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BIBLIOGRAPHY OF SCIENCE TEACHING IN SECONDARY SCHOOLS

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LETTER OF TRANSMITTAL

SIR: The Council of the American Association for the Advancement of Science, at its annual meeting in December, 1923, established a committee to make a comprehensive study of the place of science in our educational program. As a preliminary step to such a study, an exhaustive bibliography of all the articles and materials relating to science teaching in our secondary schools has been prepared. Nothing of this kind has ever been attempted before. This compilation has been made with unusual care over a period of several years. It will be of invaluable service to school superintendents, curriculum-makers, teachers of science, and students of education throughout the United States. I therefore recommend its publication as a bulletin of the Bureau of Education.

Respectfully submitted.

JNO. J. TIGERT,
Commissioner.

The SECRETARY OF THE INTERIOR.

PREFACE

Each generation must somehow transmit to the next generation as much as possible of its knowledge and results of experience. Therefore, the problems of education are among the most important and inevitable of those that confront society. This truism has always been applicable since it is an obvious corollary of the first principles of the nature of life. These far-reaching and fundamental problems become progressively more clear and more consciously appreciated as the race proceeds along the road of civilization. The efforts to improve education in this country have produced remarkable results. Modifications in educational subjects, in policy and in practice, have been made. These are surely to be regarded as representing true progress.

The implications of the educational problem necessarily change as general progress changes. This is most conspicuous with regard to the kinds of knowledge, ideas, abilities, and susceptibilities that are to be transmitted from one generation to the next. These changes are also notable with regard to the increasing experience that results from the analytical and experimental study of education. Teachers are naturally constrained to present to their pupils the kinds of material that their own generation regard as most fundamentally essential. They must present these materials by methods that they themselves approve or that are, at least, approved by their leaders. In recent decades educational thought and effort in this country have greatly changed in both these aspects.

The recent rapid advance of the natural sciences has overwhelmed us with a vast array of new information and new deductions. Much of this must somehow get presented in our schools. Science writers have been bringing this new material before the public at a rate far more rapid than it has been possible or desirable to build it into school curricula. Until recently there has been a continual demand for new courses of study in newly developed scientific subjects. In the face of this popular demand some of the older subjects have slipped into the background. This is especially true of those aspects of the older subjects which were regarded as primarily disciplinary. The newer subjects and materials are generally characterized by social and personal as well as vocational values.

With the oncoming of the age of science and of technical and vocational achievement, based on natural science and the scientific method, there have occurred corresponding revolutions in the science and art of education itself. The methods of educational practice have altered greatly and are still being rapidly modified. This is done not only to make proper use of the new material crowding into school curricula, but especially to adjust teaching to a rapidly growing and advancing body of thought. This thought is supported by truly scientific experiment and by logical deduction in the field of education itself.

Popular education has, of course, to attend to both these rather divergent movements. It can not choose between them. The fundamental and general aims of education stand always in the background, with criteria by which ultimate success or failure are to be adjudged. In the foreground, more numerous and noisy, and just as insistent, are the popular demands for informational and vocational and social education. The present task of those who guide education is primarily to arrive at school curricula that will impart as much information and practical facility as is possible, by methods which will inculcate well-balanced mental attitudes and as high a degree of honesty, loyalty, and general morality as may be secured. The content, the established conclusions, and the safe guides in thinking of modern science can not be left out, even if some may regard such omission as more or less desirable. It is obvious that no curriculum can include all that is possible of such a varied content. Then, the job of preparing more or less expert operatives in the daily affairs of life must not, in any event, be allowed to crowd out the responsibility of producing men and women who shall embody the essential elements of the eternal spirit of humanity and democracy.

General public education outside of schools, through such mediums as newspapers, pulpits, museums, motion pictures, lectures, magazines, and popular books, is confronted by essentially the same problems as those that are occupying the attention of students of school curricula.

In recent years the gauntlet of uninformed conservatism has been thrown anew in the face of advancing science, in most notable wordy strife. This renewal of an age-old struggle has constituted a clear challenge to those who appreciate the accomplishments and aims of science and their bearing on intellectual and spiritual life. It has caused some real discomfort on both sides, has aroused many fearful apprehensions, has instigated many dire predictions for both the intellectual and spiritual future of humanity. On the

whole, however, this new mobilization of the forces of progress and of inertia has been highly valuable. It has aroused many of the best minds and is surely leading toward a better understanding and more general appreciation of the matters that are involved. We have faith to believe that such controversies surely lead toward the firmer conviction that established truth is the safe guide for thought and action.

With such considerations as these as a background, the council of the American Association for the Advancement of Science, at its Cincinnati meeting in December, 1923, authorized a special committee to make a study of the rôle played and to be played by science in education. That committee was organized in 1924, and the presentation of this bibliography is the first tangible evidence of its work. The committee proposes to carry out an extensive survey of present conditions in this important field, with the aim of rendering the further advance of educational method easier, more rapid, and more satisfactory. Students of educational problems are asked to cooperate, and it is hoped that the results may eventually constitute a body of information that may be referred to as truly representative and reliable.

An adequate study of any such subject as the place of science in education must proceed with constant reference to the existing literature. The literature of science teaching is already extensive, but it is unusually scattered, in many different forms of publication. It therefore seemed highly desirable and quite fitting that the first public and official appearance of this new committee of the American Association for the Advancement of Science should occur through the presentation of this bibliography as a tool for research in this subject.

