

READER INTEREST IN SCIENCE: YOUNG PEOPLE

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In considering young people's interest in science, I intend to include people from the sixth grade level to senility. The matter of definition of children, young people, and adults is not too much of a problem because the whole concept of age level and grade placement of materials has had a severe shock during the past ten years. A few years ago you could pick up a book and find clearly stated on the jacket that this was for seven year olds, or this was for fourth grade children. Today you will find that the designators have disappeared and it is difficult to find out for whom a book is intended and why.

When you examine the interests of adults you find that they have basic problems that occupy their attention, e.g., the matter of earning a living, of adult responsibility, concern for the future, and the like. When it comes to a curiosity and general interest in the world around, the knowing of things for their own sake, the subjects that interest adults are not the kinds of things that press upon them for economic or other reasons. The differences between adult interests and young people's interests are very small. The same kind of curiosity that makes an adult read something that Watson Davis' editors get in the newspaper is about the same level of curiosity that makes young people do the same thing. Once at the level where vocabulary is not difficult, roughly about the fourth, fifth, or sixth grade or thereabouts, the interest picture irons itself out pretty much between adults and younger people. I found, for example on my own books, when a book intended for eight and nine-year-olds was borrowed from the library by Johnny and Mary, their Mother with her usual curiosity would look at the

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book and then in a short time read it. Mother learned all she wanted to know about whales, ostriches, or comets at about the same level as her children and enjoyed it very much. We found a considerable amount of evidence that adults who would never think of going to an encyclopedia, or any other reference book, for information on some of the topics about which they were vaguely curious would be very happy to read a children's book when they could do so without being conspicuous. I have advised teachers for years to read what their students were reading and not try to understand a science book that belonged at the college level. A few of them have followed my advice and have enjoyed science. The rest would not, and, as Sidney Rosen has pointed out, have been very unhappy.

We found, for example, that one of the publishers, who, for a number of reasons, abridged certain books and put them out in children's editions, created a book that was more interesting to the adult in many cases than the original book. I refer to such works as the young people's edition of Rachel Carson's book on the sea. It is in many ways a more attractive book for general adult readers than the original book. Life's first scientific effort, a description of the world around us, was a very heavy thing, but when it was reduced and brought out for young people it became a fairly good book for the adult reader. Now Winston Churchill's book, World War II, has been brought out in a children's edition and I think it will probably turn out to be an attractive adult book as well. An encyclopedia which ten or fifteen years ago advertized itself as a children's and young people's work now considers itself a family encyclopedia because the adults use it as well as the children. More examples of this kind can be cited where general information is involved. There may be differences of degree where the general reader is involved, but there are no clear cut differences of comment. In the area of science informational books, much of the material available for young people has real potential for the adult reader also. This should be quite a challenge to librarians. Librarians can be of great assistance to women, who are especially apprehensive of sciences. Mothers who are anxious to be able to converse with their own children about scientific subjects can be steered toward some of these books which are interesting, attractive, and well-written, but not aimed at the adult reader.

I would like to say a few words about books in the field of science then return to the interest of the reader. The term "science" is not easy to define. I suspect at least those of us who have a speaking acquaintance with the area would settle in

terms of a basic methodology or a group of methods rather than on any specific content definitions. In these methods, which could collectively be called scientific methods, there is an aspect of communication which is an essential part. In other words there cannot be science without broad communication. By and large this communication is the printed word. In science the fundamental aim is to discover facts which can be used in the solution of problems. In order to take a problem, localize it, particularize it, formalize it, so that it can be worked on scientifically, a background in the literature of science is needed. Science is inconceivable without books. The fact that they belong together must be clearly recognized if we are going to work with science and young people. Books are the sources that provide much of the techniques and procedures. Every book on science is technically a "how to" book because science fundamentally is concerned with the question of "how," whether it is how to make a cyclotron, or how to tell a blue bird from a black bird. The "how" question is not, as young people sometimes think, the "why" question. When you analyze what young people really mean by "why," it tends to mean the word "how." And so the "how to" approach in science from technical reports down to popularizations is exceedingly important. All of the guide books that we have are in a sense "how to books." And they are a very important kind of book, because they give people a chance not only to understand but to participate very early and very simply in the scientific process. Then, finally, we come to the books that deal with understanding science, the appreciation of science.

