Rituals to Block the Reform of Education

Joseph Agassi
Tel-Aviv University and York University, Toronto

New York University Professor Jerome S. Bruner, an eminent and influential educationist, is the author of numerous papers published in professional journals as well as of several highly successful books. Bruner's slim book titled *The Process of Education* is a most significant work. At the time of its publication (1960), Bruner was a professor of psychology at Harvard University, where he ran the Center for Cognitive Studies. It is an acclaimed classic and was translated into several languages within a few years of its original publication. Though published in 1960, *The Process of Education* is still very prestigious and influential (see, for example, *The Encyclopedia of Informal Education* found at http://www.infed.org/thinkers/bruner.htm).

The Process of Education was the outcome of the historic Woods Hall Conference of 1959 where ideas were chewed by the cleverest activists Bruner could invite in hopes of planning education anew. The conference, headed by Bruner, consisted of thirty-five participants who served as distinguished representatives of lustrous new educational experiments. These representatives included two historians as well as scientists, scholars, and educationists, under the distinguished auspices of the U.S. National Academy of Science. Some of the conference participants greatly assisted Bruner in developing this book through their "on the spot" deliberations. The results of these deliberations were summed up in various reports, selections of which are incorporated in *The Process of Education*.

In this book, Bruner surveyed existing large-scale projects of educational reform in high schools in the United States. He formulated this survey in the manner of a manifesto, though its tone was somewhat more explanatory than declarative. He laid down the line -- concerning topics, directions, and priorities of both teaching and research -- with the confidence that teachers and educationists alike were going to toe the line to quite a significant extent. This, I suppose, is true; but not completely to my liking. The great clarity of its exposition and its brevity, as well as its manifesto-like character, all make the confusions and dilettantism behind it rather obvious. Unfortunately, however, these qualities are shared by too many researchers and teachers of the theory and practice of education -- this being most of its prospective readers. As noted on the back cover of the book, in his review featured in the *New York Herald Tribune*, even such an educational iconoclast as Paul Goodman calls this tepid volume "lovely" and says that "it will be a classic." I hope my laboring the obvious in this instance is excusable.

The preface to the book discusses the planning of curricula by expert scientists with no reference to the traditions of teaching that teachers have developed through generations. There is simply no discussion of the merits and defects of these traditions. It is in the introduction that Bruner presents the problems at hand: what to teach where, and how? And what purpose, what emphasis, what effective techniques should education be provided with? These questions arose because of the increased expansion of academia in the two to three decades following World War II, and the subsequent desire of university teachers to control high school education, as Bruner sees it (3).

To Bruner's credit, it should be noted that though he is a psychologist he is at least critical of that branch of psychology which deals with learning and which was, at the time, as he saw it, too academic ("academic" is more suitable here than "abstract") to connect with the facts of learning in schools (in contrast, psychology, today, does a lot of work in this area). Traditionally, education was split between transmitting general understanding and special techniques, but under the impact of late nineteenth-century psychology it tipped the scale in favor of technique -- only to be soon deserted by psychology

altogether. One may wonder how valid his observations were at the time and, more so, how valid they are now. But this is a separate issue, and at the very least we should acknowledge Bruner's readiness to be critical of the system.

In Chapter One Bruner presents the structural approach, which is hardly more than praise for structures where structures are nothing more than general theories. General theories are applicable to specific cases. They may also first lead to special theories and then to specific applications. General theories may be useful to very clever and advanced students, but what about those who are not? Can the structural approach -- primarily the transmission of general theories -- offer specific help to those who need it without handicapping the rest? These are the questions Bruner raises and discusses in later chapters.

