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Teaching People to Think:

Unresolved Dilemma and Instructional Challenge

I. The Problem

This paper is addressed principally to staff members of faculties or colleges of education, and its theme is that, whether lecturing in foundations subjects or in academic course content and methodology, they should attempt to bridge the widening gap between educational theory and research on the one hand and, on the other, the classroom teachers and various other people who help to run school systems.

The political, as well as the educational, climate today is favourable to the spending of vast sums on what American educators, with direct encouragement from Washington, are calling educational research and development on a nation-wide scale. Even the people responsible for the ambitious planning are concerned about the extent to which the results of this research will actually change teaching-learning procedures. The researchers are being urged to involve in their studies as many school people as possible, and to follow up initial studies with evaluation surveys at various later stages—something which has not been a conspicuous feature of doctoral and post-doctoral research in education. The fact remains, however, that until the university people who are responsible for the professional preparation of teachers themselves become identified with this research activity, at least to the extent of interpreting its most significant elements to teachers-in-training and to practising teachers, implementation of research findings will continue to be a tiny fraction of the total activity.

One example of the general situation I have described may be found in the printed proceedings of two conferences on "Productive Thinking in Education" held in 1961 and 1963 under the joint sponsorship of the National Education Association and the Carnegie Corporation of New York. At the second of these meetings, C. W. Taylor called for a large "educational engineering" effort to "build a bridge between research and practice," an effort, he said, "that is largely non-existent in education today."[1] I shall not be arguing here for yet another hierarchy in the

[1]M. J. Aschner and C. E. Bish (eds.), *Productive Thinking in Education* (New York: National Education Association, 1965), p. 246.

school system like Taylor's "educational engineers," but rather for a clarification of our thinking on the main issues in the teaching-learning field, so that teachers and teacher educators will at least know what the problems are, and how far from reliable solutions everyone, including the researchers, remains.

The need for this clarification is illustrated by the ambiguous title of the two NEA conferences. The term "productive" thinking was used to denote ideas associated with both "creative thinking" and "problem solving."[2] Participants at the conference soon disagreed about the precise meanings of *productive* and *creative.* Some preferred *divergent* for people who apparently are thinking for themselves but not turning out something concrete, as an artist or craftsman does, or who are not producing a new idea as a creative thinker presumably does.[3] What the NEA inquiry was actually concerned about, of course, is what educators have always asked themselves: How can we teach people to use what they learn in school (or from books, people, etc.) in everyday living, working, behaving, deciding? That is, *how can we teach them to think for themselves, to acquire the power of independent thought?* The question could be put in another way by a school examiner: *By what evidence shall I be able to select the independent thinkers, the people who have acquired some measure of intellectual excellence?*

Sharing the view of Charles Morgan — "Only a fool thinks of himself as a Modern with a capital M. No one is ever at the head of Time's procession."[4] I propose to initiate a discussion of these and related matters with a backward glance at some of the seminal thinkers in the history of education, in the hope that their insights, interpreted in current terms, will serve to stimulate our own.

II. From Plato to Dewey

Plato and Aristotle both thought it was important to master an extensive body of information about man and his world, but at the same time to acquire intellectual skill in the use or application of this knowledge. *Use* did not mean vocational aptitude in the sense of earning one's living, but rather an ability to make the wise judgments required of a political leader, a senior civil servant, or a member of a respected profession. Plato thought higher mathematics and dialectical reasoning particularly valuable in developing this intellectual skill; indeed, he had a rather mystical view of the process by which a philosopher King would achieve wisdom in practical affairs; namely,

> . . . through discourse of reason and apart from all perceptions of sense to find his way to the very essence of each thing; [so that he] does not desist

[2] *Ibid.,* p. 9.

[3] *Ibid.,* pp. 159f., 274, 295, *et passim.*

[4] Charles Morgan, *The Judge's Story* (London: Macmillan, 1958), p. 37.

> till he apprehends by thought itself the nature of the good in itself [and] arrives at the limit of the intelligible.[5]

Aristotle and his scholastic followers placed more reliance on a thorough grasp of well-organized knowledge in textbook form, and on special training in logical methods of argument. Throughout the middle ages the appropriate examination for determining success or failure was the oral defence of a scholarly thesis, using the approved logical steps and drawing upon the acknowledged authorities. Few questioned the process of education or the system of evaluation, because elitism went generally unchallenged, and there were always enough trained intellectuals around to fill top posts in government, in teaching, and in the church.

