

# EDUCATIONAL PSYCHOLOGY

BY

DANIEL STARCH, PH. D.

CONSULTANT IN APPLIED PSYCHOLOGY AND COMMERCIAL RESEARCH

FORMERLY OF THE UNIVERSITY OF WISCONSIN

AND HARVARD UNIVERSITY

New York

THE MACMILLAN COMPANY

1928

*All rights reserved*

150 9  
528  
cop 2

COPYRIGHT, 1919 and 1927  
By THE MACMILLAN COMPANY

---

Set up and electrotyped. Published June, 1919.  
Reprinted January, April, August, December, 1920;  
November, 1921; October, 1922; April, October,  
1923; January, 1924; July, 1925; March, July,  
August, 1926. Revised edition, July, 1927.

SET UP AND ELECTROTYPED BY T. MOREY & SON  
PRINTED IN THE UNITED STATES OF AMERICA BY  
THE BERWICK & SMITH CO.

## PREFACE

The preparation of this book has been carried out according to two fundamental purposes: First, to present that material which seems to be most useful and relevant to the problems of educational psychology; and second, to maintain a strictly experimental, scientific viewpoint in discussing these problems. The result of these aims has been a considerable reduction in the amount of space usually devoted in texts on educational psychology to certain topics such as, instinct, fatigue, and imagery, and the inclusion of new topics such as tests of intelligence, studying, transference of training in school subjects, the assignment of marks, and much of the material in Part III which has as yet not found a place in text-books.

The space devoted to the discussion of instinct has been materially reduced for two reasons: In the first place, while the instincts are fundamental in human life, too much time has usually been devoted to their consideration for the amount of direct benefit gained. The actual use in school work that can be made of a detailed knowledge of instincts, which in our present stage of information is largely analytical and theoretical, is relatively small when it comes to dealing face to face with concrete school problems. In the second place, a great deal of experimental and statistical material has accumulated in recent years which is more immediately valuable in solving the problems of the psychology and pedagogy of learning.

It would have been desirable to include a discussion of the psychology of more of the high school subjects; but this is impossible at the present time. The discussion of the school subjects in Part III has been confined to tangible, scientific investigations. Obviously there is little or no material of this sort on most of the high school subjects. The consideration of educational tests in the chapters of Part III is perhaps brief; but a detailed treatment of the theoretical and statistical principles underlying their construction belongs rather in special treatises. Chapter XII on How to Study is not altogether satisfactory, because of the scarcity of definite or substantial

material in this field. It was, however, included because the topic is exceedingly important in school work and because it was hoped that its inclusion would stimulate discussion of it by teachers and prospective teachers.

I take pleasure in expressing my obligations to the persons who have assisted me in various ways in the preparation of this book; namely, to Dr. Helen Hubbert Caldwell and Mr. A. O. Hansen, who have read the manuscript and offered many helpful suggestions, to Mr. W. R. Ames who has prepared the drawings, and especially to Dr. C. L. Hull who has critically examined every portion of the manuscript and has offered many suggestions which have been incorporated in the book.

DANIEL STARCH.

MADISON, WISCONSIN,  
October 5, 1918.

## PREFACE TO THE REVISED EDITION

The chief changes in this revision consist in the addition of Chapter XIII on Mental Hygiene, and of summaries of the more important researches that have been made since this book was originally published. The chief additions were made in Chapters II, III, VII, XV, XVII, XVIII, XIX, XX, XXI, and XXII.

I wish to acknowledge here the able coöperation of Dr. Harry F. Latshaw, Instructor in the Graduate School of Education, Harvard University, in making these revisions.

D. S.

CAMBRIDGE, MASS.,  
June, 1927.