The bibliography herewith presented has been in process of preparation for several years as a part of a series of studies of science teaching. It includes articles bearing upon those sciences most generally taught in secondary schools. It has recently been entirely revised and checked and made to include titles up to the earlier publications of the year 1925. It is obvious that an annotated bibliography might be more helpful in many cases. To annotate the whole list of titles would produce a volume too large for publication. The purpose of this publication is to assemble in one volume the titles of magazine articles thought likely to bear upon any of the science-teaching problems. In the future it may be possible to publish selected and annotated bibliographies bearing upon specific science-teaching problems.

The membership of the committee on the place of the sciences in education of the American Association for the Advancement of Science is as follows:

Dr. Otis W. Caldwell, *chairman:* Dr. Edna M. Bailey, Dr. Eugene Davenport, Dr. Jesse B. Davis, Prof. W. H. Davis, Dr. E. R. Downing, Mr. W. L. Eikenberry, Dr. Max Farrand, Dr. N. M. Grier, Dr. R. C. Gowdy, Dr. Henry Harap, Dr. George W. Hunter, Dr. Vernon Kellogg, Dr. Harvey B. Lemon, Dr. Burton E. Livingston, Dr. C. R. Mann, Mr. John Mills, Dr. Alwin Pappenheimer, Dr. Mary S. Rose, Dr. G. M. Ruch, Mr. S. D. Shankland, Dr. E. E. Slosson, Dr. Frank L. Wade, Dr. H. J. Waters, Dr. Hanor A. Webb, and Mr. C. M. Westcott.

BIBLIOGRAPHY OF SCIENCE TEACHING IN SECONDARY SCHOOLS

SCOPE OF BIBLIOGRAPHY

One of the first needs encountered by the student, teacher, or investigator who is studying the problems of science teaching is that of a comprehensive and critically annotated bibliography.

In the fields of pure science the journal literature is thoroughly covered by such publications as Chemical Abstracts, for chemistry, and Science Abstracts, Section A, for physics. Other sciences have similar publications. No such abstract journal is available for the field of education, however, though it is greatly needed, and no adequate bibliographies are to be found that deal with the teaching of high-school science. The Bibliography of Science Teaching, Bulletin, 1911, No. 1, published by the United States Bureau of Education, contains 97 titles for general science and biology, 70 titles for chemistry, and 77 titles for physics. The Record of Current Educational Publications, issued by the Bureau of Education from time to time, contains a few titles bearing on secondary school science. Since none of these publications list an appreciable fraction of the articles that have been published, it has become necessary to prepare a new bibliography on science teaching in high schools.

The expense involved in the preparation of a comprehensive, annotated bibliography is such that it was decided to publish, first, a list of titles bearing upon the teaching of the chief science subjects, which have been found to be general science, biology, chemistry, and physics. This publication represents the first portion of the work. The preparation of a critically selected, annotated bibliography for a limited number of topics in the field of science teaching is in progress and will be published later.

The titles in this bibliography were obtained by an examination of the following periodicals:

Education, vols. 21 (1900) to 45 (1925); Educational administration and supervision, vols. 1 (1915) to 10 (1925); Educational review, vols. 19 (1900) to 69 (1925); General science quarterly, vols. 1 (1917) to 9 (1925); Journal of chemical education, vols. 1 (1924) to 2 (1925); Journal of educational psychology, vols. 1 (1910) to 15 (1925); Journal of educational research, vols. 1 (1920) to 10 (1925); National education association, reports, vols. 1899 (not numbered at that time) to 68 (1925); School and society, vols. 1 (1915) to 21

(1925); School review, vols. 1 (1893) to 33 (1925); School science and mathematics, vols. 1 (1901) to 25 (1925); Science (new series), vols. 1 (1894) to 61 (1925); Teachers college record, vols. 1 (1900) to 26 (1925).

A few citations will be found to periodicals not in the list given above. These titles were obtained from miscellaneous printed sources, and in some instances we have been unable to verify the entry in the original publication.

A laborious checking system has been used in the preparation of this bibliography in order to have all entries correct. If students, teachers, or investigators discover any errors, we shall be greatly pleased to be informed. We shall be grateful, also, to receive any information that will enable us to add titles that have been overlooked in this work. Very few bulletins, dissertations, and miscellaneous publications are included in this list. No books are included, since these can be found readily in other publications, such as the United States Catalogue. We did not have access to the Reports of the New England Association of Chemistry Teachers, and Reports of the Eastern Association of Physics Teachers; hence no titles from these publications are listed. Very few titles are included that relate to the teaching of science in the British, French, or German schools.

Some entries are included for the year 1925, but the list is by no means complete, since only a few months had elapsed when this bibliography was sent to the printer.

PART I.—GENERAL BIBLIOGRAPHY OF HIGH-SCHOOL SCIENCE SUBJECTS

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PART II.—BIBLIOGRAPHY OF CHIEF SCIENCE SUBJECTS

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Journal of educational research, Public school publishing co., Bloomington, Ill.

Journal of chemical education, Easton, Pa.

School and society, Science press, Garrison, N. Y.

School review, Department of education, University of Chicago, Chicago, Ill.

School science and mathematics, Mt. Morris, Ill.

Science, Science press, Garrison, N. Y.

Teachers college record, Teachers college, Columbia university, New York, N. Y.

Section 2. Minor Sources of Science Articles

Elementary school journal, Department of education, University of Chicago, Chicago, Ill.
Fairmount state normal school bulletin, Fairmount, W. Va.
High-school quarterly, University of Georgia, Athens, Ga.
Kansas state university. Bulletin. Topeka, Kans.
Library journal, R. R. Bowker and Co., New York, N. Y.
Nebraska teacher, Lincoln, Nebr.
New England journal of education, Boston, Mass.
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