

EDUCATION AND THE PSYCHOLOGY OF THINKING

BY

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EDWARD L. THORNDIKE

PREFACE

This book has grown out of a desire to satisfy my curiosity about the nature of the thinking process. Psychological discussions about the nature of thinking are rare and those which exist are somewhat meager; books on logic have as their function the description of relationships between concepts, propositions, and inferences, and the treatment of the mental processes involved in thinking is outside their province. Philosophers have devoted considerable attention to the nature of the thinking process, but the work of such a writer as John Dewey is notably synthetic rather than analytic inasmuch as his primary concern is with the complete act of thought.

Since my concern was to orient myself in the whole field of thinking rather than in the detailed study of some aspect of thinking, I used a method that is more in the nature of a survey or finding study than of precise experimentation. There is great need for a vast amount of carefully controlled experimental work to validate many of the hunches, guesses, and hypotheses arrived at by the method of superficial observation and introspection.

My method was to meet with a group of interested and willing graduate students in education for one evening a week during the greater part of a school year. At each meeting one type of mental process would be stimulated by appropriate questions while I would endeavor to observe the process by noting the responses of the group to the questions. A more precise worker would have made verbatim notes of all that took place and would have quoted from these notes to illustrate or prove the conclusions reached. I am sorry that my work cannot show the

use of such obvious requirements of the scientific method. I preferred to devote my time to trying to fathom and interpret what was going on. Then the next morning I would arrange the impressions which I gathered on the previous evening in an orderly and systematic presentation. It must be obvious that the product of my work shows a minimum of evidence and a maximum of interpretation on my part. Perhaps this is a necessary limitation of an exploratory study that tries to cover so vast an area. In writing up these analyses I have tried to set forth the steps in terms of the processes that one goes through in performing each mental operation. Certainly steps of this kind are an abstraction since the mind may telescope or reverse the order of operations so that they are all but unrecognizable.

To complicate matters still further, my publishers insisted that this report would gain in value to its readers if I could review recent experimental work on the thinking process, and also make more applications for educational practice. Accordingly I have gone very carefully and thoroughly over the experimental literature in psychology produced during the past years which deals with all phases of the thinking process. These findings have been incorporated throughout the manuscript wherever they belong. I have been gratified to find that almost without exception the experimental findings have harmonized with my own observations and interpretations.

In addition to this I have drawn on my familiarity with the psychology of the school subjects to introduce illustrations of the application of various thought processes to school learning.

This makes a scrambled presentation which is neither the result of my own observations nor a review of the experimental literature nor a presentation of educational applications, but a medley of all three.

It was my hope when I finished that I could take the pieces as represented in Chapters II to XX and fit them

together so as to show the structure of thinking. It was my belief that a "problem" requires for its solution the complete act of thought, which is composed of some of the various subsidiary processes, and that these in turn used still simpler processes until one came to certain basic operations. In this I was mistaken. Such a hierarchy is impossible to find. In any thinking operation almost the complete range of processes is used. Analysis, association, selection, generalization, and inference seem to pervade them all. But it is possible to note a growing complexity of operation and this I have attempted to record in Chapter XXI on *An Analysis of Thinking*.

In the last chapters I have put down some of my own observations regarding the task that education has in improving thinking. Much of what has been said and written about educating for power in thinking is limited in point of view or overlooks the complexity and difficulty of the task. This volume is addressed primarily to educators who wish just such an analysis of the thinking processes as is herein presented so as better to conceive their task in improving the powers of thought of the children who pass through our schools. It is a truism that children will forget many of the facts that they learn in school but it is our hope that they can learn a method of meeting problem situations which will result in greatly increased resourcefulness, creativeness, and improved sanity in human relations. Human progress depends solely on the capacity of men and women to find solutions to their problems. This book shows something of the task that education faces in increasing thinking ability.

I wish here to express my obligations and appreciation to the loyal group who so willingly met week after week to cooperate in this enterprise: Roy C. Bryan, R. S. Ebert, Will French, V. C. Hayden Armacost, Eugene M. Hinton, J. Andrew Holley, Theodore R. Myers, Ray O. Wyland, and Dale X. Zeller.