It remained for Comenius, over three hundred years ago, to make the first serious attempt to extend schooling to the many rather than to the few, and at the same time to equip them to cope with the additional challenge of his day, posed by what we would call an explosion of scientific knowledge. This Protestant churchman and teacher, member of a persecuted and dispersed sect, clarified the problem in his *Great Didactic* in words that have a contemporary ring:

> . . . do not imagine that we demand an exact or thorough knowledge of all the arts and sciences from all men . . . It is the principles, the causes, and the uses of all the most important things in existence that we wish all men to learn . . . For we must take strong and vigorous measures that no man, in his journey through life, may encounter anything so unknown to him that he cannot pass a sound judgment upon it and turn it to its proper use without serious error.[6]

His practical solution for the problem also strikes a familiar note. He decided he must simplify the reading matter used in schools, try to write textbooks graded in difficulty, and, most important of all, train teachers to relate unfamiliar words and concepts to actual experiences of the pupils conjured up by pictures. Nearly two hundred years later, relieved of the necessity of teaching Latin to children, Pestalozzi revolutionized the teaching of subjects like arithmetic, geography, and nature study by using direct, concrete experiences, wherever possible, to give meaning to a definition or to a system of categorizing ideas. He also developed the technique of the object lesson. However, as happens so often in the history of education, teachers after Pestallozzi practised and extended the technique, but did very little thinking about and experimentation with the theories behind the technique.

Herbart's contribution to a science of teaching was an important advance on Pestalozzi's work, in that he regarded cognition as the basic psychological activity which must be understood if instructional techniques are to be effective. He defined the act of thinking as apperception —

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[5]Robert Ulich (ed.), *Three Thousand Years of Educational Wisdom* (Harvard University Press, 1965), p. 57.

[6]W. M. Keatinge, *Comenius, Johann Amos: The Great Didactic* (London: A. and C. Black, 1907), p. 70.

grasping with the mind — and tried to show how teachers can facilitate the activity by deliberately increasing and enriching idea clusters — connected facts, impressions, ideas — in the learner's consciousness. These idea clusters later seem to be forgotten; they have merely gone into the subconscious until they are recalled for further use. It is the teacher (and eventually the learner for himself) who increases the possibilities for useful recall by constantly establishing links between old and new experiences, vicarious as well as direct. Herbart's analysis, introspective and speculative as it may be, continues to be seminal in current studies of cognition.[7] Jerome Bruner, for example, who emphasizes the value of intuition or educated guessing in teaching, has come no closer than Herbart did to explaining why a scientist's shrewd hunch, or some medical man's brilliant diagnosis, so often emerges from a well-stocked mind, provided the assimilated knowledge has been organized around basic understandings, and is therefore what Bruner would call structured.

Every student of educational history knows how an exclusive interest in Herbart's techniques for lesson-presentation (the four or five formal steps), and an over-emphasis on the teacher's role as a subject scholar and a purveyor of information, have for many people in education killed the living germ of his thought. Much of John Dewey's early work, for instance, was motivated by his reaction to the excesses of the Herbartians between 1880 and 1920. He adapted Froebel's principle of creative self-expression—never successfully demonstrated by him above kindergarten level—to the work of elementary and junior high schools; and with his laboratory school at Chicago and his voluminous writings led a possibly too successful attack on the subject-centred and teacher-dominated classroom. Whatever may be said about the excesses of progressive education, Dewey established at least one truth about pupil learning: *thinking, as distinct from fact assimilation and verbalization, is most likely to occur when the learner makes over, or otherwise uses, knowledge and/or skill in the course of his further learning.*[8]

III. Study and Research in the Past Forty-five Years

Between 1920 and 1966, inquiries into our problem have been roughly of two kinds: first, curriculum analysis and reorganization in the Herbartian tradition; and second, experimental research on learning theory with the object of identifying the intellectual skill which Dewey called reconstruction of experience. An example of the first is the book *Realms of Meaning* by P. H. Phenix; and of the second, the research already re-

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[7]See H. S. Broudy's article "Historic Exemplars of Teaching Method," in N. L. Gage (ed.), *Handbook of Research on Teaching* (Chicago: Rand, McNally, 1963), pp. 36-38.

[8]John Dewey, *Democracy and Education* (New York: MacMillan, paperback edition, 1961), p. 776.

ferred to in reports of the NEA conferences of 1961 and 1963, with the numerous studies they have since spawned.

