PRINCIPLES OF SECONDARY EDUCATION

BY

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CHAPTER III

THE SECONDARY-SCHOOL PUPIL: INDIVIDUAL DIFFERENCES

21. Importance of recognizing individual differences. Within recent years two factors have tended to emphasize the importance of recognizing individual differences among secondary-school pupils: (1) the increasing heterogeneity of the secondary-school population; (2) the development of the psychology of individual differences.

(1) Until toward the close of the nineteenth century pupils enrolled in the secondary schools of the country constituted a roughly homogeneous group in the sense that they were boys and girls from relatively well-to-do American families, who for the most part looked forward to a cultural education in the high school which would prepare them for college and for the higher walks of life. The past quarter century, however, has marked a period in the development of secondary education characterized by the expansion of the secondary school so as to provide education for classes of pupils never before represented in large numbers in the secondary school. The result has been a very greatly increased heterogeneity in the high-school population, and consequently a demand for increased attention to the varied capacities, interests, and probable future activities of secondary-school pupils, and to the differentiated needs of society.

(2) Within the past decade educational psychology has found no more fruitful field than that of the psychology of individual differences, and in no other field have the results of psychological investigation contributed more to our educational theory and practice. It has, of course, always been

recognized that individuals differ each from the other in physical and mental traits. Only recently, however, have we begun to realize the full meaning of that fact and the implications for secondary education. It is probably no exaggeration to say that the adaptation of secondary education on the one hand to meet the needs of different capacities, interests, and probable futures among pupils, and on the other hand to meet the differentiated needs of society, is the most important problem of secondary education at the present time.

Some idea of the great range of abilities among secondary-school pupils may be gained from an examination of the conditions indicated in Tables XXIII–XXIV.

When we note that high-school pupils who are engaged in the study of algebra may differ so widely in their abilities to perform the ordinary operations of arithmetic that some are from three to four times as capable as others in addition, subtraction, multiplication, and division, and almost immeasurably more efficient in handling abstract examples and reasoning as measured by the Courtis Tests, the importance of recognizing individual differences in capacities is impressed on us.

22. The distribution of individual differences. In considering differences among pupils of any given group with reference to the amounts of a trait possessed, there is always an unconscious tendency to separate the individuals and classify them in more or less discrete groups, e.g., short, medium-sized, and tall boys; young, average-aged, and older pupils — with an assumption (again commonly unconscious) that those groups may be rather sharply differentiated. Such procedure is usually fallacious and is as objectionable and productive of evil results in practice as it is unsound and unjustified in theory. It is a fact of importance that in the case of most if not all traits having bearing on secondary edu-

TABLE XXIII. INDIVIDUAL DIFFERENCES IN SEVENTH AND EIGHTH GRADE PUPILS *

Trait	*Minimum*	*Maximum*	*Range*	*Maximum÷ Minimum*
Age in months	140.5	220	79.5	1.6
Height in inches	54	67.5	13.5	1.3
Grip in kilograms	20	45.5	25.5	2.3
Cancellations, number of A's	39	95	56	2.4
Addition, number of problems	0	9	9	?
Spelling, per cent right	20	94	74	4.7
Associations, number right	0	21	21	?
Auditory memory, per cent	38.3	90	51.7	2.4
Visual memory, per cent	46.6	96.3	51.7	2.1

* Chambers, W. G., "Individual Differences in Grammar Grade Children," *Journal of Educational Psychology*, vol. 1, pp. 61–75.

TABLE XXIV. DIFFERENCES IN ARITHMETICAL ABILITIES IN FIRST-YEAR HIGH-SCHOOL PUPILS (COURTIS TESTS)†

Trait and Test	*Minimum*	*Maximum*	*Range*	*Maximum÷ Minimum*
1. Addition	35	115	80	3.29
2. Subtraction	25	105	80	4.20
3. Multiplication	25	85	60	3.40
4. Division	25	105	80	4.20
5. Copying figures	5	205	200	41.00
6. Speed reasoning, attempted	1	13	12	13.00
Speed reasoning, right	0	10	10	?
7. Abstract examples, attempted	7	19	12	2.71
Abstract examples, right	0	19	19	?
8. Reasoning, examples attempted	0	8	8	?
Reasoning, examples right	0	7	7	?

† Compiled and arranged from Courtis, S. A., in *Report of the Committee on School Inquiry*, Board of Estimate and Apportionment, City of New York, vol. 1, pp. 434, 440–44.

cation, sharply differentiated groupings of pupils must be considered as arbitrary divisions which may facilitate organization and administration, but may also lead to baneful educational results.

If we consider, for example, the age of pupils in any grade of the secondary school we find that the term "average age" means little, and that the classification of pupils as young, average-aged, and old is even less intelligible. Thus in the following table classification on such a basis would mean little.

