AAAS Science Books: A Selection Tool

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FOR AT LEAST two decades, the American Association for the Advancement of Science (AAAS) has had an active program intended to improve children's understanding of the products and the processes of science. The association's programs to promote "science literacy" have included development of a science curriculum for the elementary grades (*Science: A Process Approach,* K-6), sponsorship of traveling science libraries, preparation of annotated bibliographies of science books for children and young adults, and the publication of the science book review journal, *AAAS Science Books.*

The association's interest in the development of science literacy in all segments of the population and in all age groups is a necessary consequence of the three objectives for which it was formed. These are (1) to further the work of science, (2) to facilitate the use of science to promote human welfare, and (3) to increase the public understanding of the uses of science for human welfare. Unlike the individual professional societies (approximately 300 of which are affiliated with AAAS), the association is a multidisciplinary society concerned with interdisciplinary communication and with promoting communication between scientists and laymen on all aspects of the sciences.

The association (and its 135,000 individual members) has an interest in making science information widely available because the public's understanding of science has a considerable impact on how effectively work in the sciences can be carried out. Further, in order to use the sciences to promote human welfare—that "welfare" being defined by the people affected—there must be substantial public understanding of possible uses of science and of potential difficulties. Science literacy—for this discussion at least—implies a minimum necessary understanding of the sciences.

Just how a reasonable degree of science literacy can be developed in either adults or children has been matter of considerable dispute during the past quarter century. To date, there is no evidence that

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significant numbers of adult laymen either have been or can be influenced to increase their understanding of science to any measurable extent. Children, however, especially those in grades 1 through 8, are apparently open to and eager to acquire science information.[1] It is this group which the AAAS has been making a special attempt to reach.

From 1955 to 1964, the association administered the traveling science libraries which went to hundreds of schools so that there would be science materials other than textbooks available to as many students as possible. The need for the service was substantiated by surveys: there was an average of only 5-6 percent science or science-related books in the recipient schools' permanent library collections. But, even though traveling libraries appeared to be excellent "starters" for building interest in science, the association's main thrust was toward improvement of permanent science collections in school and public libraries for both children and their parents and teachers.

To help those responsible for science book selection, the AAAS published book lists.[2] These annotated bibliographies (the most recent of which was published in 1972) covered separately books for children and for young adults. Each bibliography was a major undertaking and listed books from all science areas. Since it proved impractical to keep these book lists current, in 1965 the AAAS established an additional selection tool, the review magazine, *Science Books: A Quarterly Review.*

Now in its ninth year of publication, and with a new name, *AAAS Science Books* is received by about 6,000 libraries and school systems. In the magazine, current books are assigned ratings (highly recommended, recommended, acceptable, or not recommended) and grade level estimates (three divisions for the elementary school, one each for junior and senior high school, one for lower division college, and one for those professional level books which reviewers feel are suitable for reference or review for science teachers). Reviewers provide a 100-300 word summary-critique of each book, and are asked to comment specifically on the accuracy of the information, the scope of the work, the clarity of the writing and the value of the book when compared with other similar titles. The reviewers' comments (or summaries of their comments), complete citations and often some additional information supplied by the staff are published for about 900 science books each year. These 900 books (roughly half for readers in grades K through 10) are selected from some 2,000 science books received annually, and are reviewed by 650 volunteers, all of whom are either scientists or science librarians.

AAAS Science Books

At the time *Science Books* was established, science and scientists were highly regarded, and the highly visible achievements of the sciences made science studies and science book purchases attractive. Many book publishers responded to this favorable climate with a flood of books for young people on a multitude of science topics. Some were very careful and employed competent consultants familiar with each particular field. Other publishers, even some of the biggest, seemed more interested in return on investment than in accuracy or intellectual quality. The problem of selection was real, and the AAAS acted to "provide those who buy books for school and general library use with critical and reliable judgments concerning quality, content, and appropriate age level of the new books shortly after they appear."[3] Most reviewed books were at least "acceptable," but some "not recommended" books were included with appropriate explanations to further the goal of promoting excellence in children's science books.

To judge the credibility of a book review journal and its usefulness as a selection tool, one must know (1) the purposes of the organization which provides it, (2) the nominal standards, (3) the ability and willingness of the reviewers to conform to these standards and (4) the adequacy of the standards for making appropriate selections for a particular audience.

