TRANSLATING GRADES FROM ONE MARKING SCALE INTO THOSE OF ANOTHER

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It frequently becomes necessary in statistical studies of college grades to translate those of one marking scale into the equivalent of grades on another scale. The writers encountered this problem in a study of the relation of graduate to undergraduate scholarship.

TABLE I

DISTRIBUTION OF THE GRADUATE GRADES ON THE OLD SCALE AND ON THE NEW SCALE ACCORDING TO THE NUMBER AND PERCENTAGE OF EACH MARK

OLD SCALE-1925-26			NEW SCALL-1928		
Mark	Number	Percentage	Mark	Number	Percentage
A	1708	35.6	H	2079	24.8
B	2060	43.0	P	5705	68.1
C	664	13.9			
D	82	1.7	U	126	1.5
F	31	.6	F	37	.4
NG	143	3.0	NG	190	3.5
PG	103	2.1	PG	141	1.7
	4791	99.9		8278	100.0

NG means no grade, PG means provisional grade; both indicate incompletes.

At the University of Chicago at the time the study was made, undergraduate marks were on a five-letter scale with grade-point values as follows: A, 6; B, 4; C, 2; D, 0; F (failed), -2. The scale used for marking graduate students was formerly the same, but in 1926 it was revised to include only four marks without point values as follows: H, honor; P, satisfactory; U, undergraduate credit only; F, failed. The study included a period of years encompassing the use of both marking scales. Therefore, before the grade-to-grade undergraduate grades could be compared

necessary to assign to the new marks grade-point values in terms of the values on the old scale.

The grade distributions used in the calculation are presented in Table I and Figure 1.

Inspection of the table and the figure shows that the H

FIG. 1.-Percentage distribution of 1925-26 grades and of 1928 grades issued to graduate students, the percentage of each grade level, and the accumulative percentages.

on the new scale is a higher grade than the A on the old scale, because 35.6 per cent of the total grades on the latter were A's, whereas only 24.8 per cent of the total on the former were H's. It is also clear that H and P on the new scale cover approximately the same range as that included by A, B, and C on the old scale, the accumulative percentages being 92.9 and 92.5 respectively.

The procedure used in determining the grade point values of the new marks is an adaptation of that illustrated by Holzinger in his discussion of the Normal Probability

$ Karl J. Holzinger, ***Statistical Methods for Students in Education,*** pp. 222 and 223. Boston: Ginn and Company, 1928.

The first step is the calculation of the sigma value of grade category. The steps in the procedure are shown in Tables II and III.

TABLE II
CALCULATION OF THE SIGMA VALUES FOR THE GRADES ISSUED IN 1925-1926

Area between ordinates	Are	Value of or	Sigma Value from 4-place		
	.500	.0000	.3727	-.0000	.3727
					= 1.05+3=4.05
.356			.356		.356
	.144	.3727	.2914	-.3727	-.0813
					=- .19+3=2.81
.430			.430		.430
	.286	.2914	.1416	-.2914	-.1498
					= -1.08+3 =1.92
.139			.139		.139
	.425	.1416			
.017			.1160	-.1416	-.0256
					=-.151+3=1.49
	.442	.1160	.017		.017
.006					
			.1064	-.1160	-.0096
	.448	.1064		=	=-1.60+3=1.40
.030			.006		.006
			.0525	-.1064	-.0539
	.478	.0525			1.80+3 =1.20

From Tables II and III we see that the sigma, abstract values of the various letters are

A=4.05	H=4.28
B=2.81	P=2.73
C=1.92	U=1.47
D=1.49	F=1.40
F=1.40	NG=1.17

The point values of the letters of the first group are: A=6, B =4, C=2, D=O, F=-2, NG=O, and PG=O.

greater value than the A, 24.8 per cent being in the H category and 35.6 per cent being in the A category; that the P, 68.1 per cent, includes 10.8 per cent A's, 43.0 per cent B's, and 13.9 per cent C's; that the U is practically equal to the D; and that the F's, NG's, and PG's in one series practically equal the same letters in the other series.

TABLE III

PG NG F U P H **.017 .035 .004** .015 .681 .248 $\sigma_{z'}$ z'_{87} z'_{81} Se

Ordinate	Area between ordinates	Area	Value of ordinate	Sigma Value from a 4-place table
a7		.500	.0000	.3164 -.0000 .3164 = 1.28+3=4.28
	.248			.248 .248
z6		.252	.3164	.1357 -.3164 -.1807
	.681			**=- .27+3=2.73**
s6		.429	.1357	.681 .681
	.015			.1128-.1357 -.0229
Z4		.444	.1128	= -=-1.53+3=1.47
	.004			.015 .015
z,		.448	.1064	.1064-.1128 -.0064 = =-1.60+3=1.40
	.035			.004 .004
z,		.483	.0422	.0422-.1064 -.0642 = -=-1.83+3=1.17

abstract values for the letters of the two series and the point values of the letters of the first group, the point values for H, P, U, and F were determined as follows.

4.28 (H)

4.05 (A) X 6 (Value of A) =6.24 or H=6.2

2.73 (P) X 6 (Value of A) = 6.044 X $\frac{108}{681}$ (that portion of Ps 4.05 (A)

included in the A's) = . 6413

2

2.73 (P) .81(B) X4 (Value of B) =3.886 XsB-(that

1.92 (C) X2 (Value of C) =2.843 Xggi(that portion of P's

included in the C's) = . 5802 Total 3.6745 Therefore..... P=3.7

The values for U, F, NG, and PG were assumed to be 0, -2, 0, and 0, respectively.

The following is given as evidence of the validity of the foregoing procedure. Using the percentages of each category given in Figure 1, the point values of the letters of the first group and the derived point values, we have

A = . 356 X 6 = 2.136 B = .430 X 4 = 1.720 C = .139 X 2 = .278 D=.017X 0= 0 F=.006X-2=-.012 NH=.030X 0= 0 4.12

H = . 248 X 6 . 3 = P U=.015X0= F = . 004 X -2 = - .0080 NG=.035X 0= 4.074

The total for the values of H, P, U, F, NG, and PG is but .0479 of a grade point less than the total under the old scale. The method illustrated here may be of some interest to those engaged in a statistical study of college marks. It might, for example, be used in comparing the values of the marks of different instructors, different departments, and different schools. It might be emphasized in this connection that comparisons of the grades of two or more or schools are not reliable unless grade distributions are taken into consideration