Phenix postulates the search for meaning as the human motive for learning; he recommends teaching methods which accent inquiry, arouse imagination, and promote growth in meaning as the mind of the learner "actively assimilates and recreates the materials of instruction;" and points to "representative ideas"—that is, seminal and key ideas—as the subject content worthy of emphasis by the school.[9] But nowhere in his book does he help the classroom teacher with the main problem of distinguishing the parroting of knowledge from the ability to use it, or think with it, by supplying an illustration of specific content, taught in a certain way, with the test or examination used to measure the effectiveness of the teaching. And, of course, Phenix is far from being alone in that omission.

The omission is one of the reasons why current curriculum reform in Canada, especially in the humanities, remains in the constructive straitjacket imposed by traditional concepts of a liberal education. The tradition is as old as Plato, but the accents in which it is expressed are still those of Cardinal Newman when he said a century ago that a liberal education is "simply cultivation of the intellect as such, and its object is nothing more than intellectual excellence. . . . [which has the power] to open the mind, to correct it, to refine it, to enable it to know, and to digest, master, rule, and use its knowledge."[10] The difficulty is this: the knowledge referred to is that of the scholar in each academic discipline; his ability to use his knowledge in any vocational sense is taken for granted, and there is the big assumption that the intellectual capacity he has presumably displayed in school and university examinations will transfer to thinking effectively in other areas of life.

Such academic optimism does not take us very far toward a satisfactory description of *thinking* as an aim of teaching and learning in the second half of this century. Fifty years ago, Dewey pointed up the issue clearly when he observed that the error made by Aristotle and many scholastics —I would add Newman—was not in their depreciation of mere technical skill and an accumulation of facts, but in their insistence upon a separation of "significant knowledge" from "practical achievement," and in their conclusion that "the education which is fit for the masses must be a useful or practical education in a sense which opposes useful and practical to nurture of appreciation and liberation of thought."[11]

Many of the cognitive studies which followed the conferences on "productive thinking" seem to me to present, in the main, a striking contrast

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[9]P. H. Phenix, *Realms of Meaning* (McGraw-Hill, 1964), pp. 344, 332f., 322f., 10, 12, *et passim.*

[10]John Henry (Cardinal) Newman, *The Idea of a University* (London: Longmans, Green, 1912), pp. 121, 122.

[11]Dewey, *op. cit.*, pp. 256-7.

between the relative precision of the research instruments employed and the ambiguity of the language used to describe what the instruments presume to measure. Educators had been impressed for too long by scores on IQ tests, because they correlated well with measures of scholastic achievement. What everyone was failing to measure is described in recent studies as "ideational fluency," "divergent thinking," "adaptive flexibility," "originality," "creativity," to name only a few of the expressions used.[12] But the tests devised to isolate and measure this mystery element were usually the same as those which claimed to measure whatever *diverged* from standard features of IQ tests. From that point it was only a step to the conclusion that *divergence* is the hallmark of creativity and originality, and the very essence of what we have been looking for—that is, the antithesis of rote learning and inert ideas. This may explain the tautologies which have crept into the descriptive terms used in many cognition studies, particularly in North America. In a paper which will be cited again, Getzels refers to the superfluous adjective in such expressions as "creative thinking," "innovative problem-solving," "productive thinking," which attempt to describe any thinking procedure involving novelty "in however modest a degree."[13]

More hopeful and useful is the research supporting the conclusion that Guilford has reached: that creativity is not a single ability, that it is not confined to the gifted few, and that a high IQ is unessential for creative performance in non-verbal areas;[14] likewise for Hallman's thesis, that creative potentialities exist in all normal children and that creativity can be taught.[15] This, however, is not to say that test questions on children's opinions which elicit evidence of disagreement with parental or community norms, or of a critical or sceptical attitude, or of a superficial nonconformity, are clear indications of their creative capacity and their ability to think. To maintain this would be to mistake the shadow for the substance in somewhat the same way as Dewey's more literal-minded followers identified the physical externals of pupil-planned projects with activity learning.

A salutary corrective to these pseudo-scientific studies of creativity can be found in the writings of certain English educators who employ a common-sense approach that may dispel some of our confusion. For this purpose I have chosen two men, one an experimental psychologist,[16] and

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[12]W. F. White and R. E. Williams, "Identification of Creativity and the Criterion Problem," *Journal of Secondary Education* 40:6, Oct. 1965, pp. 275-281.

[13]J. W. Getzels, "Creative Thinking, Problem-solving, and Instruction," NSSE *63rd Yearbook, Theories of Learning and Instruction* (University of Chicago Press, 1964), p. 242.

[14]J. P. Guilford, "Creativity in the Secondary School," *Education Digest,* Oct. 1965, or *The High School Journal,* May 1965, pp. 451-8.

[15]R. J. Hallman, "Principles of Creative Teaching," *Educational Theory* 15:4, Oct. 1965, pp. 305-16.

