	80
[illegible]	30	3	90	270
[illegible]	170	2	340	680
[illegible]	[illegible]	1	[illegible]	[illegible]
75-79	440	0	1000	
70-74	470	-1	-470	470
[illegible]	160	-2	-320	640
[illegible]	88	-3	-264	792
[illegible]	36	-4	144	576
[illegible]	15	-5	61	305
[illegible]	11	-6	66	396
	1040		-1331	5196

$C = \frac{331}{1040} = -.175$ $\quad C^2 = .030$

$C = -.175 \times 5 = -.875$

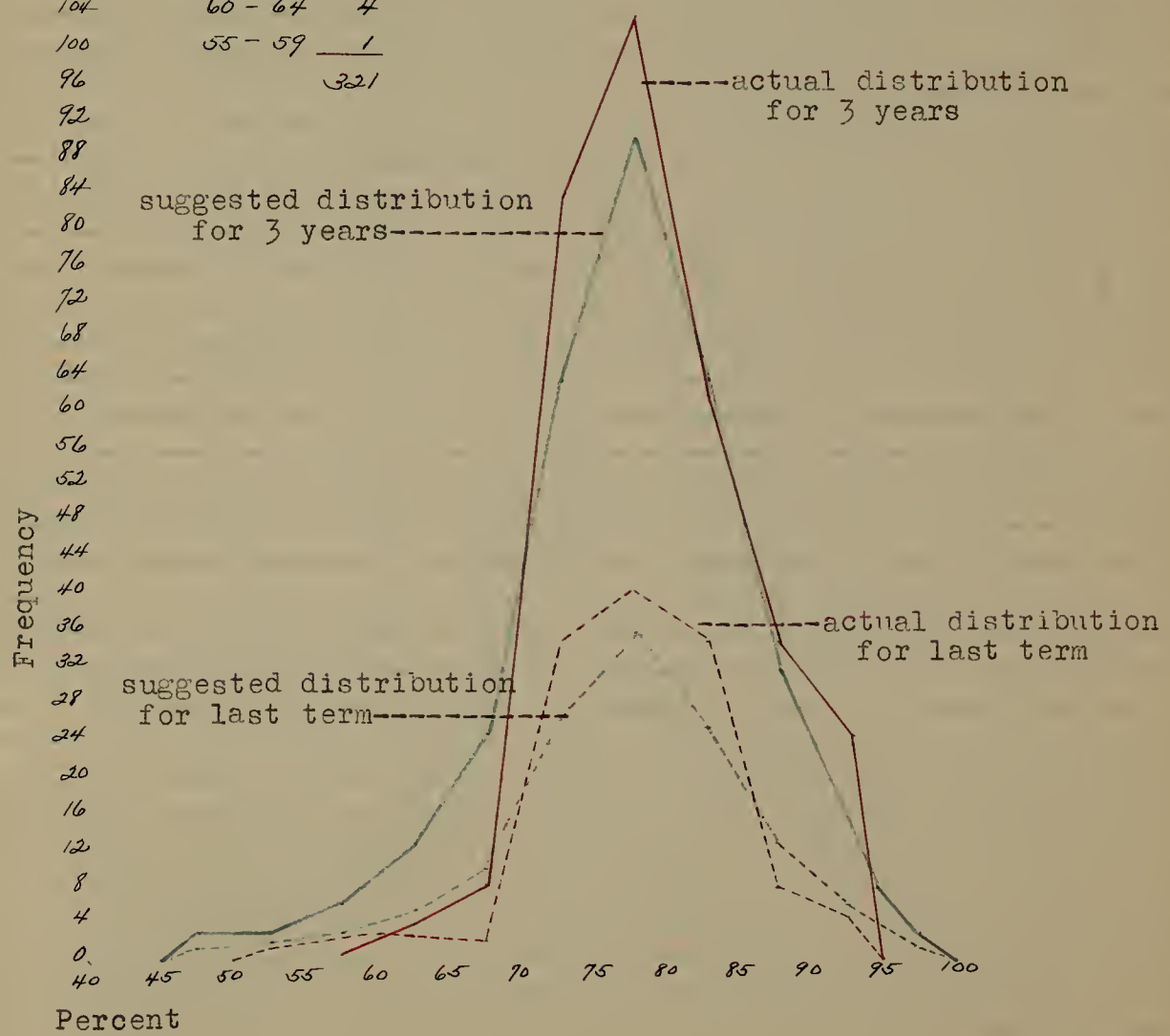
$A = 77.5 - .875 = 76.62$

$\sigma. D. = \frac{5196}{1040} - .030 \times 5 = 4.85$

GRAPH 18

Teacher K

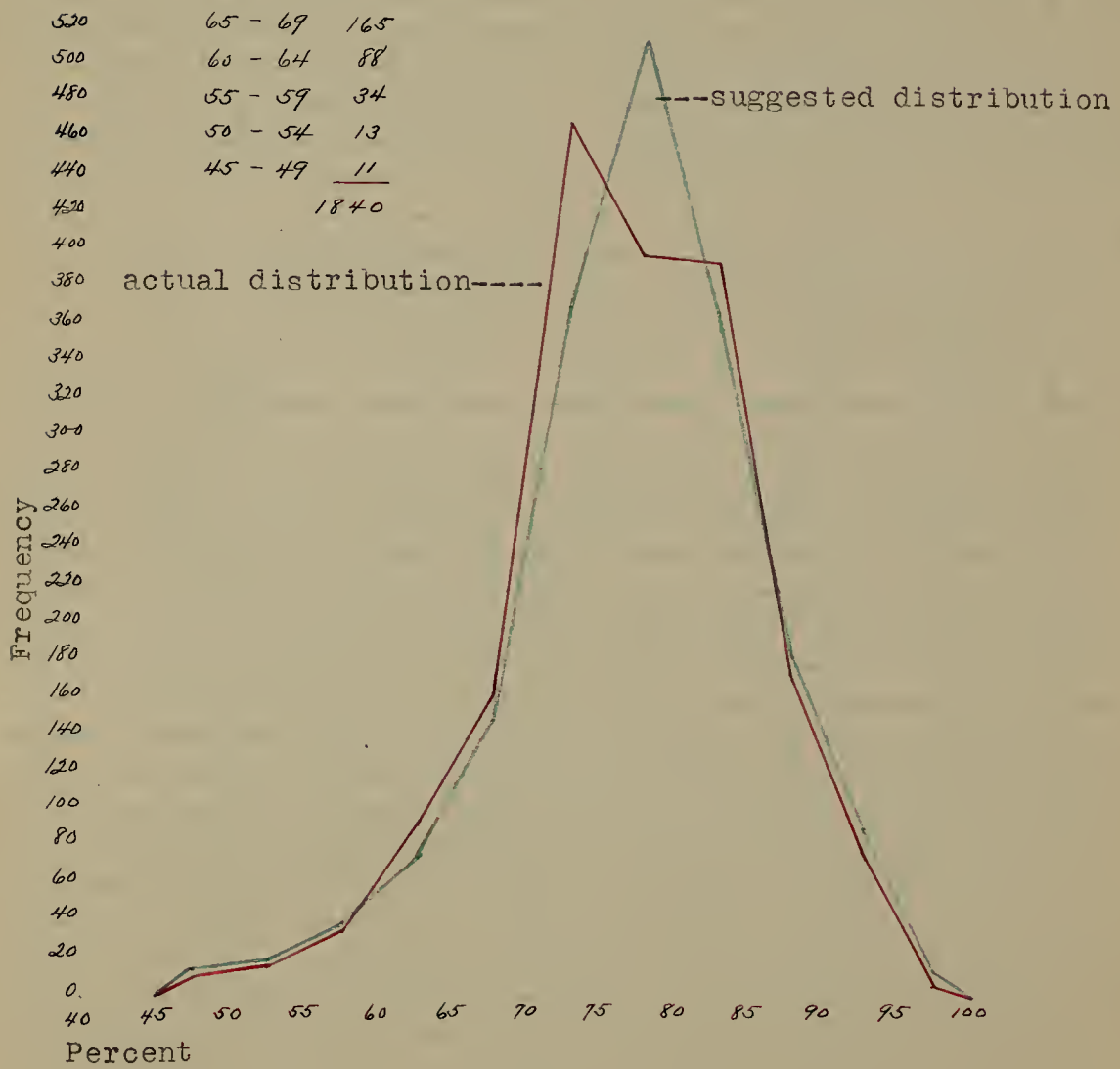
Interval	F
90 - 94	25
85 - 89	33
80 - 84	63
75 - 79	103
70 - 74	84
65 - 69	8
60 - 64	4
55 - 59	1
	321



GRAPH 19

Total Scores of High School ast Midyear 1933

Interval	F
95 - 99	5
90 - 94	80
85 - 89	175
80 - 84	399
75 - 79	400
70 - 74	470
65 - 69	165
60 - 64	88
55 - 59	34
50 - 54	13
45 - 49	11
	1840



unaltered. The mean of 76.63 continues slightly lower than the recommended mean, the mode persists on the 73.5 line, and there are still too few cases at the C+ level. As there are 1840 marks considered in this computation it seems reasonable to assume that there should be close proximity to the recommended frequency polygon. While individual teachers seemed to be helped in some cases the fact remains that in the aggregate there is no appreciable alteration of the frequency polygon of the school.

Table 13 brings together in a convenient form most of the important results of the various computations. It will be noted

