THE DIMENSIONS OF EDUCATIONAL ACHIEVEMENT[1]

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The achievement of a student in school learning, as we all know, appears to depend rather directly upon a number of things--intelligence, home environment, desire to learn, teaching method, and so on--all combined in a mix that is different for every child. Educational researchers continue to study one or another of these factors, hoping that by its modification the achievement of students can be extended one more notch.

From one point of view, the dimensions of possible achievement in school learning are perceived as known or predictable; from this point of view, one widely held in educational circles, the utmost limit of achievement lies just a little beyond that which is now accomplished by our very best students in our very best schools. From another point of view, the dimensions of possible achievement in school learning are unknown--barely suspected by but a few people.

It is this latter view that I should like to explore with you briefly, engaging in some very personal speculations. In order to launch my speculations properly, I need to establish a base of sorts by characterizing present educational practices.

The educational system in which we conduct our research is an inherited system, the product of about 500 years of habit. It sweeps up children at age five or six, incarcerates them 180 days a year in a special building set aside for the purpose, keeps them herded in groups of 20 to 40 of their age-mates, and provides coaching in certain kinds of academic skills by specially-trained adults. There are variations in the system to allow for observed differences among learners--as well as to allow for differences of opinion among educators--but the total system has a pattern that remains the same from one generation to another.

Within the system, we educational researchers have for 50 years busied ourselves with finding better ways of doing the school's work. Whatever innovations we may have introduced into our research--whatever new tack we may have taken to uncover and describe the learning paths of youngsters neatly seated six to the row--we have stayed within the framework of "school", within the bounds of the system.

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Running all through our research and our teaching are certain assumptions about the children whose learning is the object of the whole tremendous system. Such as:

1. The rate and extent of a child's school learning are limited by his intelligence, which is composed of learned and inherited traits in an indistinguishable combination;

2. The child is ready to read--hence ready to start school--only when he reaches a "mental age" of about six;

3. A child somewhat handicapped in intelligence needs more motivation to achieve than does a child favored with high intelligence.

There are others .... but these three assumptions are basic to the operation of our system and all three are probably dead wrong. Furthermore, our research into the educational process is distinguished by the remarkably small amount we know about how human beings learn. What is the learning process? How can we lay our hands upon it in order better to teach young people the things we think they ought to learn? We simply don't know.

The limits of time force me to be very unfair to both the teacher and the researcher in this preliminary summation of the educational system as it is. We run the business of teaching children better today than we did even one generation ago, largely as a consequence of research. But the fact remains that we attempt to teach children in an institution that has been shaped by the social and economic and political needs of adults--rather than by any real knowledge of what learning is or how it is accomplished. That we succeed as well as we do is a tribute, not to our knowledge of the teaching-learning process, but to the unbelievable force and tenacity of the young human intellect. In the plainest English, I believe that we educators labor along, doing the best we can, with only a little more insight into the nature of learning than our ancestors had a millenium ago.

However, there are teachers and researchers in far corners of the field whose observations of the learning phenomenon provide a glimmer of light. These people are widely scattered and, taken individually, cause scarcely a ripple of interest among educators because their separate observations affect only tiny parts of our total educational structure. But when one looks at them together--roughly pooling their evidence and regarding all of it as a partial

manifestation of a unified though yet incomplete picture of learning--one is led toward the kind of speculation I should like to share with you.

Jean Piaget, the Swiss biologist-sociologist-mathematician-philosopher, has for thirty years been reporting the learning behavior of individual children under his clinical observation. His technique has been to observe and test and interact with the same children from the very first weeks of their lives until they reach adulthood. Out of these continuing observations, he has built--with many false starts and revisions--a theory of learning which still has some thin spots but which appears to account for more of the normally observed attributes of learning than any other theoretical model of learning advanced to date. That is, Piaget may have come closer than anyone to construction of a universal theory. Whether the whole theory will in fact stand up is not an important question here, but one or two substantial elements of it seem to me to be as important to the history of civilization as Einstein's early theoretical developments on the structure of matter.

First, Piaget hypothesizes that almost all human beings are born with approximately the same set of biologically inherited reflexes. Except for the unfortunate few who are biologically deficient (have reflexes missing) or who suffer injury in the processes of gestation and birth, everybody starts life with about the same set of reflexes. Second, Piaget hypothesizes that all intellect (intelligence, we call it) grows out of the interactions between this original set of reflexes and the environment that surrounds the individual; in other words, Piaget proposes that intellect is not inherited but generated--actually created--by means of a constantly enlarging complex of actions and reactions that start with a "standard set" of reflexes when an infant is first born. Third, Piaget hypothesizes an invariant sequence of learning activities through which the developing intellect grows--stages of development which appear to have an unchanging order, even though different children reach them at different times and proceed through them at different rates. From Piaget, then, we get some intimations that intelligence may be generated wholly out of human experience rather than inherited, and that its development may follow a sequence of stages through which we all pass. The intimations from Piaget are the first provocation to speculation. There are others.