[16]Suggested by J. G. Woodsworth's paper, "Some Theoretical Bases for a Psychology of Instruction," *Canadian Education and Research Digest* 5:1, March 1965, pp. 14-26..

the other an analytical philosopher, both of whom look on thinking as a skill to be learned, particularly in school.

In 1948 Sir Frederick Bartlett of the University of Cambridge gave a series of popular lecture demonstrations on the workings of the mind which were published three years later.[17] The theories expounded then were more fully stated and illustrated in a book published in 1958.[18] Both books start from the position that the way men think now is the result of a very long biological development; that thinking is "a complex and high-level kind of skill" with its acknowledged experts (as in other forms of human skill); and that "much of the expertness, though never, perhaps, all of it, has to be acquired by well-informed practice."[19] After performing (with his lecture audience, not with animals) a number of ingenious experiments, Bartlett arrived at this theoretical description of thinking which he also used in his later book:

> For no doubt it will have been noticed that in all our discussions and experiments, whenever the mind comes into operation, most unmistakably it is by filling up gaps that are left in the evidence that has been gained by direct observation.[20]

This view of thinking as gap-filling seems obvious when Bartlett is considering what he calls closed-system thinking, and using experimental designs which require one to find, by interpolation or extrapolation, the unknown term in a series of items that form a recognizable pattern. However, he is at pains to show that the steps by which one attains skill in gap-filling grow out of many prior experiences and contributory skills, such as observing, noting connecting relationships, remembering (which itself involves an organization of experience); but also insight (or intuition) and a kind of wisdom which he thinks complement one another and are the result, not of a lucky guess or hunch, but rather of hard work and an ability to detect clues and to see integrating rules or principles.[21]

Bartlett's experiments and rationalizations lead him to postulate two categories of thinking: the closed-system kind already mentioned; and "adventurous thinking," which is made up of three varieties: (a) the *experimental thinking* of the scientist where gap-filling is subject to empirical controls;[22] (b) the *everyday thinking* of people who, without trying to be logical or scientific, make decisions or form opinions, usually by trying to fill up gaps in the information previously available to them;[23] and (c) the *artist's thinking,* which Bartlett regards as a process distinct

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[17]F. C. Barlett, *The Mind at Work and Play* (Allen and Unwin, 1951).

[18]F. C. Bartlett, *Thinking—An Experimental and Social Study* (Allen and Unwin, 1958).

[19]Bartlett, 1958, *op. cit.*, p. 11.

[20]Bartlett, 1951, *op. cit.*, p. 121.

[21]*Ibid.*, pp. 114-5, 123-4, 128, 136-41, *et passim.*

[22]Bartlett, 1958, *op. cit.*, pp. 160-63.

[23]*Ibid.*, p. 164f.

from the others. He says that the artist adds to successive stages in the mastery of his craft, involving both intellect and technique, a drive towards achieving a standard of work which he conceptualizes but has not yet reached.[24]

What I find reassuring about Bartlett's work is his success in finding, and his persistence in looking for, empirical support of the common sense view that thinking has both creative and non-creative aspects; and that *creative* normally implies making something that bears marks of individuality, of uniqueness. D. E. Berlyne, now of the Univerity of Toronto, supports Bartlett's position. "To be creative," he says, "a product of a thought process must be initially improbable and hence unpredictable." He stresses the importance of examining more thoroughly than has yet been done the cognition behaviour of ordinary men, those who do "reproductive thinking," as well as the thinking of the rare genius.[25] A good place to begin, it would seem, is with those who make a profession of clarifying difficult concepts in teaching and learning. Here the Oxford philosopher, Gilbert Ryle, is an acknowledged leader.

Ryle refuses to postulate any metaphysical theory of mind, any "ghost in the machine." He regards as a muddying of the waters of understanding the employment of descriptive terms like inferring, judging, concluding, rational faculty, flash of insight. His concern is with "intellectual operations." "What distinguishes sensible from silly operations," he remarks, "is not their parentage but their procedure . . . in intellectual as in practical performance." It is not important if we fail to give "a hard-edged definition of 'intellect' and 'thought'," since such analytical descriptions are as likely to be wrong today as were the terms used by the old faculty psychology. Instead, he suggests the simple term *schooling* for all intellectual powers when viewed in the context of performance, commenting that they are "developed by set lessons and tested by set examinations." In short, Ryle defines the intellectual as the well-schooled man.[26]

Unlike many educational theorists, Ryle takes some account of the work that school teachers actually do. He accepts, for instance, the need for drill-type lessons, a kind of conditioning (as in learning how to pronounce words in a foreign tongue); but he distinguishes these from what he calls training lessons, which build up intelligent capacities and involve "the stimulation by criticism and example of the pupil's own judgment."[27] He does not despise the traditional assign-learn-recite type of lesson, because he sees the result as more than meaningless repetition. Note this passage, excerpted from several pages of close reasoning and illustration:

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[24]*Ibid.*, pp. 187-195.