# CONTENTS

| CHAPTER   | PAGE |
|---|------|
| I. PROBLEMS AND SCOPE OF EDUCATIONAL PSYCHOLOGY . . . . .                                       | I    |
| PART I. THE NATIVE EQUIPMENT OF HUMAN BEINGS  |      |
| II. THE INSTINCTIVE ELEMENTS OF NATIVE EQUIPMENT . . . . .                                      | 9    |
| III. VARIATIONS IN HUMAN CAPACITIES . . . . .   | 28   |
| IV. CORRELATION AMONG HUMAN CAPACITIES . . . . .  | 55   |
| V. SEX DIFFERENCES . . . . .  | 70   |
| VI. THE INHERITANCE OF MENTAL TRAITS . . . . .  | 81   |
| VII. THE MEASUREMENT OF MENTAL CAPACITIES . . . . .   | 107  |
| PART II. THE PSYCHOLOGY OF LEARNING:  |      |
| A. IN GENERAL   |      |
| VIII. ANALYSIS OF PROBLEMS . . . . .  | 127  |
| IX. THE RECEPTION OF STIMULI: A. SENSORY DEFECTS . . . . .                                      | 133  |
| X. THE RECEPTION OF STIMULI: B. PERCEPTION AND OBSERVATION<br>OF THE SENSORY MATERIAL . . . . . | 144  |
| XI. THE RATE AND PROGRESS OF LEARNING . . . . .   | 154  |
| ✓XII. HOW TO STUDY . . . . .  | 191  |
| ✓XIII. MENTAL HYGIENE . . . . .   | 208  |
| XIV. TRANSFERENCE OF TRAINING IN SPECIFIC MENTAL FUNCTIONS . . . . .                            | 219  |
| XV. TRANSFERENCE OF TRAINING IN ABILITIES IN SCHOOL SUBJECTS . . . . .                          | 247  |
| PART III. THE PSYCHOLOGY OF LEARNING:   |      |
| B. OF SCHOOL SUBJECTS   |      |
| XVI. THE PSYCHOLOGY OF LEARNING SCHOOL SUBJECTS . . . . .                                       | 299  |
| ✓XVII. READING . . . . .  | 302  |
| XVIII. HANDWRITING . . . . .  | 345  |
| XIX. SPELLING . . . . .   | 374  |
| XX. LANGUAGE . . . . .  | 409  |
| XXI. ARITHMETIC . . . . .   | 442  |
| XXII. HISTORY . . . . .   | 495  |
| XXIII. MARKS AS MEASURES OF SCHOOL WORK . . . . .   | 512  |
| BIBLIOGRAPHY . . . . .  | 537  |
| INDEX . . . . .   | 559  |

# EDUCATIONAL PSYCHOLOGY

## CHAPTER I

### PROBLEMS AND SCOPE OF EDUCATIONAL PSYCHOLOGY

**What is Education?** The problems and the scope of educational psychology are necessarily determined by our conception of what education is. If we conceive education to be primarily self-development, our problems will be of one sort; if we conceive education to be fundamentally social adaptation, our problems will be of another sort. In the former case, education would mean the complete training of the mental and physical capacities irrespective of environment; in the latter case, education would mean the training of those capacities which will adapt the individual most adequately to the social and physical environment in which he is to live. For our present purpose it is not necessary to define in complete detail the aim and meaning of education. It will be sufficient to state in the simplest terms what education is as a psychological process.

In the broadest sense, education is the production of useful changes in human beings.<sup>1</sup> These changes may be classified into three divisions: changes in knowledge, in skill, and in ideals. Through education the child is to acquire useful knowledge; he is to acquire skill, both motor and intellectual, in the use of his muscles and in the manipulation of ideas and concepts; and, finally, he is to acquire the right ideals of life which will actually function in his behavior. Probably all changes wrought in human beings which in any sense are educational, fall under these three heads. Obviously then, education is the most momentous, as well as the most essential, business of the

<sup>1</sup> Thorndike has defined the purpose of education thus: "The aim of education is, as we have seen, to change human beings for the better, so that they will have more humane and useful wants and be more able to satisfy them." ('12, p. 52.)

human race; for the welfare of the race depends upon education as it depends upon nothing else.

Which changes are useful and which are not is a question that cannot be answered as easily as it would seem at first glance. Learning to read or to figure are obviously useful modifications; but it is not so easy to say whether the study of a given drama, or the knowledge of certain facts of history, or the understanding of a certain theory of matter, or ability to read a given foreign language, are useful, or sufficiently useful to be included in the common school, in the high school, or in the university. The term useful should not be limited narrowly to the things which are immediately applicable in making a living, but should include all changes which will broaden and enrich the life of the individual.

**The Problems of Educational Psychology.** In accordance with our definition, the fundamental problems that we must raise concerning education are as follows:

1. What changes are to be made in human beings?
2. What are the agencies by which the changes may be brought about?
3. What are the capacities which human beings possess for acquiring the changes?
4. What are the most economical methods by which these changes may be brought about?

The first problem is primarily a problem for philosophy and sociology. What changes are ultimately to be made depends upon our ideals of life and our views of society. The modifications that have been sought by different nations and different systems of education have varied from century to century and from race to race. The ultimate aims of education sought by the ancient Greeks or by the mediæval monks were very different from those sought by the modern Americans or Europeans.

The second problem deals primarily with the value of school subjects and exercises in bringing about the changes that are to be made. To what extent will the study of arithmetic, the study of grammar, or the study of physics or Latin be able to produce the training that philosophy and sociology dictate? This problem is partly sociological and partly psychological.