The reasons for the AAAS's interest in promoting science literacy have already been set forth. Initial criteria for review were developed by Hilary Deason, who was in 1965 the director of the AAAS Library Program and the first editor of *Science Books.* The criteria which he established (and explained in an article in *Science and Children*) were:

> *Authorship*—Does the author have the scientific qualifications to write a book on a particular subject?
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> *Subject and Content*—Is the subject of fundamental interest and importance to the prospective reader? Is it handled in sufficient depth so that it will constitute a worthwhile learning experience? Is the organization logical? (If the book answers the fundamental questions of "how" and "why" using appropriate technical terms, it is probably worthwhile; if it is a superficial survey covering too broad a scope, perhaps it should be avoided.)
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> *Illustrations*—Are the photographs and drawings accurate and are they accompanied by adequate explanatory legends keyed directly to the text? Mere embellishments that add nothing to the text are seldom worthwhile.
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> *Vocabulary*—Most young children can and should read any words

that are the best choice for expressing scientific ideas and concepts. "Controlled vocabularies" are totally unnecessary. With pronunciation markings and definitions either in the text or in a glossary, a reader of any age can understand and learn to use correct technical terms.

Biographies—Science biographies for children and young people should be written as contributions to the history of science and stress the biographee's discoveries, contributions, and professional attainments and associations. A fictionalized biography that relies heavily on manufactured conversation and relates nonessential personal details may be interesting reading, but it has no value in science education.

Nature Study Versus Science—Animal tales and folklore have their place, particularly for preschoolers. In school, children deserve more substantial fare—no talking animals, no anthropomorphisms, no "Dick-and-Jane" reading matter. Material taught in terms of biological science (Who? How? Why?) is interesting and enables students to "get involved." Genuine biology books are preferable to superficially descriptive and sentimentally written "nature books." Look for books that give complete life histories or ecological studies.

Physical Science and Technology—Merely descriptive books about rockets, missiles, airplanes, atomic reactors will entertain but are not educationally worthwhile unless they introduce the reader to fundamental scientific laws and principles—and to the painstaking underlying research and experimentation. Such books should demonstrate to the reader how and why his science and mathematics courses are basic preparation for those who want to be scientists, technologists, doctors, engineers, and space travelers.

Experiment Books—"Experiment books" designed to demonstrate scientific facts and principles should encourage the reader to do additional experimentation on his own initiative and should stress the value of additional background reading.

Reaching Upward and Outward—Buy books for children and young people that they will have to "grow into"—books that hold their interest but that require repeated reading and study to understand and enjoy thoroughly. Books should be chosen not only to deepen the reader's major fields of interest, but also to acquaint him with other, unfamiliar areas of knowledge.[4]

Books which met all or most of these criteria were to be rated "highly recommended" or "recommended" in *Science Books*; those which were

somewhat deficient in one or more characteristics but which did not contain any serious errors were rated "acceptable," while books with serious errors or deficiencies were listed as "not recommended." In defining science, it should be noted that, while primary emphasis was placed upon mathematics and the physical and biological sciences, other areas were also included: applications in medicine; engineering sciences and technology; and some areas of the behavioral sciences, especially psychology, sociology and cultural anthropology.

The watchword was *rigor*, and the above criteria meant that sentimental, anthropomorphic, merely descriptive, or overly simplified presentations were not considered to be science. These selection standards were developed at the same time that major nationwide changes were occurring in science curricula. The scientists and educators involved in preparing new curricula for science courses for elementary and secondary students were also emphasizing rigorous presentation of science information. These curriculum developers were quite influential, and their science presentations emphasized the logic, intellectual achievements and the spirit of adventure and discovery which motivated the scientists themselves. It was expected that the same courses which would interest and prepare a scientist-to-be would prepare a future citizen to "appreciate" science and to be scientifically literate.

The basic assumption underlying these new science curricula was that the study of science provided its own motivation. That was also a fundamental assumption in *Science Books* criteria. Thus the quality standards for *Science Books* were compatible both with those of the science curricula and with the expectations of most university-based scientists, many of whom were *Science Books* reviewers. But, while there was unity of purpose among members of the scientific community, one must still question whether the *Science Books* review process was completely adequate for making appropriate selections for an audience of children, young adults and adults, most of whom were not and would never be scientists.

Of late, educators and many scientists have begun to realize that no single science curriculum will reach all students, and that the rigorous new science curricula turned off more students than they attracted. It seems reasonable to suppose that *books* selected primarily for accuracy or for "science for the sake of science" will also fail to attract substantial numbers of today's young people. Just as some curriculum groups are now working on more "relevant" science courses, so we at *Science Books* are also considering additional standards for selecting science books for young people.