In his Chapter Two, Bruner advocates the structural approach. It comes in answer to the question, "How can this exposure [to materials learned] be made to count in their [the students'] thinking for the rest of their lives?" (11). Now we have no right to influence the thinking of our students for the rest of their lives, except by helping them think critically, for themselves. This is not how Bruner sees things. Neither facts nor techniques, he says, are educationally as important as some familiarity with the most general theories available (18 ff.). They are important for those who will not be specialists, and who will, thus, need only a general outline of the subject, as well as for those who will later become experts: their high-school studies should facilitate their future specialized studies. The trouble is that most teachers cannot convey the general theories. Various committees have now grown like mushrooms to aid them with proper textbooks in this area -- of which Bruner comments that these committees are manned by the very best top dogs. Yet there is not a word about the poor teacher who so desperately depends on the textbook he or she teaches -- desperately since, according to Bruner, their dependence is total. The textbooks on which teachers depend, Bruner points out, are insufficient at best: they need supplementation (20-4). They include no adequate treatment of either learning or research, and the students need both the latest and most general theories and research techniques (32). Who are these students? The prospective amateur or the prospective specialists? Bruner does not provide an answer. This is not a criticism of Bruner but of the system: teaching is for prospective experts. Others will benefit from what goes on as best they can. For my part, this is where the system requires a radical reform.

Experience in the method of discovery, Bruner says, shows that students learn faster and deeper when they are allowed to discover the material for themselves (with the possible exception of mathematics). (21-2). He does not see students as little Emiles, however, who are best left to their own devices in Nature's bosom. The teachers, he says, impart to the students the principles of the field and the method of discovery (23-4). All those who discussed the discovery method -- now much less popular than when this book was written -- seemed to assure its success. This was an error, however; even the best researchers are never assured of success. Einstein and Planck worked for many years with little or no success, even after they were established as great discoverers. Would they have benefited from courses that imparted the discovery method such as the ones Bruner refers to? If yes, let everyone know and teach this method so that science can grow a thousand fold faster. If not, why not? No answer. Perhaps all the fuss I am making is simply about the pretentious title by which writers (including Brunner, of course) refer to this method: "method of discovery" or "discovery method." I wish this were so. Bruner later recognizes only once (and in passing) that teachers are familiar with methods that may yield solutions and help students discover (21, 27).

Let me hasten to add that my complaint is about the ambiguity of Bruner's discussion regarding the discovery method, an ambiguity that is very widespread. I have no intention to belittle all the texts that belong to the discovery method literature, particularly not Robert Lee Morton et al., *Modern Arithmetic Through Discovery* (1963), but I do not pretend to agree with them either. Children learn to count up and

down and in a series of odd and even numbers and more, all before they have the benefit of arithmetic classes. The classes are disastrous, as they introduce pressure to memorize. Extant methods, even the most advanced ones, still fail to help children develop their arithmetic proficiency without pressure and memorizing.

Also in Chapter Two, Bruner states that students who understand a general theory understand more clearly the case(s) it applies to; they remember it better; they can even transfer their development and increase their capacity in other fields. Moreover, learning general theories is something that spreads over various years and affords students opportunities in later classes to re-examine and deepen their understanding of the material learned in earlier classes.

In the new preface to the 1977 edition of the book Bruner reports that he was asked whether six-year-old children can really understand calculus. He dismisses the question: he says, "We can get cross the idea of limits, and that is an honest step en route to grasping a basic idea of the calculus"(x). In a sense this is true. A six-year-old can see how we blacken half of a square and then half of the remainder and so on, but this is far from the teaching of up-to-date basics that Bruner recommends.

Bruner discusses the application of Newton's mechanics to the tides without taking notice of the fact that already Laplace declared it highly unsatisfactory. This is a bit finicky, of course, but it illustrates a broad aspect of the matter. Bruner's chief idea is that the comprehension of any item should be better and come easier if instructors tie it in with some principle. Except that his suggestion to teach both gravity and quanta this way is unworkable. Generally, we hardly ever have principle as general and up-to-date as he wants: unless we teach matters critically and show the shortcomings of principles, the process becomes hopelessly confused.