[25]D. E. Berlyne, *Structure and Direction in Thinking* (Wiley, 1965), pp. 317-320.

[26]Gilbert Ryle, *The Concept of Mind* (Hutchinson, 1949, Barnes and Noble, 1963), pp. 27, 32, 49, 283-4, 299-300.

[27]*Ibid.*, pp. 42-3.

> Didactic discourse is the vehicle for the transmission of knowledge . . . Didactic talk . . . is meant to better the mind of the recipient. . . . that is, to improve its equipment or strengthen its powers. . . . Teaching is teaching someone to do, which includes to say, things. . . . Now, didactic discourse, like other sorts of lessons, but unlike most of the other sorts of talk, is intended to be remembered, imitated, and rehearsed by the recipient. . . . Learning the imparted lesson is becoming competent, not merely or principally to parrot it, but to do a systematic variety of other things. . . . We learn from these lessons how to say and do things, most of which are not echoes of the words of the lessons.[28]

Ryle also gives examples of intellectual performance which is nonverbal; for instance, playing chess, completing a jigsaw puzzle, untangling wool.[29] His illustrative list of famous intellectuals would include geometricians, physicists, and explorers, as well as historians and theologians. But, whether engaged in the contemplative kind of thinking employed in learning geometry, or in the executive or contructive kind required to do arithmetic and algebra,[30] or in the investigative kind, as when a housewife tries to decide whether a carpet will fit a floor area,[31] the thinker, Ryle seems to insist, must be able to *state* the results of his theorizing. *Saying something*—aloud or in one's head, in words or in other symbols —is "thinking the thought;" moreover, there are levels of difficulty in both the theory-making and the exposition of it, the highest level being found by him in institutions of higher learning:

> Intellectual work has a cultural primacy, since it is the work of those who have received and can give a higher education, education, namely, by didactic discourse. It is what constitutes, or is a *sine qua non* of, culture.[32]

Thus the logic of his argument brings Ryle to the very comforting conclusion, for school people, that we learn to think by the didactic discourse of school work; that the intellectuals are the best products of the schools and universities; and that school and university examinations separate the non-thinkers from the mediocre thinkers, and the latter from the good and the superior.

But surely this is a question-begging conclusion. It makes the assumption that teachers' tests are measures of "intellectual work," and that the assessing process in schools and universities is reliable. Useful as Ryle's book is in clarifying the issues, we cannot stop where he stops. The weakness of his argument is that of nearly all analytical philosophers. They reason inside a web of their own verbal definitions. This criticism has been well put by Wilfred Cantwell Smith, in the context of theology and religion rather than education:

> . . . they have erred, we feel, in working on a foundation principle that words and sentences mean something. In fact, it is only persons who mean some-

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[28] *Ibid.*, pp. 209, 310, 312.
[29] *Ibid.*, pp. 282-3.
[30] *Ibid.*, pp. 305-6.
[31] *Ibid.*, p. 288.
[32] *Ibid.*, pp. 296, 314.

> thing; language is their instrument. Though convenient enough for certain everyday purposes, it is ultimately wrong to suppose that a statement can in itself be true or false. It is what the statement means that is true or false. This apparently innocent point becomes enormously important when the same statement means different things to different persons.[33]

In brief, what Ryle takes for granted is the whole reason for our present discontents. We are no more satisfied than Whitehead was fifty years ago with the large-scale examination for school graduation, college entrance, or the winning of a university degree.[34] School teachers know —as do university professors, also, if they take the problem seriously— that we have not succeeded in our testing, and only occasionally in our teaching, in distinguishing reliably between (a) a mindless regurgitation of facts, (b) a thoughtful interpretation of the same facts, and (c) an ability to use and apply learned material, or, again in Whitehead's words, the mastery of the art of the utilization of knowledge. And so we turn, still with hope, to another group of cognition studies which appear to be more conscious of the teaching task—of what the teacher should be doing—than any of those examined so far.