O. K. Moore of Yale allows children two and three years of age to teach themselves to read and write and spell by turning them loose in a rich opportunity to learn. The learning phenomena he observes and reports are so clearly manifestations of the Piaget hypothesis that they are startling. The Moore technique needs to be seen to be believed (it's on motion picture film for unbelievers). At the outset he just turns a toddler loose in a small room

that contains an electric typewriter and a human or electronic prompter. The child, with his natural inclination to touch things, soon touches one of the typewriter keys. Up flies an arm with a clear click and prints "G" (or some other letter) on the paper and a voice says "G." The child does it again, or touches another key; each time the machine prints the letter and the prompter says the letter aloud. Nothing more. No "let's do this instead," or "that's wrong," or "now try the letter F." When the child's interest wanes he wanders away and does not come back until the next day. Never directing or suggesting or correcting--at least, not so the child is aware of it--this process of reacting positively to the child's own interest and action (his expanding intellect) goes on until he has learned the feel and sight and sound of letters, then words, then sentences. No failures, no tensions, no gold stars--just an environment rich enough and responsive enough to a three-year-old to let him teach himself to read. (One can't help but feel sympathy for the kindergarten teacher on that day when a whole troop of new kids show up who can not only read and write and spell but also <u>type</u>!)

Sylvia Ashton-Warner, teaching at the primary level in mixed classes of English and Maori children in New Zealand, found the Maori youngsters severely handicapped in learning to read with the printed primers available. When the individual children were permitted to choose words they wanted to learn (some of which a publisher would consider unprintable), they happily fell into the scheme of learning to read and spell and write one new word a day until they themselves had constructed a Maori primer. Other Maori kids learn to read in this child-made primer as quickly as the English youngsters with their down-under version of Dick and Jane. Again, the observed learning behavior fits the Piaget model.

Jerome Bruner and Martin Deutsch, working independently with culturally deprived children, find--as all others have found--that children from slum homes earn substantially lower scores on all kinds of intelligence tests than do children from middle class and favored homes. This has been a common observation and the difference has been attributed at least in part to the "culture-loading" of the tests. But have you heard that these same culturally deprived children time and again have earned higher intelligence test scores when they were <u>paid</u> to take the tests? Money rewards for higher scores put the test-taking situation into a context that was familiar. Another fit with Piaget.

The intimations accumulate. You can think of many more: Robert Davis teaching fractions to second-graders, Max Beberman easily teaching the calculus to sixth-graders, and so on. But these few--Piaget's from Switzerland and France, Moore's from New

England, Ashton-Warner's from New Zealand, Bruner's from the slums of New York--offer beguiling peeks into what may be the true nature of learning. And they invite speculations. So here goes ....

Suppose that Piaget's theoretical model stands up pretty well in further research during the next twenty years; suppose that its major elements are proved out in approximately their present form. What then?

Then intellect may be recognized as a power which is generated through interaction of the individual and an appropriate environment in an appropriate sequence. Every child, except those biologically or psychologically crippled, may be seen as originally capable of intellectual development to infinity minus one. And if this be the case, why should we not step in with our educational institutions at that point in the child's life when the intellect begins to form and take enduring shape--when he is a new born infant? Why should we struggle with only partial success to educate youngsters whose intellectual characteristics have been largely determined, by chance, before we ever see them in school? If O. K. Moore can have run-of-the-mill three-year-olds learn to read by giving them appropriate opportunities one hour a day .... if Sylvia Ashton-Warner can at one cut release Maori children from reading handicaps that appear to be the teacher's rather than the children's .... isn't there some reason to believe that we are approaching a break in the curtain through which we have been groping for children's minds for centuries?

I am ready to accept Piaget's propositions as working hypotheses, but I think that more hard research is needed on the elements of the Piaget model before we can justify an alteration of our educational system. We just do not know enough of the specifics of either the environmental content or the sequence of interactions to be able now to institutionalize the technique and put it to work. But Piaget and others have unearthed enough parts of the whole structure of developing intellect to convince at least a few members of the fraternity of research that such a structure does exist and that it does have the general shape and dimensions that Piaget has hypothesized. In this, the psychologists and educators who listen seriously to the Swiss are like anthropologists who have described the general nature of an ancient civilization on the basis of artifacts dug up at one site; there is a lot more digging to be done before the details can be filled in accurately.

For hundreds of years we educators have looked at the six-year-old entering school as if he were a brand new organism, a freshly-sprouted little seedling which we in our school buildings can cultivate into healthy intellectual growth. It is possible that this is an erroneous view. We may be starting the educational process at the wrong time, in the wrong place, using the wrong

methods. Our perceptions of intellect and the nature of its development may be so seriously limited as to reduce by more than half the effectiveness of our efforts. If, instead of starting education with a six-year-old intellect that has been shaped and nourished by chance through a large proportion of its normal development, we could discover the most appropriate methods for encouraging growth in directions we desire--perhaps then we could turn better-developed intellects toward achievements that are beyond our present comprehension.