This is not to deny Bruner's claim that students also learn how to apply scientific methods and thus acquire experience in the method of discovery. Nor is it meant to deny his assertion that all these fringe benefits apply to science as well as to mathematics and even to literature (where the laboratory is replaced by efforts to imitate the style of some important writer). These are very general claims that Bruner makes. They demand examination, and, in particular, they have to be lined up with the demand that scientific method should include the method of criticism, and learning some ideas that are outdated is still very important.

For readers who suspect the above paragraph is a caricature, I invite them to read Chapter Two of Bruner's book and judge for themselves. Other readers may see nothing obviously amiss in what I report. I invite them to re-read the above paragraph and notice the crucial sentence in it: Bruner takes it for granted that even in early high school classes students should not be taught outdated material in its erroneous or even merely misleading form. They may find nothing wrong with this attitude, so let me elaborate a bit on it.

Let us take a concrete example. Since Bruner considers mechanics to offer the best example for his method of structural teaching (teaching by connecting details to principles), let us choose mechanics. By the traditional method, instruction starts with Galileo and proceeds later -- perhaps a year later -- to Newton. This is erroneous or misleading, as we can easily see. Galileo says that all freely falling bodies accelerate equally. This is erroneous if taken literally, or misleading if the word "roughly" is not explicitly inserted into the law. For, as Newton tells us (in his Book III of the 3rd edition of his *Principia*), the acceleration of a freely falling body is smaller the higher it is above the surface of the earth. When we calculate, according to Galileo, the motion of, say, a cannon-ball, we draw vertical lines from its various positions, assuming them to be parallel; vertical lines are sufficiently nearly-parallel for practical purposes, but theoretically they are not, since they meet at the center of the Earth. As Newton's

theory is more up-to-date than Galileo's (yet recognizably less up-to-date than Einstein's), let us take it instead. Newton says that forces act at a distance, whereas Einstein says that they nearly act at a distance traveling as they do with the speed of light. Should ten-year-olds be taught Einstein by teachers who can only do so if they use textbooks prepared by the best brains in the field? Yes, according to Bruner, we should have the best experts write textbooks; in their absence, "schools programs have often dealt inadequately or incorrectly with contemporary knowledge" (3). Perhaps I exaggerate, and perhaps Bruner is inconsistent. I cannot judge. For, elsewhere, he explicitly encourages teachers to make daring hypotheses in class and thus not fear making mistakes (90).

All that Bruner asserts in favor of the structural method would indeed apply most beneficially to any person who can study in accordance with it. Such a person usually belongs to graduate courses as taught in the better universities; but some young students are precocious enough for this method, and to them, quite possibly, all that Bruner says may well apply with some profit. This, however, is not what he means. There is one exception, though. The most advanced theory may become out-of-date, hopefully due to some progress in the field; in which case Bruner will justly say it is erroneous or misleading. Hence, today's discovery is somehow accompanied by the recognition that yesterday's views were somewhat erroneous or somewhat misleading. Students who realize that Newton's theory corrects Galileo's, and that Einstein's theory corrects Newton's, may suspect that Einstein's too need not be the last word. Yet, if they begin with Einstein, we may have on our hand precocious dogmatists.

Brunner's Chapter Three opens with a bold hypothesis. Every subject can be taught to every student in any stage of development, though admittedly it has to be taught superficially at first. What is the content of the hypothesis? One cannot expect readers to know this on the basis of what has been said thus far. One can easily find out, however, upon little reflection, that in one sense of "subject" this allegedly bold hypothesis is trivially true; and in another sense it is trivially false. Bruner says it was amply confirmed; as Sir Karl Popper has shown in detail, all such hypotheses are very easily confirmable -- by the very virtue of their ambiguity. See Popper's *The Logic of Scientific Discovery*, sections 33 and 85. A vague assertion excludes fewer possibilities than a more precise version of it. When we specify more carefully what assertion comprises the principle of a subject that Bruner says every student can learn, the harder it is to avoid meeting with its refutation. The vaguest assertion, then, can only be confirmed, never refuted.