This matter of books about science, rather than books that are a part of science, is a rather interesting thing to explore. The books that are about science are the books that are designed for general reading. They give a picture as to what it is all about, which is the primary concern in these times when science is moving ahead so rapidly. In this area the kinds of interests are pretty much the same for young and old and are strongly socially conditioned. Strong sex differences and degrees of interest are involved in this social conditioning. The range of interests is far greater than most people suspect. Librarians seem quite concerned in having a nice, general book that has the answers in it. Young people are concerned with just the opposite. Their interests are quite specific. If Johnny comes in and wants a book on goldfish, he does not want a book on zoology. He wants a book on goldfish. Later on he may proceed from a book on goldfish to a book on other fish until he finally gets up into the animal kingdom. Young people's interests

can be quite specific, and if we can visualize these specific interests, which cover a tremendous range, we have a chance to see some of the great educational potentials in the picture. There are many books dealing with a wide range of subjects now available for young people because of the appreciation of their specificity of interest.

And finally in these general books there comes a question which is most difficult to answer, the question of accuracy. I don't know quite how to answer it. I have been working all week with a world famous ornithologist and we still seem to differ. I would suggest at this point that accuracy has to be commensurate with a purpose and unless the purpose is clear you cannot set up absolute criteria of accuracy. A book which a top physicist would regard as grossly inaccurate, may be exceedingly accurate and useful for ten-year-olds. This does not mean that you include deliberate errors. This does not mean that you condone careless writing or misstatement of facts, but it means that understanding has to be commensurate with background and so does purpose and accuracy also. This is important for librarians who are constantly being asked "how do we know this book is accurate?". If librarians turn for an evaluation to their colleagues in the science departments of universities they tend to get misled because the colleague looks at the book in his own terms rather than in the terms of its intended reader. You have to watch out when you go to a professor of physics or chemistry and ask if this is a good book to put on the shelf for housewives and young people. When writing for these audiences the question should be: Are the facts understandable and clear on their level? All books relating to science ought to make some contribution to the person who is reading them. They could not make any better contribution than to lead the reader to a stage where he or she would act scientifically in an appropriate situation. I would like to emphasize that everybody from the kindergarten up can act scientifically in an appropriate situation. These situations have to be defined in the terms of the individual and complexity of the things involved. But science is not something you can read about now and act on ten years later. You can read science at any age level and if the reading is appropriate, if it moves in the right direction, you can act scientifically. Lots of people act scientifically and they do not know it. Acting scientifically involves discovering things for yourself, discovering things through a very simple process, mainly the process of observation. This is the fundamental technique of science. You open your eyes and look. You may look through a microscope or a telescope, or use a ruler to

help you measure more carefully. Experiments are merely devices that help one make better observations because the situation is controlled. Some very excellent experimenters were never scientists, never thought of themselves as scientists, and never wanted to be considered scientists. For example, women get into the kitchen, they look at a recipe, they try a little bit more of this, or a little bit less of that, and see what happens. That's experimenting, isn't it? They are trying something out to see what happens. They are discovering something new. That's acting scientifically in an appropriate situation and there are millions of appropriate situations in which young people and adults can act scientifically. Reading in the general area of science can move in that direction, but unless the reader begins to get some degree of this participation then I don't think the reading has been successful. In short, the purpose of reading in science is not more intellectual understanding but it is something which moves the reader into an action program to some degree.