It is sociological in so far as the determination of educational agencies depends upon the physical and social environment of mankind; it is psychological in so far as it necessitates a study of mental processes affected or brought about by these agencies. This latter phase of the problem merges into problems three and four.

Problems three and four are fundamentally psychological and, together with the second phase of problem two, constitute the main scope of educational psychology. It is a psychological problem to determine what capacity and equipment human beings have for acquiring the changes that are to be made. Likewise, it is fundamentally a psychological problem to discover the most economical methods of learning. Accordingly, the field of educational psychology is divided into two large divisions which we may designate as:

- I. The native equipment of human beings.
- II. The psychology of learning.

**Psychology and Teaching.** Methods of teaching rest fundamentally upon the psychology of learning. Since the experimental analysis of learning processes will have to reveal the principles according to which the human mind learns, and learns most economically, it follows that the methods of teaching will have to be based upon these discoveries. This may be illustrated in the case of reading. If the child learns to read most economically by the word method, it follows that the most economical way of teaching reading would be by the word method. Likewise, if a child learns to spell homonyms more easily by studying them together, or memorizes prose or poetry more readily by wholes than by parts, it follows that these exercises should be taught accordingly. Evidently the fundamental principles of teaching must be based upon the psychological laws and principles of economic learning.

**Waste in Education.** Exact information concerning the proper procedure in educational matters is exceedingly rare. Definite, scientific knowledge of the proper methods of learning and teaching school subjects and of the efficient administration of our schools is surprisingly small, and the field of educational psychology in its broadest sense opens up endless prob-

lems for the future to solve. We know relatively little in a scientific way about the learning of any single school subject. For example, we do not know with any definite assurance what is the most economical amount of time to devote to any one of the school subjects. From such investigations as have been made, we may infer that there is an enormous waste in our educational practices which is indicated by such facts as the following: It has been found by recent tests and measurements that some schools obtain just as good results by devoting only one-half as much time to writing as other schools do. Similar facts have been brought out in the case of reading, arithmetic, and other school subjects. Schools which have devoted as much as 100 minutes a week, or 20 minutes a day, have obtained no better results than other schools devoting 50 minutes a week, or 10 minutes a day, to the same subject. If these facts actually represent the real possibilities, it seems quite obvious that there is an enormous waste in our schools and this waste is far greater than we realize until we make definite calculations of the possible saving of time. If by some means it were possible to save one minute a day for every school day during the eight years of a child's school life, we would be able to save one entire week of school time. If we could save four minutes a day for the same length of time, we would be able to save one month; if we were able to save 18 minutes a day, we would be able to save one-half of a school year; and if by more economical methods of learning and distribution of time we were able to save 36 minutes a day for eight years, we would be able to save an entire school year. Such a saving is not impossible; indeed, by a better use of time and more effective methods of learning, it is highly probable. Eighteen minutes a day would mean a reduction of only  $4\frac{1}{2}$  minutes in each of four subjects; 36 minutes a day would mean a reduction of only 9 minutes a day in each of four subjects. This time could be devoted with greater advantage to other and possibly more advanced school subjects and school exercises.