I am referring here to the work of Jerome Bruner of Harvard University which in its beginning was directly influenced by the inquiries of Max Wertheimer, who focussed attention on ways of developing what he called structural insight, structural mastery, and meaningful learning as opposed to the "structurally blind" methods of learning by drill, by external conditioning, by memorizing, or by trial and error.[35] For over ten years now, Bruner and his associates have been developing this hypothesis. An early study of thinking directed special attention to the process of categorizing, and reached this tentative conclusion:

> Any cognitive operation involving grouping and re-grouping of materials into equivalence classes is rendered more comprehensive once one has a better grasp of the nature of categorizing. Judgment, memory, problem-solving, inventive thinking, and aesthetics—plus conventional areas of perception and concept formation—all involve such operations.[36]

Thus, as one commentator has observed, the teaching-learning activity becomes one of selecting, presenting, and learning facts in a context of connections which will enable the pupil to find, predict, or regenerate other details.[37] The language here has obvious Herbartian overtones.

At the present time Bruner seems to see the school's working solution for the knowledge explosion of today in the cultivation of "the art of

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[33]W. C. Smith, *The Meaning and End of Religion* (Macmillan 1962, Mentor Books 1964), pp. 164-5.

[34]A. N. Whitehead, *The Aims of Education and Other Essays* (Macmillan, 1929, Mentor Books, 1958), pp. 16, 17.

[35]Max Wertheimer, *Productive Thinking* (Harper and Row, 1959), pp. 2-3.

[36]J. S. Bruner, J. J. Goodnow, G. A. Austin, *A Study of Thinking* (Wiley 1956/61), pp. 2-3.

[37]M. J. Adler, "Some Educational Implications of the Theories of Jean Piaget and J. S. Bruner," *Canadian Education and Research Digest* 5:1, March 1965, pp. 5-13.

connecting things that are akin, connecting them into the structures that give them significance."[38] He thinks it possible to identify the structure of the various school subjects in sufficient detail and clarity to enable teachers to teach basic principles and understandings successfully, if a beginning is made early (for instance, Euclidian geometry and physics in the primary grades) with a *spiral* development of the curriculum instead of a logical. Basic notions in such fields as geometry and physics "are perfectly accessible to children of seven to ten years of age, provided that they are divorced from their mathematical expression and studied through materials that the child can handle himself." The teaching and learning of these basic notions, or structures, in important subject areas, and not the mastery of facts and techniques, insists Bruner, "is at the centre of the classic problem of transfer." He sees the jump from learning to thinking as a consequence of intuition, the educated guess, even more than of any analytic procedure; but points out that "there are some experiments on learning that indicate the importance of a high degree of mastery of materials in order to operate effectively with them intuitively."[39]

In a recently published book, Bruner comes close to recommending a specific procedure for the improvement of instruction. After noting that we have plenty of maxims about teaching and learning but not the necessary theory of instruction to guide pedagogy, he insists that the development of such a theory must become the principal task of educational psychology, and concern itself with "how to arrange environments to optimize learning according to various criteria—to optimize transfer or retrievability of information, for example." He then suggests that curriculum building should be done (and be constantly evaluated and revised) by teams composed of the scholar, the curriculum maker, the teacher, and the evaluator, who would design assignments and exercises "in conjecture, in ways of inquiry, in problem finding" in such a way as to overcome tendencies to passive rather than active learning by pupils.[40]

There is an interesting unanimity among research psychologists in education at the present time on the need for more study of the teaching task, and presumably less on abstract learning theory. Getzels, for example, reached the conclusion in 1964 that (a) "no single set of principles of instruction for creative thinking and problem-solving can be drawn from present theory and research;" and (b) that it might be advisable for both theorists and researchers to concentrate attention on the practice of the teacher and on the teaching-learning-thinking process as

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[38]J. S. Bruner, "Liberal Education for All Youth," *Education Digest* 31:6, pp. 5-8, or *The Science Teacher*, November 1965, pp. 19-21.

[39]J. S. Bruner, *The Process of Education* (Vintage Books, 1960, pp. 3, 43, 12, 57, *et passim.*

[40]J. S. Bruner, *Toward a Theory of Instruction* (Harvard University Press, 1966), pp. 31, 37-8, 159, 164..

it develops in classrooms.[41] Gage similarly argues that "theories of learning will become more useful in education when they are transferred into theories of teaching."[42] So it is not surprising that the most promising (to the teacher) kind of research on teaching and learning today is taking the form of analyses of what actually takes place when teachers teach.[43]

IV. An Instructional Strategy

Meanwhile, school must be kept and pupils must be taught. The theme of this paper, expressed in the opening paragraph, has been that teacher-educators have the responsibility of bridging *the gap* between research theory and school practice. This can only be done if they are constantly involved in revising curricula, teaching methods, and measuring instruments now employed in the schools and therefore about to be used, and (hopefully) improved, by new teachers. If the findings of theoretical speculation and of educational research are to be applied to the improvement of teaching more quickly and more widely than in the past, an essential operating factor will be an attitude favourable to innovation in our faculties and colleges of education which takes the form, among others, of a continuing dialogue and a working partnership between the so-called foundations lecturers and the subject-methods lecturers.