I have a debt of gratitude to express to my colleague, Professor Helen M. Walker, who gave the manuscript careful reading. I have benefited from her knowledge of the field and her keen analysis and cogent criticism and wish to acknowledge here my obligation to her for many of the ideas herein contained.

PERCIVAL M. SYMONDS.

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PART I
INTRODUCTION

CHAPTER I

INTRODUCTION

Educators have strenuously maintained in book and lecture that one of the aims of the process of education is the development of the powers of thought. In hundreds of treatises and addresses it has been asserted that the specified facts and skills which children learn in school will be soon forgotten, but the power to attack problem situations and to reach a correct or reasonable solution is the enduring outcome to be achieved. Whitehead¹ opens his essay on "The Aims of Education" with these positive words:

Culture is activity of thought, and receptiveness to beauty and human feeling. Scraps of information have nothing to do with it. A merely well-informed man is the most useless bore on God's earth.

Bode² comes directly to the point when he says,

The concern is not with the strengthening of mental faculties, nor with the acquisition and organization of information, nor yet with the formation of S-R bonds, but with the cultivation of thinking. For the power to think is the educational kingdom of heaven; if we seek it persistently, other things will be added unto us.

Cubberley,³ in his book *The Principal and His School*, states:

¹ Whitehead, A. N., *The Aims of Education and Other Essays*, p. 1, by permission of The Macmillan Company, New York, 1929.

² BODE, B. H., *Conflicting Psychologies of Learning*, pp. 273-274, D. C. Heath & Company, Boston, 1929.

³ CUBBERLEY, E. W., *The Principal and His School*, p. 401, Houghton Mifflin Company, Boston, 1923.

The real purpose in education, aside from the learning of a few facts, and the mastery of certain abilities that are found to be of use in later life, is to train young people how to analyze a problem and find out things for themselves; to form in them good working habits; to show them how to concentrate attention and to study effectively and independently; to teach them how to gather facts and marshall them to form a conclusion; and to awaken in them motives for work beyond what the school requires. . . . The most important element in good teaching is the development of good habits of study and the ability to do independent thinking.

The Tenth Yearbook of the Department of Superintendence of the National Education Association, *Character Education*, puts the whole matter succinctly when it says,

To *think*, not *what* to think, is the good curriculum's objective for the child.¹

The psychology of problem solving has been much slighted in recent textbooks in educational psychology. Gates in his *Psychology for Students of Education* has an excellent chapter. Many of the books, however, omit any reference to problem solving. The present would seem to be timely for a revival of interest in this field. The necessity which this country faces as never before for solving its own national problems and the failure of any plan to convince large numbers of our population make imperative the necessity for devoting some emphasis to the matter of problem solving in education. Teachers of social science for a number of years have emphasized that the aim of teaching in that field is not mere acquisition of facts but ability to use those facts in the solution of problems involving social issues.

Outstanding Contributions to the Psychology of Thinking. One who traces the literature in the history of psychology will find a good basis for a renewed interest in the field of the psychology of thinking. Older books on logic described the structure of thought even though they

¹ P. 191.

did not discuss the mechanics of thinking. The early attempts of the English school as exemplified in John Locke's *Essay on Human Understanding* (1694), David Hume's *Enquiry Concerning Human Understanding* (1748), James Mills's *Analysis of the Phenomena of the Human Mind* (1829), and Alexander Bain's *The Senses and the Intellect* (1855) and the *Emotions and the Will* (1859) provide an excellent foundation on which later work has been built.