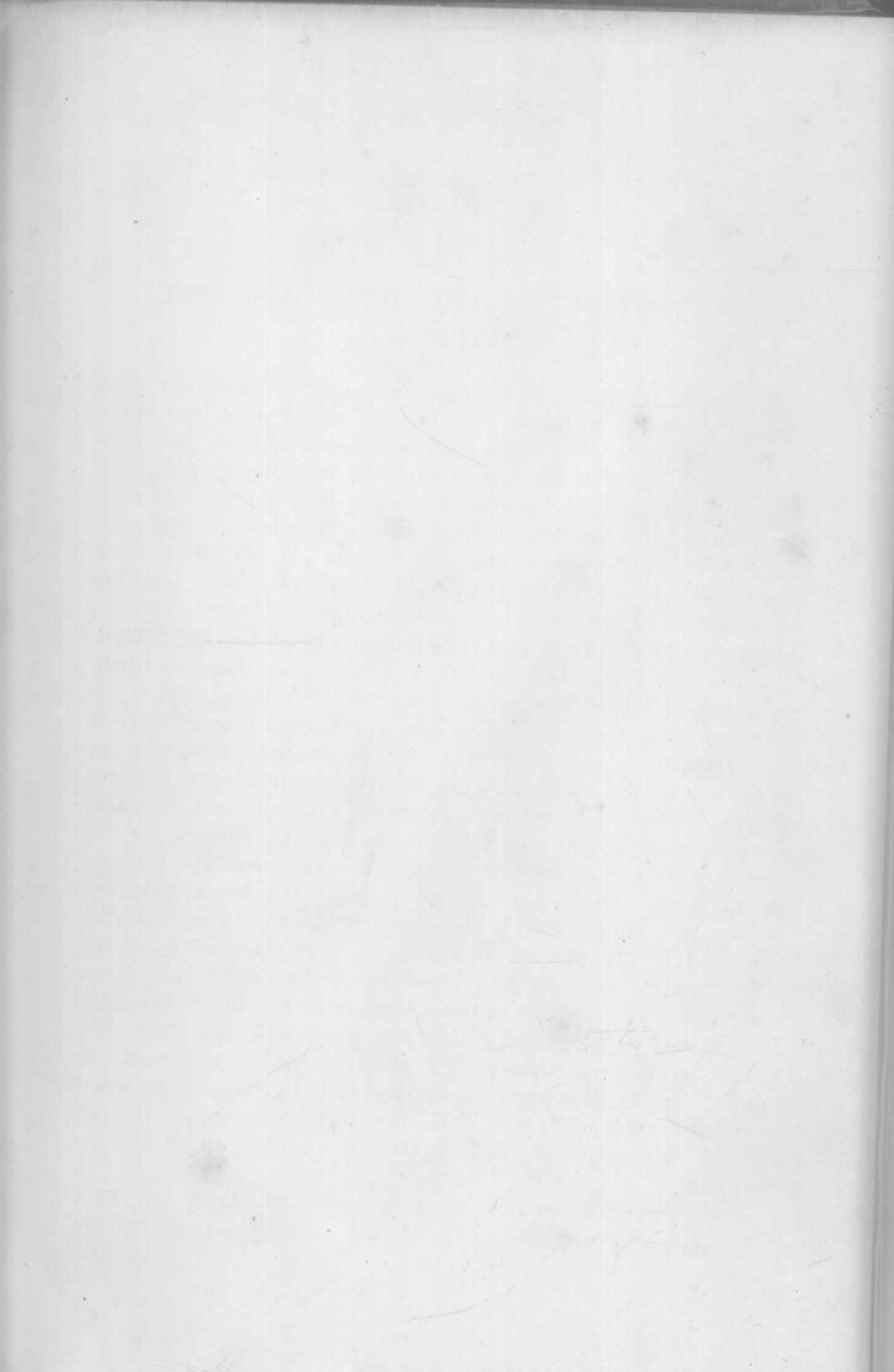
**The Specific Topics and Problems.** In order that we may be properly orientated with reference to the problems that will be discussed under the two large divisions of educational psychology, the following order of topics will be considered:

- I. The native equipment of human beings.
  - a. What does it consist of?
  - b. To what extent does it vary?
    1. Among individuals.
      - (a) In single traits.
      - (b) In combinations and relationships of traits.
    2. At different times of life in the same individual.
    3. Between the sexes.
  - c. To what extent is it inherited?
  - d. How may it be measured?
- II. The Psychology of Learning.
  - a. The psychology of learning in general.
    1. Observation and perception.
    2. The rate and progress of learning.
    3. Transference of training.
  - b. The psychology of learning school subjects in particular.
    1. The psychological processes involved in each subject.
    2. The measurement of ability and progress in learning each subject.
    3. The most economical methods of learning the material of each subject.



PART I

THE NATIVE EQUIPMENT OF HUMAN BEINGS



## CHAPTER II

### THE INSTINCTIVE ELEMENTS OF NATIVE EQUIPMENT

**Reflexes, Instincts, and Capacities.** The equipment with which human beings start in life may be divided into three types of inherited responses and abilities: Reflexes, instincts, and capacities. The distinction among these three is primarily one of definiteness and degree of complexity. An instinct may be defined from the neurological side as an inborn neural connection between sense organ and muscle. It may be defined from the functional side as an inborn capacity of responding in definite ways under definite circumstances. These responses are prior to experience and training, and need not be learned. To close the eyes when an object suddenly approaches them, to get food when hungry, to strike when struck, and to be afraid of thunder and of the dark, are illustrations of instinctive responses. The reflexive and instinctive responses are inherited in the sense that there is present in the nervous system, either at the time of birth or later on as a result of growth, a set of nervous connections already formed for the carrying out of a particular action in response to a given situation. If the child closes his eyes when an object suddenly approaches, it means that the motor impulses travel from the retina to the visual center of the brain, from there to the motor center which controls the movement of the eyelids, and from there out to the muscles of the eyelids to cause the contraction. In the case of inherited responses, the connection from the sensory to the motor centers is already present and ready to operate in carrying out the action. In the case of acquired responses, such as habits, these nervous connections must be formed as a result of effort and trial on the part of the individual.