Having finished my digression let me get back to the areas of interest as far as young people are concerned. Here I must fall back on some research which I did twenty years ago. I was fortunate a long time ago to get a grant to investigate scientific interests of young people. I have not had a chance to reinvestigate the problem thoroughly since the Atomic Age dawned on us, but I have had a chance to check enough to believe that some of the facts that I uncovered twenty years ago still hold true today.

First of all I don't think there is such a thing as an interest in "science." Science is too broad, too general. As Mr. Rosen pointed out, this fear or this misunderstanding of science is far more common than an interest in science. Young people are interested in themselves physically and in their health: boys in strength and muscle building and girls in their appearance. Young people are interested in food and nutrition and hygiene. And they go to the shelves and find book after book filled with fable rather than fact in many of these important areas. They are interested in physiology and anatomy, i. e. the mechanism of their bodies and how it operates. They are interested in their brain, their nervous system, digestive system, and all the like. They are concerned even more with growth and with the fundamental concept of normality. They hate to think of themselves as deviating in even the slightest kind of a way. Science can point out the great range of individual variation, the great range of normality and help reassure adolescents in problems that involve them very much. Of course, they are inter-

ested in sex, endocrinology, and heredity. They want to know about mental growth, IQ, talent, their own abilities, this vague thing called personality, behavior, and their emotional life and development. From this core of self-centeredness young people move out to seek information about the family, their siblings, their parents, and their grandparents.

They are concerned with social and group behavior and in a vague way with vocations and jobs. Some of these subjects have a great deal to do with science, others have nothing to do with science. And in nearly every case, facts alone are not the whole story. There are facts plus values that are involved. This means a responsibility on the part of the teacher or librarian to supply the kind of material which will put the two together, if that kind of material is available, and unfortunately it rarely is. Going out from this bull's eye of the target there are other interests of course. Young people are interested in the whole world of life, and in fairness I should say that part of the interest in the world of life is really a sublimation of the interest in themselves. Some parts of this are hard to understand and others are fairly obvious. For example their interest in animals is greater than in plants, yet certain phases of this escapes. There is more than a general interest in animals because animals are more like humans than plants. There are specific interests, identification interests. Even in the simple participation in science in which young people, and old, are involved these are emotional experiences which should not be underestimated. I imagine that the simplest kind of emotional scientific experience a young person can get is to look at a bird on a branch and then look at a picture in a book and say "They are the same aren't they?". This is not at a high-intellectual level but the number of people who get satisfaction from exactly this kind of thing, from simple identification, putting a name on something they have discovered by themselves, is enormous. Three million copies of my own bird book have sold for this reason. The satisfaction of starting off and discovering for themselves the identification of natural objects is a very interesting place to begin and a very important one to young people. Both boys and girls are interested in living things. Girls tend to be more interested in living things and less interested in non-living things than are boys.

Now let me drop from this living world to the non-living world. The science that we hear about today, the science that has us competing with the Russians is primarily the science of the non-living world. Here in terms of interests we have overlays that are of particular importance. There isn't any doubt

the word "space" produces emotional reactions now that it could not have produced ten years ago. There are strong concerns that are built up because of the currency of topics. There is interest in the universe, the stars, and the planets and space around us. There is geology which involves the past and fossils and dinosaurs which have a peculiar attraction for the young. There is less interest in the weather, except the extremes, such as storms, tornadoes, and the like. When you start dealing with the fundamental areas of physical science, with energy and power, atoms and sub-atomic particles, the interest of the boys is exceedingly high and the interest of the girls is decidedly less. And here is an intangible area which is exceedingly difficult to understand. And so when it comes to writing it is not surprising that the number of books which do a good job in this area are much fewer and harder to get than the books that deal with the living world. Machines, planets, rockets, automobiles, and ships, the whole area of mass transportation has a special appeal to boys. The element of speed is something that seems to have caught the fancy of young people. The concept of computers and how they work, machine tools, automation devices, whole areas of physics, like solid state physics, have to be made clear to general readers. I have been looking at these problems for a long time, and as an editor I have been looking for authors to work with them. It is so much easier to work with the simpler areas of biological science, with the identification, than it is to work with the fundamental areas of physical science that it seems almost a difficulty that can not be bridged. Yet, I insist that we must face the problem. We must get the scientists and writers and illustrators together. We must have these areas explained clearly and simply on several levels of understanding because they are too important to pass by.