This paper has tried to show that there is a substantial body of knowledge and insight on which the teacher can draw, supported by experience and logic and, at times, by empirical study; and that there is a surprising amount of agreement on the main objectives of teaching, if not always on the definition of these objectives for purposes of measurement and evaluation. While we wait for guidance from the research on the teaching task that is now under way, it should be possible to formulate tentative conclusions from our survey that may be helpful to those actually engaged in curriculum making and in the improvement of day-to-day instruction.

The following statements are an attempt to summarize the conclusions of philosophers in the past and of research studies in recent years as I have presumed to select them for the light they shed upon the school's main task: *teaching people to think.*

1. The instructional goal of the school is the development of mature persons capable of thinking for themselves and of continued self-teaching. The goal is real but always out of reach, being simply, but profoundly, *wisdom:* the ability to make the right decision in personal and social affairs.

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[41] Getzels, *op. cit.*, pp. 265, 266-7.

[42] N. L. Gage, "Theories of Teaching," *NSSE 63rd Yearbook, Theories of Learning and Instruction* (University of Chicago Press, 1964), p. 284.

[43] See B. J. Biddle and W. J. Ellena (eds.), *Contemporary Research on Teacher Effectiveness* (Holt, Rinehart, Winston, 1964).

2. To acquire a measure of wisdom in this sense, one needs both knowledge and intellectual skill in the utilization of knowledge. The acquisition of knowledge and intellectual power is one process, the process of thinking.

Figure A

A Paradigm of Thinking—A process of schooling which involves the acquisition of knowledge and skill in one or more of three areas

Levels	I *Saying* Communicating in words—the humanities curriculum	II *Doing* Executing, planning, or problem-solving as in mathematics and science	III *Making* Producing something, as in arts and crafts, creative writing, musical composition, applied science and technology
Level 1: Grades 3-4	Basic skills of speaking, reading, writing —memory training— reproduction of simple stories	Basic skills of counting, noting differences in size and quantity—learning basic concepts with concrete materials	Manipulative skills —free expression with clay, paint, and other materials; also in speech, dance, etc.
Level 2: Grades 6-7	Reading for main ideas and details— vocabulary building —recall of facts by categorization—class recitation with individual interpretation and questions	Solving problems by known or taught procedures, but with encouragement of intelligent guessing	Making or doing things to specifications—recognizing degrees of excellence in workmanship or design—more free expression, but controlled by plan or purpose
Level 3: Grades 9-10	Further development of reading and communicating skills— practice in defining, explaining, arguing —distinguishing facts from opinions—more work on categorizing—simple paraphrasing	Extension of knowledge and skills— improvisation in the solution of problems —individual research encouraged	Further development of knowledge and skill in the appreciation and production of good work— practice in expressing such ideas verbally or symbolically
Level 4: Grades 12-13	Critical reading and formal reasoning— drawing inferences and forming judgments—applying or using facts or principles recalled from reading— paraphrasing, condensing, expanding complex selections of prose and poetry —panel discussions and debates	Practice in forming and testing hypotheses—solving problems by methods not taught	Translating an idea, a theme, a unified scheme into a finished piece of work
Level 5: Grades 15-16	Previous activities at higher levels of complexity and abstraction—evolving "original" ideas or theories—forming and defending principles	Ability (a) to express oneself in symbolic language, and (b) to innovate in planning or problem-solving	Ability to compose an original work at a high level of abstraction and/or to explain its meaning or use

3. The thinking process is creative in the sense of producing something new—that is, new to the thinker if not always to others; but it is also non-creative or reproductive. It has several manifestations rather than just one; every normal person can be taught, or teach himself, to think in one or more of these ways, and in greater or lesser degree.

4. The school, society's formal agency for training people to think, provides opportunities for practising intellectual operations by deciding what essential knowledge and skills must be acquired at various stages from primary to higher (or further) education.

5. What the classroom teacher needs most from theory and research is concrete help in the task (a) of distinguishing intellectual performance from conditioned responses, (b) of selecting materials and assignments which will develop intellectual power or the art of utilizing knowledge, and (c) of devising valid and reliable measurements of this intellectual power in action.