The difference between reflexes and instincts is largely a difference of complexity. Both are inherited types of re-

sponses. Reflexes are simpler forms of reaction usually involving a limited set of muscles and occurring in response to precise stimuli. The contraction or expansion of the iris, the closing of the eyelids, the knee jerk, are illustrations of reflexes. Instincts are complex reactions involving the use of large groups of muscles or, in many instances, the entire muscular system of the body. They may be aroused either by external stimuli or situations or possibly by internal stimulation. To make movements in the direction of getting food when hungry, to seek shelter when cold, to offer resistance when hemmed in, to spit out what tastes bad, and the like, are instinctive reactions. Capacities are distinguished from reflexes and instincts in being general mental abilities rather than specific motor responses and in referring primarily to the native mental equipment, such as the powers of sensation, perception, retention, attention, imagination, and all the varied complex psychic processes.

**Classification of Instinctive Responses.** The older classifications of instincts usually divided them into three or four large groups of responses, such as individual, racial, and social, and regarded them rather as general tendencies than as specific responses. The present conception of instincts is to regard them as specific responses with inherited neural mechanisms which will be set into action by specific stimuli or situations. On this basis the classification consists of an enumeration of as many definite, identifiable, unlearned reactions to specific situations as can be observed and as can be recognized in human beings prior to training and habituation in each particular type of activity. Accordingly, Thorndike ('14, I) enumerates forty or more different types of instinctive reactions as follows:

I. Food getting and protective responses.

1. Eating.
2. Reaching, grasping, and putting objects into the mouth.
3. Acquisition and possession.
4. Hunting.
5. Collecting and hoarding.
6. Avoidance and repulsion.
7. Rivalry and coöperation.

8. Habitation.
9. Response to confinement.
10. Migration and domesticity.
11. Fear.
12. Fighting.
13. Anger.
- II. Responses to behavior of other human beings.
  14. Motherly behavior.
  15. Gregariousness.
  16. Responses of attention to other human beings.
  17. Attention getting.
  18. Responses to approving and to scornful behavior.
  19. Responses by approving and scornful behavior.
  20. Mastering and submissive behavior.
  21. Display.
  22. Shyness.
  23. Self-conscious behavior.
  24. Sex behavior.
  25. Secretiveness.
  26. Rivalry.
  27. Coöperation.
  28. Suggestibility and opposition.
  29. Envious and jealous behavior.
  30. Greed.
  31. Ownership.
  32. Kindliness.
  33. Teasing, tormenting, and bullying.
  34. Imitation.
- III. Minor bodily movements and cerebral connections.
  35. Vocalizations.
  36. Visual exploration.
  37. Manipulation.
  38. Cleanliness.
  39. Curiosity.
  40. Multiform mental activities.
  41. Multiform physical activities.
  42. Play.

The number of the instincts and the amount of learning involved in their activity is a matter of debate. Space does

not permit more than passing reference to this debate. Briefly stated, two important opposing views are the behavioristic and the psychoanalytic. Behaviorists regard instincts as precise and machine-like in their operation, few in number, and as being exhibited in their purity only in infants. They emphasize the learned elements in instinctive activities and regard the so-called instincts of the older classifications as being the original, fundamental habit systems, or pattern reactions, acquired by the organism. Psychoanalysts regard instincts as vague and constantly changing in their motor aspect, two in number, and as being exhibited in their purity not only in infancy but throughout life. These two instincts are the self-preservative and the race-preservative. They, too, emphasize the learned elements in instinctive activity but have no regard for precision of reaction. To the psychoanalyst the important thing in instinct is not an unvarying reaction pattern but an unvarying underlying motive. Accordingly all activity of the infant, the child, and the adult is regarded as exemplifying an intermingling of these two motives, the self-preservative and the race-preservative. The broad educational implication of these views is that the child upon entering school has previously learned from the environmental influence of home and neighborhood many "instinctive" habit systems which the school is expected to refine and enlarge.

**Relation of Education to Native Endowment.** The inherited equipment of the human being is the foundation upon which education must build; it consists of the faculties and capacities which the child has for reacting to his environment. It is the utilization, the training or the curbing of these endowments which education attempts to accomplish. In much of the writing and thinking concerning educational problems, there has been a relative overemphasis, in space and time, upon instincts and an underemphasis upon the mental capacities. Education in the sense of schooling has as much if not more to do with the latter than with the former. The direct appeal to, and use of, instinctive reactions in actual concrete instances in school work are not as frequent and specific as is commonly implied. The number of instincts enumerated in the preceding list which may be directly and concretely appealed