These new standards must be concerned with both a book's relevance and its motivational material, especially since the climate of opinion about science has changed considerably in the past decade. Eight years ago, more than half of the public accepted science as a beneficient factor, but eighteen months ago that figure had dropped to one-third.[5] In this poll, adults were questioned, but young people are surely influenced by the climate of opinion around them. Further, many young people seem not to be seeking a rational understanding of the world; there is a resurgence of interest in mysticism, astrology, and the occult. These may be only passing fads, but the basic problem remains: if we cannot find some way of getting most young people interested in the sciences as a means of understanding themselves and the real world, then this civilization is in considerable trouble.

Science, through its discoveries, and especially through its conceptual processes, has become a major intellectual and economic force. While the theories and concepts of science may never have great aesthetic appeal for most people, all responsible citizens must have some real understanding of science processes and potential science applications because, through design or through incomplete understanding, science and technology can be directed to some very destructive purposes. While some may argue that we can solve such problems by decreeing "no more science," most thoughtful people agree that our technologically based culture has progressed too far for that. More science, not less, more scientists, not fewer, are needed to solve the technical problems we already have and to prevent much more serious problems from developing. Some young people must become scientists, but all young people should have an understanding of science.

In the schools, science must become an integral—and integrated—part of all studies. And we must somehow discover and put in the libraries the kinds of science books which young people will read willingly. I do not mean to suggest that we no longer need to be concerned with accuracy, logic, good design, and all the other selection criteria previously listed. Indeed, we need to be particularly careful of accuracy of both fact and implication in all science books—including those for the beginning reader—which undertake to show children the interactions of science and society. Errors learned early are hard to correct later, and most children have only about ten years in which to acquire basic science information. When we consider that the voting age is now eighteen and that most children do not really begin to read with any facility until they are seven or eight, we have to view the

selection of good science books *which children will read* as a matter of some urgency.

Unfortunately, social relevence does not guarantee reader interest any more than does scientific accuracy. Motivational material is needed, but what kind and how much is difficult to judge adequately. Any competent scientist can say whether or not a book in his own field is accurate and not so overly simplified as to be misleading. But what will appeal to the student not already interested? Here we move into an area of art and a maze of individual abilities and preferences. We do not yet know enough about individualization of instruction to do it effectively; but we do know that we need quite a variety of different materials to satisfy different student needs. Similarly, if diverse individual needs are to be satisfied by libraries, science collections are going to have to expand considerably, and books offering many different approaches to the same science areas will have to be provided. This means that additional demands will be put on already limited library resources. It also means that more stringent requirements for book recommendation must be set by selection tools such as *Science Books*.

What in particular should we look for in judging young people's science books? First, we can certainly look for science books in which the writing is lively and not too difficult. Second, we can look for a personalized approach. At a minimum, characters and situations should be portrayed so that a variety of readers can identify with both. Pictures are especially important; they should have the clarity and impact of a good news photograph, and they should give the reader a feeling of personal involvement in the science process in as many ways as possible. This includes such now obvious factors as showing representatives of various races and both sexes participating in the activities illustrated.

Books must be lively, but they must also avoid the "gee-whiz" type of presentation which tends to promote a mystic attitude toward science-as-magic rather than science as human investigation of natural events and forces which have explanations understandable by the reader. After reading a good science book, children should have the feeling that their world has become more predictable. Thus, as they gain knowledge, they also gain self-confidence and pleasure in their developing sense of personal competency.

Many science books would be more interesting if they included more about the historical or social setting and if the author displayed some sympathy for the "ignorant" who may have opposed the use of a

particular science discovery or failed to understand the significance of some newly developed concept. (After all, we also are ignorant of tomorrow's discoveries, and displaying the need for humility is not amiss.) Authors must, in addition, make a real effort to reach out to the readers who may already be frightened or alienated by a scientific culture which seems about to engulf them.

We need to look for presentations which are not so imprecise that readers will misunderstand the implications of scientific concepts. But, for younger children especially, we should realize that some abstract concepts probably *cannot* be explained properly. When reference is made to aspects of science which cannot be adequately explained, readers can be told the minimum necessary and told to look the matter up elsewhere if they wish. Every writer should also be very faithful in pointing out that no field of science is known completely and in most fields our knowledge is still scant. The scientific elitism which has plagued many science books in the past should be avoided at all costs.

