The Fallacies of Jerome Bruner's Hypothesis in 'The Process of Education:' A Deweyan Perspective

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ABSTRACT: This article attempts to expose the fallacies of Jerome Bruner's curricular hypothesis in *The Process of Education* through invoking the ideas of John Dewey, and in so doing, questions the uncritical acceptance of Bruner's doctrines by today educators. It examines the underlying assumptions in the hypothesis, focusing on the untenable dualisms between the logical and the psychological, subject matter and method. The central thesis is that the organization and formulation of the subject matter of the school curriculum involves essential psychological and epistemological issues whose neglect and denial would lead to confusion in theories of curriculum and instruction. This thesis carries significant implications for the making of the school curriculum.

RESUME: À travers les idées évoquées de John Dewey, cet article essaie de montrer les erreurs de l'hypothèse exposée par Jérôme Bruner sur La Méthode d'Enseignement et par conséquent, de mettre en évidence les questions que les enseignants d'aujourd'hui se posent sur l'application dangereuse de ses doctrines. Ce papier analyse les suppositions sous-jacentes de l'hypothése, en s'axant sur les ambivalences invraisemblables entre Ie logique et Ie psychologique, que ce soit sur Ie du fond ou que ce soit sur la forme. La thèse pivot porte sur l'organisation et la formulation du thème du programme scolaire, ce qui génère des questions de premier ordre dans les domaines psychologique et épistémologique. Les omettre et les nier conduirait à semer Ie trouble dans les théories du programme et de l'enseignement. Cette thèse entraîne de sérieuses conséquences dans l'élaboration du programme scolaire.

About a half century ago, in his influential book, *The Process of Education,* Jerome Bruner (1960/1996) advanced a controversial *curricular hypothesis* that "any subject can be taught effectively in some

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intellectual honest form to any child at any stage of development" (p. 33). The key to this hypothesis lies in the premise that the structure of an academic discipline can be transformed via various modes of representation. Therefore, the subject matter of the scholar could be adapted into different stages of learning readiness instead of waiting for the learner to exhibit readiness. This hypothesis, together with the hypothetical proposition that "intellectual activity anywhere is the same, whether at the frontier of knowledge or in a third-grade classroom" (p. 14), became the essential underpinning for the two curricular principles serving as the central framework for the United States curriculum reform movement in the 1960s: a) curriculum content should be organized and formulated according to the structures of the disciplines; and b) instructional processes should be developed through the inquiry /discovery activities and modes of the disciplines (Tanner & Tanner, 1980).

The curriculum reform movement has fallen short of living up to its expectations. The movement itself has received severe criticisms (e.g., Hurd, 1970; Jackson, 1983; Stake & Easley, 1970; Tanner, 1971; Tanner & Tanner, 1980; Weiss, 1978). Reasons for the failure include, as pointed out by Hurd and Jackson, the neglect of considering the role of student experience and interest, the inadequate consideration of the importance of readiness for learning, unrealistic assumptions about student motivation and background, the difficulties involved in teaching and learning with inquiry/discovery methods, and the lack of adequate teacher preparation.

In spite of the reform failure and criticisms, however, Bruner's doctrines continue to be an inspiration to many contemporary educators; they are well alive today, although in different forms and languages. Some educators championed the notion of the child as a scientist by contending that there is no qualitative difference in intellectual activities between a professional scientist and a child (e.g., Chaille & Britain, 2002; Karmiloff-Smith, 1988; Holland, Holyoak, Nisbett, & Thagard, 1986). On various occasions eminent educational scholars cited Bruner's curricular hypothesis in support of their new theories or arguments (e.g., Ball, 1993; Brown, 1994; Hirst, 1996; Shulman & Quinlan, 1996). Some scholars seemed to espouse the notion that there is no fundamental difference in substance and practice between a school subject (e.g., mathematics and history) and its corresponding intellectual discipline (e.g., Ball, 1993; Lampert, 1990; Wineburg, 1991a; 1991b).

This is somewhat an irony because Bruner's ideas in that regard had shifted significantly in later years.

This paper attempts to expose the fallacies of Bruner's curricular hypothesis through invoking the ideas of John Dewey, and in so doing, questions the uncritical acceptance of Bruner's doctrines by contemporary scholars and educators. This task can be viewed as a continuation of the work of other researchers – notably Fox (1969), Tanner (1971), Tanner & Tanner (1980) – who have examined some of the doctrines of Bruner from a Deweyan perspective. Through contrasting the assumptions about knowledge, the knower, and knowing between Bruner and Dewey, Fox showed that Bruner and Dewey are significantly different in their philosophies of education, reflecting their differing views on epistemology and psychology. Tanner and Tanner (1980) examined Bruner's two curricular principles and hypothetical proposition, with a view to comparing them with the ideas of Dewey. They argued, among other things, that Bruner's curricular principle yields a "distorted" notion of knowledge that ignores how the subject matter was first discovered and formulated. Furthermore, Bruner's hypothetical proposition, Tanner (1971) argued, contradicts the thesis of progressive intellectual development established by scholars such as Dewey and Piaget – a thesis that testifies to the essential difference in intellectual activities between a child and a professional scientist. However, none of the authors cited had examined Bruner's curricular hypothesis.

The main theoretical perspective employed in this article is Dewey's logical-psychological distinction articulated in his 1897 essay "The Psychological Aspect of the School Curriculum" which is in effect a criticism in advance of Bruner's hypothesis. This article will start with an examination of underlying assumptions in Bruner's curricular hypothesis, focusing on two dualisms – the dualism between the logical and the psychological, subject matter and method – which are fundamentally untenable from the perspective of Dewey. What follows will be a discussion of Dewey's logical-psychological distinction which reveals certain psychological issues essential for the organization and formulation of the subject matter of the school curriculum, yet largely ignored by Bruner. Afterward, the article will further question Bruner's hypothesis in the light of Dewey's principle of continuity of experience and Harré's epistemology of science.