TABLE XXV. AGE DISTRIBUTION OF 949 PUPILS ENTERING THE PUBLIC HIGH SCHOOLS OF NEW YORK CITY IN 1906*

Age in years	*Boys*		*Girls*		*Both*	
	Number	*Per cent*	*Number*	*Per cent*	*Number*	*Per cent*
11.5–12.0	2	0.6	0	0.0	2	0.2
12.0–12.5	2	0.6	2	0.4	4	0.4
12.5–13.0	13	3.6	13	2.2	26	2.7
13.0–13.5	45	12.4	73	12.4	118	12.4
13.5–14.0	55	15.2	85	14.5	140	14.8
14.0–14.5	55	15.2	116	19.8	171	18.0
14.5–15.0	74	20.4	105	17.9	179	18.9
15.0–15.5	38	10.5	87	14.8	125	13.2
15.5–16.0	35	9.7	53	9.0	88	9.3
16.0–16.5	24	6.6	37	6.3	61	6.4
16.5–17.0	12	3.3	12	2.0	24	2.5
17.0–17.5	6	1.6	3	0.5	9	1.0
17.5–18.0	1	0.3	1	0.2	2	0.2
Median M.D.	14 yrs., 6 mos. 9 mos.		14 yrs., 6 mos. 8 mos.		14 yrs., 6 mos. 8 mos.	

* Compiled and arranged from data given by Van Denburg, J. K., *Causes of the Elimination of Students in Public Secondary Schools of New York City*, p. 23.

The distribution of various amounts of any trait follows regular laws and is not haphazard and hit-or-miss. It has been found that in the case of variable physical and mental traits, where a sufficiently large number of individuals is measured and no selective agency is involved, the numbers of individuals possessing different amounts of the trait

measured tend to be distributed according to the laws of probability. Such laws imply that between the lowest amount of the trait which is found in an individual at one extreme, and the highest amount which is found in an individual at the other extreme, individuals will be found possessing different intervening amounts of the trait; that the greatest number of individuals manifesting any given amount of the trait will be found at a point half-way between the two extremes; that the number of individuals possessing various amounts of the trait increases as the mid-point is approached from either extreme according to a fixed mathematical law. Such a distribution is illustrated in the following tables.

TABLE XXVI. DISTRIBUTION OF VARIOUS AMOUNTS OF HEIGHT IN THE CASE OF 1171 AMERICAN SIXTEEN-YEAR-OLD GIRLS, COMPARED WITH AN APPROXIMATE THEORETIC DISTRIBUTION*

Height in centimeters	*Actual distribution 1171 cases*		*Theoretic distribution 1024 cases*	
	Number	*Per cent*	*Per cent*	*Number*
136–139	2	0.2	0.1	1
140–143	12	1.0	1.0	10
144–147	54	4.6	4.4	45
148–151	159	13.6	11.7	120
152–155	280	23.9	20.5	210
156–159	310	26.5	24.6	252
160–163	218	18.6	20.5	210
164–167	102	8.7	11.7	120
168–171	31	2.6	4.4	45
172–175	2	0.2	1.0	10
176–179	1	0.1	0.1	1
139–177	1171	100.0	100.0	1024

* Figures for the actual distribution compiled from data given by Burk, F. (after Boas). "The Growth of Children in Height and Weight," *American Journal of Psychology*, vol. IX (1897–98), p. 266.

TABLE XXVII. DISTRIBUTION OF ARITHMETICAL ABILITIES (ABSTRACT EXAMPLES — COURTIS TEST NO. 7) IN THE CASE OF 996 HIGH-SCHOOL PUPILS IN NEW YORK CITY*

Number of Examples Done Correctly	*Actual Distribution 996 Cases*		*Theoretic Distribution 1024 Cases*	
	Number	*Per cent*	*Per cent*	*Number*
0–1	4	0.4	0.1	1
2–3	15	1.5	1.0	10
4–5	54	5.5	4.4	45
6–7	108	10.9	11.7	120
8–9	206	20.9	20.5	210
10–11	212	21.5	24.6	252
12–13	203	20.6	20.5	210
14–15	123	12.5	11.7	120
16–17	58	4.9	4.4	45
18–19	13	1.3	1.0	10
(20–21)	(0)	(0.0)	0.1	.1
0–19	996	100.0	100.0	1024

* Actual distribution compiled from Courtis, S. A., in *Report of Committee on School Inquiry*, Board of Estimate and Apportionment, City of New York, vol. 1, p. 434.

Such tables as these may readily be plotted and expressed in the form of graphs in which the amounts of the traits are measured along the base line from the lowest amount on the left to the highest amount on the right, and the number of cases for each amount are measured by the heights of the vertical lines or columns. (Figures B and C.)

The same general law of distribution is found more or less applicable to grades in the subjects of study in the secondary school, although a number of factors tend to make such distributions complex. Some sample distributions of high-school grades will illustrate the operation of the law. (Table XXVIII.)