Letters

Who Reads the Journals?

Abelson's editorial regarding foreign distribution of U.S. scientific literature (6 Aug., p. 589) requires comment. In 1961 we began publication of a semiannual geological journal, *Contributions to Geology*. We solicited both U.S. and foreign institutions for exchange or subscriptions. Our circulation from both sources is now approximately 1000 copies. The interesting point is that apparently our foreign readers outnumber the domestic ones by a very large factor. We see references to articles in *Contributions to Geology* in many foreign journals, and reprint requests from abroad are numerous. The fact that many such requests and references are from respected and influential scientists reflects discredit upon American scientists. I suggest that the lesson to be learned from this vignette of scientific publishing is that Americans do not, by and large, read publications. Our colleagues in Europe and Asia are apparently vastly better informed than we are. Circulation or membership figures are so misleading as to be worthless. It is what people actually read that counts. May I suggest to my American colleagues that they spend more time reading and less writing. Our foreign colleagues do.

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How Children Learn to Read

One can only applaud the *rapprochement* between psychology and education signalled by Gibson's recent article in *Science* entitled "Learning to read" (*1*). But it would be a pity if the careful and imaginative research that she and her colleagues have undertaken were to lead to the error that has, to my mind at least, marred so much of educational research—that is, the effort to devise new instructional methods and materials without sufficient consideration of the nature of mental growth and ability. Although Gibson and her colleagues are still far from taking a "methods and materials" approach, her report suggests that the work is tending in that direction.

This impression is derived from Gibson's emphasis upon the "learning process" in the strict sense in which this term is used by learning theorists. While Gibson uses the terms "development" and "stage," there is no real consideration of how the learning process changes or new processes are acquired with maturation. Indeed, one gets the impression from the article, perhaps mistakenly, that there is *a* learning process which is invariant with age, and that the task of research on reading is to find ways of bringing about relevant discriminations and transfers. Such a position leads inevitably back to the methods-materials approach, because it emphasizes the manipulations of the teacher rather than the mental activities of the pupil.

Our own research on reading, strongly influenced by the work of Jean Piaget, takes a rather different starting point. We start with the assumption that the learning process is a function of the child's developmental level and that the first task of the psychologist is to diagnose such levels and the learning processes associated with them. We have tried to show, for example, that perception changes with age, and that even the ability to reverse figure and ground (*2*) and to integrate parts and wholes (*3*) is partly a function of age. Short-term learning (*4*) does not alter these age differences. With respect to reading, we have tried to show that such developing perceptual abilities are related to reading skill (*5*) and that slow readers are deficient in them (*6*). In recent, as yet unpublished, research we have found, moreover, that perceptual skills important for reading at one level of development may be unimportant or detrimental at other levels. Tactile discrimination of letters, for example, is positively correlated with reading skill among young children but negatively related to reading ability in older children.

A goodly number of recent studies by other researchers also suggest that the learning processes and strategies utilized by children are, in part at least, dependent upon their developmental level. It is also coming to be acknowledged that theories derived from experimentation on adults cannot be applied to children without serious modification. The Gibson article takes no note of these trends and cites research with adults as being relevant to the reading processes of children.

Also omitted from Gibson's article is any mention of individual differences in ability to profit from certain methods and procedures, and of the difficulties of applying laboratory-derived methods in an ordinary classroom. I recall vividly the despair of my father, a machinist, over the meticulous blueprints given to him by inexperienced engineers. The trouble with these blueprints was that they just could not be machined! The same will hold true of blueprints for teaching reading that fail to take account of the realities of the classroom.

Cooperation between psychologists and educators, as Gibson has so clearly pointed out, is long overdue. But theoretically and experimentally sound methods are of little real value unless they can be applied. How to apply them does not follow as a matter of course but is in itself a matter for research.

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Elkind criticizes our work for taking what he calls a "methods and materials" approach. Insofar as this is true, I am not at all dismayed by the criticism. One of the principal emphases of progressive reading programs for the past two decades has been so-called "readiness"—an emphasis on maturation

and unhindered development. This approach has yielded disappointingly few demonstrable gains. Readiness measurements do not even correlate significantly with reading achievement. On the other hand, recent advances in the teaching of mathematics have been impressive, largely because the mathematicians and educators concerned have looked not only at the child but at the discipline to be learned, sought new ways of structuring it, and revised the methods and materials. For good instruction, instead of simply waiting for "new processes" to be "acquired with maturation," one must indeed program the teacher. That the program must be geared to the child's potentialities goes without saying. Piaget's work has played a significant role in the "new math," but so has rational analysis of a problem with resulting programs of experiment and instruction (*1*).

Elkind's letter implies that I think of the child as a miniature adult and am unconcerned with developmental psychology. This is not the case, for my own current research is concerned with perceptual development—in fact, with development of strategies in perceptual processing. But in studying development of a particular skill, I think it is essential to analyze that skill so as to discover the optimum strategy at its final attainment—in this case, what kind of perceptual processing characterizes the skilled reader. The sequencing of training procedures, I believe, must lead to this strategy as a final goal. That some components of the skill must precede others, both developmentally and in training, was the major point of my article. For example, Elkind points out that tactile discrimination of letters is positively correlated with reading skill among young children but negatively related to reading skill later. This makes good sense in terms of my analysis, for letter discrimination is a prerequisite to decoding, and tactile and visual discrimination of letters shows cross-modal transfer (*2*). But later, the child should have proceeded to the processing of larger units, and perceptual skills different from single-letter discrimination would correlate with success. Factor analysis of the learning of the Morse code at different stages of mastery shows a factor shift of exactly this sort (*3*). There is no evidence that this shift is due to development of new learning processes. It seems rather that acquisition of superior performance of the task demands it.

I do not believe, as it is now fashionable to profess in some circles, that anyone can learn anything at any time if the program is right. But if we are going to *teach*, we had better be concerned not only with maturation, but also with the structure of the subject we are teaching, the units that have utility for it, and the optimum strategies for it.

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Half-Life of Radiocarbon

An international conference on carbon-14 and tritium dating was held at Washington State University, 7–11 June 1965. This was in effect the sixth international conference on radiocarbon dating and the first one in which discussions of tritium were included. As in the past, the question of which value for the half-life of radiocarbon should be used in reporting radiocarbon dates was debated at some length. Upon conclusion of the discussion, an *ad hoc* committee drew up the following statement, which was unanimously approved by vote of the conference:

The sixth radiocarbon conference meeting at Pullman, Washington, on June 11, 1965, under the general title "International Carbon-14 and Tritium Conference" reconsidered in some detail the question concerning the half-life that would be most useful in expressing radiocarbon dates. The consensus of opinion favored the retention of the previously used half-life of 5568 years [*Nature* **195**, 984 (1962)]. The reasons for this decision were based in the main on the desire to avoid the confusion which would arise should the many thousands of published dates require revision. It was also recognized that there are discrepancies between the radiocarbon chronology and other chronologies which would not be corrected by a change in the half-life.

It was recognized that the value 5730 remains the best available half-life for the decay of radiocarbon. Those who wish to do so may continue to convert the published dates by multiplying by the factor 1.03.

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