Because the range of stimuli available to young people is so wide, interests cover a tremendous number of things. It is almost impossible to find an area of knowledge in which young people are not interested.

Now to come back to libraries and science. Science is a matter of action and a matter of doing. It is not the job of a library to create science. Yet libraries can make important contributions. I have already indicated the importance of the fundamental sources of information, communication through the printed word, both in setting up and defining problems. Communicating information so that it can be checked and verified are essential parts of the process of science. Without communication you cannot get the dissemination which is essential for

verification. Without verification you cannot establish facts. Without this you don't begin to get the variation and modification of ideas which lead to new discoveries. It seems to me, therefore, in broad aspect, that science and communication must go hand in hand. Science and secrecy just don't belong together. Books, and I state this with a bit of timidity, do not in and of themselves create an interest in science. I have found very few cases where people have said I got interested in science because I read it in a book. There tends to be behind young people's interest in science some actual experience, something they have done, something they have seen, something that has given them a positive emotional slant. And then they read a book on the subject and went on from there.

But to start off with a book does not seem to me an important place to begin. Yet when the young person has an interest, no matter how slight, if he has only identified one bird, collected one stone, or learned one little thing about electricity and wants to learn more, books can immediately nurture that interest and nurture it with great rapidity. The intellectual calories that a young person can get out of books are beyond counting, and so the books take on an immediate function of re-enforcing and building up interests. Even more than that, the young person usually comes around with a clear specific interest and this is due to the fact that his knowledge is limited. He has a goldfish and he wants to know what it will eat. He has watched some piece of machinery and he has seen some specific thing he wants to know about. He starts reading at the point of specific interest and begins to broaden this immediately. He sees the relationship to other things and in that you get what is fundamentally education: a broadening process, an inter-relationship that comes into the picture. At the same time this creates new problems, it raises new questions, and it creates the kind of situation that is characteristic of science, a thing that is going on and on, an endless frontier.

Now, what can librarians do? First of all they can provide rich and varied book resources. Thank heaven they are available. When I went to the library as a child, there was a little children's shelf in the corner and it was about 98 per cent fiction and the number of books of the non-fictional, informational type available were very few. Now we are swamped with them. I think on the whole that this is good, but there are so many now that discretion is needed. But you can provide a rich and varied book resource for younger readers. You can at last provide resource information on several different levels. The chances of picking up the specific interests of young people

when they occur by providing the information to help them get started, enable them to move on, is very important. We should not have the tremendous gaps that we now have because certain areas in science have not been tackled and worked out at appropriate levels.

Next, I think it is important to provide attractive books. We all enjoy a well-designed, well-illustrated, and well-made book. Young people have short interest spans, dealing with interests that are competing with all kinds of other interests, all kinds of other demands on their time, so that attractive books become quite important. Again there are a good many very attractive informational and scientific books for young people and I urge you to locate and use them, making certain they are accurate in terms of the purpose.

And then most important of all, as Mr. Rosen has pointed out, is the personal relationship between the librarian and the consumer. Librarians have redefined their role in the past ten years. School librarians consider themselves as sort of resource persons. They not only know the books on the shelves, but they know other places to get materials. They go out of their way to find people who know; they find pictures; they find phonograph records; they find all kinds of resource materials which will help young people learn. This role of helping each young person become a learner is the role in which librarians can make their greatest contribution. We haven't enough librarians, we haven't enough learners. I think the problems that were touched on by Frederick Seitz earlier in relationship to science in the future are problems that are solvable in the very fundamental term of making science information available and usable for everyone, to enable everyone to act scientifically in the appropriate situations, and to make everyone who can read, a person who wants to learn.