Let us take "subject" to mean a set of problems; physics asks questions concerning weights and temperatures, economics concerning budgets and trade. All students know questions from both physics and economics and some answers -- mistaken or vague -- even before they enter elementary school. They know how much bubble-gum costs, and even its opportunity-cost in terms of ice-cream; they know that daddy can't afford a Cadillac convertible (at least if they have older siblings); they know that toy-cars fall faster than badminton bats and that sufficiently cold weather turns water into ice. They even have a few ideas about genetics and hematology, come to think of it; and they are experts in space science, especially if they like Buzz Lightyear; and they are inevitably a full-fledged criminologist, even though they will not touch criminology in class until college, if ever.

Take the second sense of "subject," then. In this book the words "subject" and "structure" are often used interchangeably. Can we explain the Fermi-Dirac statistics to an average eleven-year-old? No. We can explain to them some of Mendel's genetics, but not up-to-date genetics, Pasteur's ideas, but not the vaguest notion on the latest views concerning the etiology of cancer.

The last two paragraphs, I am afraid, do not represent the views of Bruner, except as caricatures. He always aims at the golden mean (5, 21, 39, 43, 48-51, 54, 61, 64, 69, 71-2, 77, 79, and Chapter 6); he has in mind neither primitive physics nor Einstein, but Newton; neither primitive geometry nor algebraic nor projective nor non-Euclidean nor differential nor multi-dimensional geometry -- but Euclidean

geometry, and a smattering of it at that. That would not matter except for the fact that theories such as Euclid's, which are not up-to-date in the least, fall under Bruner's category of false or misleading ones, as Chapter Two of this volume makes obvious.

Bruner advocates the so-called spiral curriculum: the method of teaching the same subject a few times -- meaning the same theories etc. -- on different levels of detail, precision, etc. This, again, is correct; it is old hat. To be consistent he should object to imprecision as mistaken or misleading -- and there goes the spiral curriculum. So nothing remains of Chapter Three -- except for Brunner's admission (to its credit) that any curriculum may be open to revision; pending further research, of course (54).

Chapter Four advocates intuitive thinking. I have some difficulty in deciding whether I understand Bruner correctly here. The first sentence contrasts the intuitive with the formal. The seventh and eighth paragraphs contrast the intuitive with the analytic. The seventh paragraph describes analytic thinking as explicit, be it inductive or deductive. The eighth describes intuitive thinking as skipping steps, with little or no awareness of the way by which the answer was found -- or even with an erroneous view of that way. In the ninth paragraph intuitive understanding of a given material in class is contrasted with the more traditional forms of deduction and demonstration. In the tenth paragraph three methods are explicitly mentioned -- the analytic, the inductive, and the intuitive.

On a rainy day, having nothing better to do, the reader may list the ambiguities, incongruities, inconsistencies, and cross-purposes, implicit in the above. For example, analytic thinking is once explicit, be it inductive or deductive, and once deductive but not inductive and not intuitive (in disregard for the analyst's intuition). To Bruner's credit, however, one point should be stressed. Chapter Four mentions the existence of problems and the intuitive solutions of some of them.

Bruner adds a warning: intuition has its pitfalls. He stresses that the outcome of any intuition may be false, and can only be proven analytically if it is not. Like a nineteenth-century philosopher, he denies that any scientific theory may sooner or later be shown false or misleading, contrary to his own Chapter Two. To his credit, however, it may be noticed that at least when talking about intuition he recognizes that there is no finality in science -- for a short while, admittedly, as the outcome of intuition awaits its supplementation or overthrow by proof. Nonetheless, happily he does admit that theories within science may lack finality.

How does one train for intuition? Encourage students to guess? Their guesses are too often likely to be false. Guided guessing is one thing Bruner does recommend. So now he comes closer to the so-called method of discovery in teaching. The other is the development not of the cock-sureness of a guesser but the assuredness based on knowledge: the more you know the better you guess: *vide* the doctor's tentative diagnosis (66).