Figure A on page 27 is an attempt to illustrate these five statements. The reader will notice that three kinds of thinking are isolated for examination: saying, doing, and making; but of these the first is of course basic to the others, since, as Ryle has insisted, commmunication of thought is essential to human and social progress, and every act of thought should be capable of clear statement even if, as in higher mathematics, symbols other than words may be needed for complete accuracy. (Bruner has an interesting observation in support of Ryle's position.)[44] However, the inference of the tabulation in Figure A is that all three kinds of thinking should have parity of esteem in school work, and the scholastic success, including eligibility for free access to further education, should be judged by competency tests in one of the three areas only, not in all three or in the first two only. The reference here is not to basic literacy, which might be defined as competence at the second of the five levels shown in the first two areas of thinking. The five levels of development are intended to suggest the need for competency tests at the end of each period, with emphasis on the knowledge and associated intellectual skills mentioned. These tests or measurements would be (a) objective, or semi-objective when not standardized; and (b) subjective, in the sense that they would represent an informed teacher's appraisal, or estimate. The reader who has come this far needs no reminder that I regard the construction of satisfactory measures of intellectual power—the capacity to use knowledge and to learn by oneself—as the central problem confronting the school and teacher education today.

The curriculum details given in Figure A will seem wholly inadequate to teachers of individual subjects. While my choice of illustrations is tentative and lacking in authority, especially in the "doing" and "making" divisions, it will, I hope, serve to show (a) that there are important tasks

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[44]J. S. Bruner, 1966, *op. cit.*, p. 109.

to be done in teaching the humanities that are common to instruction in several subjects—that is, to teachers of history, geography, and any subject using reading matter and oral or written communication, as well as to teachers of reading, literature, and composition; and (b) that practical and technical subjects are of equal importance with the so-called cultural subjects in accomplishing the school's main task. Bloom, in reporting and commenting on research findings which support this view, points out that most measurements of school achievement are heavily weighted with the verbal ability component, presumably because so much of the learning process is mediated by words. He suggests that "other media of communication must be understood and utilized if the other talents and abilities students develop or possess are to be utilized," and cites two bits of research which indicate the possibility of developing instruments for selecting students gifted in art, music, creative writing, creative dramatics, creative dance, social leadership, and mechanical ability, as distinct from the abilities measured by general tests of intelligence. He then poses a shrewd question: "Can the learning process be different for the verbally able, the numerically able, and the spatially able?[45]

Certainly we would seem to be on secure ground in assuming that intellectual activity is everywhere the same. Whether working with words, clay, or pigments, with mathematical symbols, musical symbols, or construction materials, a student is thinking when he has to make a personal decision; to extract, or to apply, or to construct his own interpretation of a bit of life. He cannot do this, or is unlikely to do so with growing confidence and increasing success, unless he is schooled in the knowledge and skills basic to his particular discipline. The problem for the teacher is how, in Whitehead's words, "to make the pupil see the wood by means of the trees;"[46] that is, to decide how much detailed knowledge must be absorbed, how much skill and technique acquired, before structure can be grasped, insight sparked, invention stimulated, and innovating ideas initiated.

Just as crucial is the problem of devising tests and measurements of both achievement and potential which will reliably measure the former without stifling the latter. For example, how does the teacher of history measure the ability to distinguish fact from opinion, to make intelligent interpretations of historical events as distinct from literal reproductions of teacher and textbook statements, or simply to get the meaning from historical materials and to apply ideas from the past to an intelligent commentary upon current events? The answer is not likely to be found in detailed survey courses which "cover" the ancient world, the middle ages, or modern times, with their inevitable accompaniment of tests that are

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[45]B. S. Bloom, "Testing Cognitive Ability and Achievement" in N. L. Gage (ed.) *Handbook of Research on Teaching* (Chicago: Rand, McNally, 1963), pp. 384-5.

[46]A. N. Whitehead, *op. cit.*, p. 18..

heavily weighted on the side of accurate reproduction of facts. But, what is the alternative?

Helping teachers to answer such questions in their own subject areas and in a practical manner, but by methods which take some cognizance of educational philosophy, teaching-learning theory, and the insights offered by the history of education, is, it seems to me, the over-riding responsibility of staff members of faculties and colleges of education. In the past two hundred years such a task was brilliantly performed by Herbart and Dewey, with one unfortunate result in each case that their illustrative techniques continued to be used, and misused, while their theories were neglected, or rather, not re-interpreted in the current idiom. If more and more people are educated, as well as trained, to be teachers, and if the teacher educators are more successful than ever before in connecting theory with practice, history need not repeat itself.