Two other aspects of science development and discovery are interesting, important and often insufficiently emphasized in many science books. They can make science a more approachable subject for many readers and should, therefore, be on our list of qualities which contribute to a good science book. The first concerns the nature of the scientific method, and the second is the part intuition plays in many—if not most—important science insights and discoveries.

The scientific method, it should be emphasized, is not some esoteric process known only to its devotees. It is rather the analytic process we all use when we are solving problems logically. We gather data, we try to see if other people see the same things which we have seen, we sort our information into what we are reasonably sure of and what is less likely, we try to make the best guess we can about what the data mean, and then we look for further evidence to see if our guess is right. This *is* the scientific method, it is a natural human mode of operation, it is carried out more or less well by everyone, and it is just as useful in discovering the truth behind television commercials as it is in discovering the truth behind quasar signals.

In addition, analytical thinking is withholding judgment until enough data is in. Often science books—even those by scientists who should know better—skip the doubts, the wrong turns, and the incorrect guesses which went into developing some science theory. Also, they may not give the reader any real basis for understanding what constituted enough data in a particular situation. (What is "enough data"? There is no absolute answer, but certainly we need to

look for books which show young readers the tentative nature of many scientific hypotheses.)

The other aspect of science which should be emphasized is the value of intuition. For those used to the usual analytical mode of science reports, the importance of intuition in science may come as a surprise. It should not. Intuitive thinking is a natural and apparently necessary—if little understood—antecedent of scientific discoveries. Do new ideas come as a result of consciously unresolvable conflicts in observations which are then unconsciously recombined in new ways, leading to new insights? We do not know, but we do observe that creativity is often a product of aloneness, of apparent inactivity in an individual who is both knowledgeable and open to new, even outrageous, notions.

Science books which point out the fact that advances have been made in all fields of science by people who did not automatically reject wild notions ought to interest young readers who are themselves trying to break out of what they see as the undue restraints of society. (Let me enter a disclaimer at once lest anyone suppose that I am either fomenting revolution or proposing that young people be encouraged to believe in wind gods which blow out of the west or invisible ropes which hold the moon to the earth. I am only suggesting that we need to look for books which counter an overly analytical presentation of science and the scientific method.)

We need, then, additional criteria for selecting good science books for children, but not a replacement of those criteria which reviewers have used and are using when they write their reviews for *Science Books*. We need to select books which include motivational materials, lively writing, good photographs and drawings, analogies, parables, stories, and even humor. All have a legitimate place in science books, provided they add to the reader's comprehension of the science facts or processes under discussion and that they are clearly labeled so that young readers will understand what is going on.

The push toward rigorous science presentations was especially important at a time when we were taking first steps to insure accuracy in teaching science principles to all students. Now we must go one step further and integrate science into the fabric of living. Criteria for judging science books must include standards directed to this end. It appears that some of the *Science Books* reviewers are already moving in this direction. They are basing their judgments on an expanded set of criteria which include but go beyond the 1965 criteria. The next step is to develop these ideas into tentative guidelines which will then be

circulated to all *Science Books* reviewers for their comments, suggestions and corrections. This procedure should produce a very strong set of guidelines and the selection process should improve as a result.

Some very vigorous comments and some considerable disagreement among some of our contributors may be forthcoming. There may also be new insights into book selection for young people who, in the early grades at least, are curious, alert, and concerned about sorting out the contradictory information that hits them from all sides. This interchange with reviewers will mean that *Science Books* will be an even better selection tool, helping to provide an information base so that "every citizen, every man in the street . . . [can] learn what science truly is and what risks and quandaries, as well as what magnificent gifts, the powers that grow out of scientific discovery engender."[6]

References

1. Winslow, Richard K. *Publishing for Scientific Literacy: A Report to the Committee for the Public Understanding of Science* (AAAS Miscellaneous Publication 72-11). May 1972. See also: Byler, Ruth V., ed. *Teach Us What We Want to Know.* New York, Mental Health Materials Center, 1969.

2. Deason, Hilary J., comp. *AAAS Science Book List for Children.* 3d ed. Washington, D.C., AAAS, 1972; and ————. The AAAS Science Book List. 3d ed. Washington, D.C., AAAS, 1970.

3. Wolfle, Dael. "Science Books," *Science,* 148:317, April 16, 1965.

4. Deason, Hilary J. "Evaluating Science Books for Children," *Science and Children,* 3:9–11, Nov. 1965.

5. Harris, Louis. *New York Times,* Nov. 13, 1972.

6. Glass, Bentley. Speech before the Thomas Alva Edison Foundation, Dearborn, Michigan, Feb. 11, 1967.