Chapter Five concerns incentives. Bruner prefers the technical term "stimulus," but he does not use it in any technical sense: grades are incentives; in the technical sense of the word a stimulus happens today, not tomorrow. And what constitutes stimuli, then, is not the grade of the morrow, but perhaps the pep talk about them of the day. Ideally, the best incentive is provided by the student's own interest, but it is neither possible nor wise to abolish grades and other external incentives. In his Chapter Three, Bruner says explicitly that the inherent interest of the material at hand is a good incentive and grades are a poor substitute for it. Why, then, does he deem it unwise to avoid the poor substitutes?

Most of the material in this chapter covers broad topics: American traditions, the crisis in the feeling of national security, meritocracy, and the two cultures. Bruner speaks of internal and external motives. The internal motive is the love of learning. The external motive is the struggle for grades and such. Bruner

oddly plays down one important incentive: the profit motive of the individual. This is odd, as the whole book stresses the collective profit motive. Students increase their enthusiasm when they see that what they study has cash value, to use a famous expression of the most famous American philosopher, the pragmatist William James.

Why is it impossible to abolish external incentives like grades and rely on nothing more than students' interest in the material and/or in making a good living? There is good reason why interest in the material is not a sufficient motive and hence, obviously, it invites some supplements. With present-day techniques we cannot arouse students' interest sufficiently. In other words, most of what we teach them is intrinsically dull. But it is useful: national security, jobs in industry, etc. This may turn schools into factories producing technicians and engineers and leave no time for studying the arts, and no need for good teachers in the arts. So we must do something against these risks, says Bruner: we should enlist federal aid for education in the arts, and seek new ways for coping with these risks.

This is disappointing. For four chapters we are assured that Bruner's method is applicable to the arts as well, that students can try to imitate a literary expert's style. Now he says he needs more money for more research before he can help raise the level of the arts and of literature in school.

The final chapter, Chapter Six, deals with teaching aides. These are very good at times, but they do not replace the teacher who must serve as a living example, "a communicator of knowledge" to the budding intellectuals, as a "model of daring," "a model of competence," "an intermediary personal symbol of the educational process," and a figure to identify with (62, 88, 90). Is this so only if the teacher uses the ideas suggested in *The Educational Process*? These are too few. Or is it so even in the run-of-the-mill schools where they are teaching out-of-date material? These are too many. Unfortunately, Bruner admits, some teachers are just terrible. Are there any means of reducing their number? It seems to me Bruner should answer this question in the affirmative. Alas, he does not address it.

A teacher must encourage students to use their intuitions by a personal example, guess, and then occasionally err. One should admit that one has erred. Is this guided discovery or is this guessing after the most up-to-date textbook has been sufficiently mulled over and real discovery is in the air? No answer. At least let us appreciate this: we know now that teachers, those intellectual figures whose knowledge is up-to-date, can still make mistakes (90).

This, then, is a summary and discussion of the content of Bruner's work on how to improve teaching: the most up-to-date and the most general theories should be processed into high school textbooks and taught to students by the discovery method while prompting them to develop their intuition. Prompting them is motivating them; motivating them is arousing their interest; arousing their interest is promising them high grades. The aid of teaching media and movies may be enlisted, but the primary factor is this: we need teachers who can serve as intellectual figures; these are teachers morally noble and intellectually armed with the most up-to-date high school textbooks written by the cleverest people in the land (according to Bruner). Each of these points merits much more research -- urgently. Federal Funds please take notice.

I have called *The Process of Education* dilettante and confused -- but not before observing how distinguished and important it is. I advocate the dialectical method of teaching: raising problems, airing solutions to them, offering criticisms to the solutions, ending up either with the last solution or the last criticism -- depending on the present state of knowledge, and beginning at least in high school, if not earlier.

References

Bruner, Jerome S.
The Process of Education. MA: Harvard UP, 1960, 1977.
Newton, Isaac.
Principia. 1687.
Popper, Karl.
The Logic of Scientific Discovery. 1st English edition. NY: Hutchinson & Co., 1959.