strata of our atmosphere. And at this threshold it will be well for us to pause and defer further exploration to a future time.

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SCIENTIFIC BOOKS.

Educational Psychology. By Edward L. Thorndike, adjunct professor of genetic psychology in Teachers College, Columbia University. New York, Lemcke and Buechner. 1903. 173 pp.

This book 'attempts to apply to a number of educational problems the methods of exact science' and to place at the service of students the incoherent mass of psychological knowledge which constitutes 'the beginnings of what we may call a general dynamic psychology.' That the facts already known "have thus far gone without systematic and convenient exposition is due to the complexity of the problems involved, not to any doubt concerning their practical importance. What we think and what we do about education is certainly influenced by our opinions about such matters as individual differences in children, inborn traits, heredity, sex differences, the specialization of mental abilities, their interrelations, the relation between them and physical endowments, normal mental growth, its periodicities, and the method of action and relative importance of various environmental influences." These then are the topics with which the book is concerned.

The first chapters deal with the measurement of mental traits. They explain the statistical principles by which we can apply exact measurements to groups of variable objects taken as a whole, and then proceed to show that in the matter of mental traits, as of physical, human beings of the same sex and approximately the same race, age and experience constitute a true group—that for every mental trait there is a mean or 'center of gravity' from which slight variations are frequent and great variations rare, according to the law of the distribution of chance events; so that measurements in terms of percentile grades or other relative standing can be interpreted fairly accurately in terms of absolute amount, and causal agencies acting unequally on different parts of the group can be detected by the analysis of curves of distribution.

In the fourth chapter the author explains the statistical principles by which we can measure the correlation between different characteristics in a group of individuals, and then applies Pearson's coefficient to show that in the matter of mental traits this correlation is amazingly small. This means that within a given group of individuals goodness or badness in one psychological function (as shown by school grades or the results of special tests) is not particularly likely to be accompanied by a similar amount of goodness or badness in another, even though the two appear to be only slightly different. If any one is disposed to deny this, let him first go over the large amount of evidence (much of it based on his own incessant investigations) which Dr. Thorndike puts together in this chapter.

Ever since the appearance of Professor James's chapter on memory the doctrine of general mental functions which can be cultivated by appropriate exercise and then turned to any use (a survival of the old 'faculty' psychology) has been more and more discredited amongst psychologists, though college presidents still make use of it to proclaim their wares and teachers in the public schools have never dreamed of anything else. But this doctrine can not be reconciled with the small coefficients of correlation shown in chapter IV. If there is such a thing as training or neglecting 'the memory' we should expect to find goodness or badness in remembering words accompanied by something like the same amount of goodness or badness in remembering numbers, to say nothing of colors, forms and tastes. But as a matter of fact the correlation is 'slight and variable'; and so with other functions.

In chapter VIII., on 'The Influence of Special Forms of Training upon More General Abilities,' the author presents evidence bearing still more directly upon this important educational doctrine, and gives a powerful argument to those who would adapt school

programs to the needs of life as directly as possible. If successful practise in guessing the size of paper squares less than four inches long gives relatively little improvement in the ability to guess the size of squares a trifle larger; if practise in marking all the words on a page which contain two given letters is very effective so far as these two letters are concerned, but gives only one third as much increase of speed for marking other letters, and still less increase of accuracy (in some cases accuracy in one function was actually diminished by the practise which increased it for a similar function); and if such improvement as there is can be accounted for by the overlapping of absolutely identical elements in the very closely allied activities tested; if, in short, there is practically no such thing as accuracy or thoroughness or concentration in general any more than there is memory or reasoning power in general, but only an unlimited number of relatively independent mental reactions, then the college president must cease promising, much like Protagoras of old, to give the young man or woman who comes to him 'a better disciplined mind for whatever work in life he may turn his attention to,' and the schoolmaster who wishes to give his pupils a 'well-rounded' education must learn to define the rotundity in terms of something other than a 'symmetrical development of faculties,' and not attach too much importance to so-called 'disciplinary' studies. *A propos* of these, it is interesting to notice that efficiency in mathematics bears no more relation to a schoolboy's general standing than does efficiency in any one of several other studies, and not so much as efficiency in English. Indeed, tests show that there is not much correlation between efficiency in two different mathematical studies, or even between two different processes in arithmetic; so great is the specialization of mental functions!

The chapter on the Inheritance of Mental Traits clears away theoretical objections to the possibility of such a thing and then shows by statistics, taken largely, though not altogether, from Galton and Pearson) that the influence of heredity is tremendous, though such evidence as is available points decidedly against the inheritance of acquired characteristics. "Original nature springs from original nature. Its improvement depends on the elimination of the worse, not on their reformation"; and yet "A college president can get hundreds of thousands of dollars to teach men various accomplishments, but he would be laughed at if he asked for $10,000 to prevent the most gifted young man in the college from remaining childless until 35."

The chapters on the relations of mental traits to age, sex and physical peculiarities are hard to summarize. They contain considerable positive material, but, like the chapter on Broader Studies of Human Nature, their main function is critical. They direct attention to unsolved problems, suggest methods of inquiry, and point out the errors by which various investigations have been vitiated; thus reminding us that, after all, we have only 'the beginnings' of a dynamic psychology.

Some such work as this of Thorndike's has been sadly needed. If the methods that it explains are all familiar to statisticians they are certainly unknown to many psychological investigators who deal with statistics, and if the criticism to which it subjects much work already done is pitiless, it is honest and fearless, and the constant expositions of method leave no excuse for slipshod work in the future.

As a text-book for students this 'Educational Psychology' can be used with great success. To be sure, it does not raise the reader to the heavens in a cloud of soul-stirring generalities, and there are some students who find many statistics somewhat overwhelming and frequent negative conclusions discouraging. But for students as well as for teachers of education it is worth while to know exactly where we stand and how great our ignorance often is; and those who have read the book and taken the trouble to master it appreciate its scientific spirit and its fiber.

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