Table IX

Summary of Average Marks and Deviations

Teacher	The analysis 1930 Ave.	1930 Dev.	1931 Ave.	1931 Dev.	1932 Ave.	1932 Dev.	DNA result 1933 Ave.	1933 Dev.	1934/1933 Dif. if Ave.	Dev.
A	76.1	9.9	76.75	10.4	74.14	8.8	77.47	8.	±3.33	- .55
B	73.7	9.95	73.90	11.1	73.11	11.	76.97	9.4	±3.33	-2.1
C	76.3	6.3	73.05	5.9	71.13	10.7	77.43	9.65	±1.3	-3.7
D	73.20	7.2	73.65	7.35	73.45	7.8	73.30	7.	±1.50	- .8
E	73.15	11.55	77.3	10.90	70.05	10.	75.91	9.5	± .78	- .8
F	73.34	8.7	73.65	8.3	73.10	10.45	73.97	10.9	± .83	± .45
G	77.3	6.3	77.15	5.15	73.05	6.8	77.0	7.4	-1.10	±1.1
H	74.00	10.5	77.	9.30	73.13	11.3	75.55	8.1	±2.47	-2.1
I	76.16	14.2	77.11	13.2	76.55	10.1	77.5	11.7	-1.05	±1.9
J	77.52	6.8	77.	5.65	74.14	6.35	77.00	6.40	±1.43	± .19
K	80.21	4.29	78.35	7.14	77.	4.2	78.15	6.5	±1.15	±1.1
	76.37	8.5	76.5	9.4	75.2	8.5	76.63	8.25	±1.37	-1.30

that in the year 1930 the average marks of the teachers covered a range of 7.91%; in 1931, a range of 7.17%; in 1932, a range of 6.17%; and in 1933, a range of 4.07%. This gradual decrease in differences of the means would seem to indicate a more uniform marking procedure on the part of the teachers. The deviations varied 5.15 points in 1930, 5.2 points in 1931, 6.3 points in 1932

and only 5.25 points in 1933. The mean for the high school increased .56 and the deviation decreased 1.37 points. Both of the results indicate a desirable tendency.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The results of this study which concerned the marking practices of eleven of the regular teachers of the Agawam High School for a continuous period of four years seem to support the following conclusions:

1. The greatest irregularity in mark distribution occurred in the English, French, and Latin departments. The best distribution of marks was found in the Science department.
2. The information given the teachers concerning the mark analysis had a tendency to raise the average marks of several of the teachers and therefore the average mark for the entire high school. The information also had a tendency to lower the deviation, or to restrict somewhat the scattering of marks around the means.
3. The investigation seems to have made no appreciable improvement in the use of the marking system. Whether this was due to an ineffective instructional program with the faculty or to the natural passive resistance on the part of the teachers to such an objective procedure, the author is not prepared to say. Most likely there were a number of variables which influenced the final outcome.
4. It would seem that simply showing a teacher where her marking variations are and then offering a standard for her to follow is not enough to bring about any great conformity in marking procedure.

suggestions based on the results of this study.

It seems to the author that this simple statistical method of revealing the grading characteristics of teachers would have some value for school administrators. While the method is somewhat crude from a statistical point of view, it does have the advantage of being easily understood and applied. Again, while many of the potentialities of the statistical method have been disregarded, the results which are obtained furnish adequate information to enable one to form a reasonable conclusion without becoming involved in abstruse mathematics. It would seem rational to use the simplest method which would answer the requirements of the situation.

The chief weakness in the procedure employed in this investigation seems to be that too little time was spent with the teachers who had the correct distribution of marks. With greater vigilance in that direction the improvement probably would have been greater.

The vital importance of having a standard school distribution of marks in the hands of every teacher is apparent. In an age such as each teacher of a school system is endeavoring to classify the same students, it is imperative that the same measuring device be used. Without such a governor the marks of the teachers would be so subjective and individualistic as to render them practically meaningless.

BIBLIOGRAPHY

1. Bliss, C.O., New Jersey Schools--Educational Administration and Supervision III, Pp. 165-178. March, 1917.

2. Colvin, F.E., Do Teachers' Marks Vary As Much As Supposed? Education 32:87-98, September, 1911.

3. Dower, Lucas, Jr., A Comparative Study of Marks in Some Connecticut Valley High School with Enrollment over 100, Massachusetts State College, (Unpublished).

4. Gamp, F.C., Home Marks--An Administrative Problem, School Review, 25:697-713. December, 1917.

5. Manning, J.H., The Meaning of Students Marks, School Review, 24:106-203.

6. Garrett, H.E., Statistics in Psychology and Education, Longmans, Green Company, pp. 54.

7. Gluck, M., A Study of the Marking System--College of the City of New York, 1937.

8. Henry, N.L., Is Anonymous Grading Wise? School and Society 29:77-78, January, 1937.

9. Jessard, C.H., Improving the Marking System, Educational Administration and Supervision, 5:25-38, January, 1919.

10. Porter, Enoch, Reflections on a New Method of Grading, School and Society 25:77-78, November, 1936.

11. Odell, C.W., High School Marking Systems--School Review, 33:348-54, May, 1925.

12. Peters, C.L., Fundamental Considerations Involved in Current Marking Systems, School and Society 21:735-36. June, 1935.

13. Rugg, Teachers' Marks and the Reconstruction of the Marking System--Elementary School Journal, May, 1918.

14. Rugg, H.O., A Primer of Graphic and Statistics for Teachers--Houghton Mifflin Company, 1925, Pp. 67.

15. Starch, D., Can the Variability of Marks be Reduced? School and Society 2:242-3, August, 1915.

16. Symonds, P.M., Measurements in Secondary Education, Macmillan Company, 1929, Pp. 498.

17. Wold, L.B., A Standard of Interpretation of Numerical Grades, School Review, 25:413-31, June, 1917.

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