IF the Piaget theory holds up, IF research effort yields the necessary details of context and sequence, and IF the political institution of education somehow can be modified to put this knowledge to work with all children -- we may witness a cataclysm in human affairs that would make the Crusades, the Renaissance, and the hydrogen bomb look like parlor games. For here would lie the key to nearly infinite intelligence, nearly infinite achievement, nearly infinite wisdom.

If the theory holds and is put to work, Generation 1 (ours or our children's generation) could generate and extend and deepen the intellect of Generation 2 in ways that would permit it to go beyond the intellectual limits of Generation 1. With this increased capacity, and with the recorded experience of its own training to serve as a guide, Generation 2 would be able to apply better techniques with greater skill to the intellectual development of Generation 3, and so on. The consequences would be accumulative in roughly a geometric ratio, following the chain-reaction pattern used to illustrate the mechanics of an atomic explosion. Only in this case it would be an explosion of <u>intellect</u>.

To complete this particular speculation, it is possible to expect that if one society or nation of human beings were to gain one single generation on all others in this process-through secret development or extraordinary effort--that society in less than one hundred years could have enough of an intellectual advantage over the rest of the world to impose upon all other men the status of worker bees in a hive. I remind you that this is pure speculation--but within the span of your memory and mine a race to the moon was also pure speculation.

To offset some of the fears that such speculations might generate, we should remind ourselves of some of the other forces that serve to dampen and slow the explosion of knowledge in all cultures. On this point, I'd like to quote Lyman Bryson (1):

> "Psychologists, sociologists, and anthropologists for decades have been pointing out general verifiable truths about men and their behavior, and if we had been willing to use the information which they gave us many of our (present) social and political problems would already

have been solved. In growing corn, in curing cancer, in building bridges, and even in winning at games, we want exact knowledge verifiable by sensory experience and based on controlled investigation. In all of these activities we are intelligent enough to act on what we have learned. But in human affairs ... we often prefer to risk our fates on old rules, ancient myths, and seedy traditions."

Education falls within the category of human affairs of which Bryson speaks, so I suppose that as long as all other cultures continue to risk their educational fates on "old rules, ancient myths, and seedy traditions" we are safe enough. But suppose that some other culture (Russian, perhaps, or Chinese?) were to abandon the old rules without notice and push hard in the direction we have hypothesized. What then?

In the event that the connection between these speculations and the theme of this conference--educational testing--appears tenuous to the point of being invisible, let me mention briefly the kinds of impact their fulfillment would have on the work we do:

1. Teachers--educators generally--will lose the rock behind which they hide when students don't learn--"They aren't bright." Teachers then would be in the position of the father who berated his son for bringing home a poor report card. "Just how do you explain those D's and F's?" he demanded. "I don't know," came the reply. "It must be either heredity or environment." Failure to learn might be recognized for what it is--failure to teach.

2. Our present generation of tests of academic ability and achievement will have a new lease on life, for they will be interpreted far more often in the way they should have been interpreted all along--as specialized and highly specific work samples of each student's growing skills, rather than as definers of global and permanent characteristics.

3. Testing will be more often recognized as a part of teaching--rather than apart from it.

4. A whole new universe of exploration and development will open up for measurement specialists: the tasks on which children can demonstrate the developmental phases they have reached in growth on intellect--that is, test content--may seldom be paper-and pencil tasks, but they are likely to be simultaneously testing and teaching devices. Oh, happy day!

And when that day comes, with its new universe of opportunity for educators in our special field of interest, it will behoove us to think and act as teachers rather than as soothsayers or head shrinkers.

One more speculation will complete this paper's set. By means of scientific inquiry, modern man has released and only partially contained four cosmic forces that dominate his life: the force of gravity, the force of electromagnetism, nuclear force, and a "fourth force" not yet fully described but known to exist within the electrically charged particles that compose the atom. We don't know what these forces really are, or where they come from, but we know how to release them--in a world of men whose intellect has not yet been sufficiently released to manage them. And all this has happened to us in a span of years that amounts to no more than one tick in the wheels of time.

It seems to me that if humankind is to live for still another tick of time, we'll have to turn the same kinds of scientific inquiry toward the discovery and release of a fifth cosmic force--the force of intellect. On the basis of intimations already revealed, and in the light of the terrible need pressed in on us by our accomplishments in the physical universe, I believe that we'll do it. Where and how and by whom it will be done is impossible now to predict. But the mysterious urge that makes all living things will to go on living will drive us to it.

For the two reasons I have outlined speculatively--both having to do with survival of free men--I believe that a concentration of scientific inquiry upon the release of human intellect will come in our time. The social customs and habits and assumptions that constitute present educational practice may resist change, but change they will--or simply be lost in a whole new world to which they have little relation.

I believe, as Hemingway did, that "we are in the morning of an epoch."

Reference

1. Bryson, Lyman. An Outline of Man's Knowledge of the Modern World. Garden City, New York: Nelson, Doubleday, 1960, p. 119.