The modern approach to the psychology of thinking has its inception in James's *Psychology* in those remarkable chapters on conception, discrimination and comparison, association, and reasoning. Here we find formulated for the first time the analysis of the thinking process which has dominated the work in the psychology of problem solving to the present time. Probably the most valuable treatise on the thought process for education is Dewey's *How We Think*, which describes the complete act of thought and the functions of education in problem solving. Binet made a contribution by establishing certain norms by age levels for problems of various degrees of difficulty. Thorndike elaborated the process of generalization and the method of forming a concept which have proved valuable in certain applied work in educational psychology, for instance, that of Gates in his work in the psychology of reading and that of Powers in his psychology of science instruction. Ruger in the *Psychology of Efficiency* made illuminating analyses of the problem-solving process by a study of puzzle solving. Spearman's book on *The Nature of Intelligence and the Principles of Cognition* deserves mention because of its piercing analysis of the fundamental principles of comprehension and thinking in the human mind. Woodworth has an excellent chapter on reasoning in his *Psychology* in which he has pointed out the various types of reasoning and their relationships when put in syllogistic form. One should not omit the contribution of the Gestalt school to the psychology of thinking. Köhler's early work on apes

brought out certain significant facts concerning the way in which primates react to an unfamiliar situation, and some of the later work of the Gestalt school, which emphasizes the importance of organization in seeing a part as a member of a whole, is an important contribution to the psychology of thinking. Dimnet has a pleasing essay on *The Art of Thinking*. We should not fail to include in our list, also, the important work of Piaget, whose studies on *Judgment and Reasoning in the Child* provide for us some understanding of how reasoning develops in the young child. Finally, W. S. Monroe has made a contribution of the first order to the psychology of the thought process in his bulletin (with Ralph E. Carter) on *The Use of Different Types of Thought Questions in the Secondary School and Their Relative Difficulty for Students*.¹ In this bulletin Monroe reports on an analysis of thought questions that teachers ask in secondary schools. He has analyzed these into twenty different types, together with some data as to the frequency with which they recur and some of the faults which appear in answers given by pupils.

What Is a Problem? In applying the psychology of problem solving to the problems of education the first question that naturally arises is: What is a problem? In asking this question of experienced teachers I have been surprised to find that although problem solving has been stressed by our curriculum makers as one of the important objectives of education, large numbers of teachers are confused as to what a problem is or what the teaching of problem solving involves. Many teachers would make problem solving synonymous with almost any difficult task, such as the problem of writing a friendly letter, the problem of expressing one's self accurately, the problem of studying with concentration, the problem of appreciating a poem. Used in this way almost any school task that is new and strange and at all difficult could be called a problem.

¹ *Bureau of Educational Research, Bulletin No. 14, Vol. 20, No. 34. University of Illinois, 1923.*

Naturally problem solution should be sharply differentiated from a skill or habit, the latter being something that is expected to be performed fluently and more or less automatically, whereas problem solving is the mode of meeting *unfamiliar* situations by *thinking*. Teachers of mathematics and science have little difficulty in giving illustrations of problems in their fields; they can readily draw upon the stock exercises that appear at the ends of chapters or on every page of an algebra textbook. However, even though illustrations of problems of this type can be glibly quoted, the real comprehension by the teacher of the nature of the problem and of the processes and operations which lead to a solution is only vague and thin.

The Dewey Analysis of Thinking. Although it is clear what educators mean when they say that the aim of education is the development of the power to meet unfamiliar and difficult situations and come to a satisfactory conclusion by the process of thinking, the method by which this is to be achieved is by no means clear. In 1909 Dewey, in his book *How We Think*, made the well-known analysis of a complete act of thought. This analysis in brief consists of the following steps:

1. Create a felt need to do something.
2. Locate and define the possibilities.
3. Propose several possible solutions.
4. Develop the suggestions sufficiently to indicate the ways in which they apply to the data at hand.
5. Continue making further observations leading to the acceptance or the rejection of the solution.¹

For over twenty-five years educators have been guided by this analysis. Present-day textbooks in teaching methods continue to advocate the use of these same five formal steps (even though sometimes expanded or telescoped, and perhaps shifted in order), as though these same five steps are present in every act of thought.

¹ Adapted from DEWEY, J., *How We Think*, pp. 68-78, 1st edition, D. C. Heath & Company, Boston, 1910.