The central thesis of this article is that the organization and formulation of the subject matter of the school curriculum involves

essential psychological and epistemological issues whose neglect and denial would lead to confusion in theories of curriculum and instruction. This thesis carries important implications for the making of the school curriculum.

Two Untenable Dualisms

Bruner's hypothesis first appeared in *The Process of Education* (1960) and was elaborated upon further in his two books, *On Knowing: Essays for the Left Hand* (1962) and, *Toward a Theory of Instruction* (1966). The hypothesis is embedded in a set of assumptions about the nature of knowledge, curriculum, and instruction which entails the untenable dualisms between the logical and the psychological, subject matter and method.

What is knowledge? According to Bruner?

> Knowledge is a model we construct to give meaning and structure to regularities in experience. The organizing ideas of any body of knowledge are inventions of rendering experience economical and connected. We invent concepts such as force in physics, the bond in chemistry, motives in psychology, style in literature as means to the end of comprehension. (Bruner, 1962, p. 120)

By this statement, Bruner means that there is a certain broad conceptual framework consisting of organizing ideas or generative concepts and principles according to which an academic discipline or organized body of knowledge is arranged and formulated. "We" in the above statement refers primarily to the scholar and the scientist who have the "ever deepening insights that are developed on the frontiers of knowledge" (1962, p. 125). The basic conceptual framework is what Bruner calls the "structure of the discipline," the identification of which requires "the most fundamental understanding of that field. It is a task that cannot be carried out without the active participation of the ablest scholars and scientists" (Bruner, 1960/1996, p. 32). Hence, knowledge is clearly confined to the subject matter of the established intellectual disciplines.

From this notion of knowledge Bruner's curricular principle follows: The subject matter of the school curriculum is organized and formulated according to the structures of the disciplines, regardless of who the learner is. For Bruner, there is no essential difference between the subject matter of the child and the subject matter of the intellectual disciplines, since "intellectual activity anywhere is the same, whether at the frontier of knowledge or in a third-grade classroom" (1960/1996, p.

14). The structures of the disciplines serve as the point of departure for the school curriculum, as well as the criterion of its content and organization.

Dewey would agree with the notion of knowledge as human construction of experience and acknowledge the role of generating concepts or ideas in organizing human experience. For Dewey (1916/1966b), knowledge not only consists of facts and principles – it is a special kind of human experience associated with special modes of insights, ways of thinking, and disposition of mind. "There is no mistake more common in schools than ignoring the self-propelling power of an idea" (1933/1986, p. 341). However, he would have serious trouble with Bruner's confining knowledge to the subject matter of the established academic disciplines – subject matter that had been hammered out through centuries of experience and separated from the actual process through which it was discovered and formulated. For Dewey (1916/1966b), knowledge is eventfulness of experience. Knowledge and ideas emerge only from situations in which the learners had to draw them out of experiences that had meaning and importance to them. In addition, the notion of knowledge has no meaning apart from a simultaneous consideration of its process of inquiry. Dewey wrote:

> Any thing that may be called knowledge, or a known object, marks a question answered, a difficulty disposed of, a confusion cleared up, an inconsistency reduced to coherence. Without reference to this mediating element, what is called knowledge is but direct and unswerving action or else a possessive enjoyment. (1929, p. 227)

Accordingly, Dewey would challenge Bruner's curricular principle by pointing out the unbridgeable gap between the subject matter of the intellectual discipline and the experiential world of the child. As he pointed out, the subject matter of the disciplines represents the "product ... of the science of the ages, not the experience of the child" (1902/1990, p. 185). It is "a stumbling block" for the immature learner because of its remoteness from the experience of the learner and its separation from the actual process of inquiry and formulation (1916/1966b). Bruner's curricular principle, therefore, entails the dualism between the logical and the psychological which is, as it were, an essential conflict between "certain social aims, meanings, values incarnate in the matured experience of the adult" and "an immature, undeveloped being" (Dewey, 1902/1990, p. 182).

How would Bruner respond to the above criticism? I think he would probably argue that the school curriculum, with the proper emphasis on

the structures of the disciplines, entails the necessity of breaking with the immediate experience of children. As he indicated, the significance of many organizing ideas of the academic discipline – for example, the concept of commutativity in mathematics – does not derive from the immediate experience of school students, and yet these ideas provide a way of thinking about experience that is immensely generative and powerful. Progress toward abstraction and understanding of these ideas involves "a weaning away from the obviousness of superficial experience" (Bruner, 1962/1979, p. 121). With various representational modes, these ideas are translatable into the individual lives of students. Likewise, he would point out that the organization and formulation of subject matter in relation to the immediate experience of the learner as advocated by Dewey, however, makes it very difficult for the learner to learn generative and powerful ideas.

Dewey, I think, would have no objection whatsoever to the need for breaking with the immediate experience in learning powerful ideas or concepts, and even had something similar in mind when he said, "the subject matter of the curriculum involves an organization and formulation which must go far beyond the actual experience of the child" (1899/1966a, p. 126). He also indicated that formal education "opens a way to a kind of experience which would not be accessible to the young, if they were left to pick up their training in informal association with others, since books and symbols of knowledge are mastered" (1916/1966b, p. 8). However, on the other hand, Dewey emphasized education as a *continuous* process of reconstruction of experience. It starts with the present experience of the learner, which is viewed as "an intellectual starting point for moving out into the unknown, not [as] an end itself" (p. 212). Furthermore, education involves "the progressive development of what is already experienced into a fuller and richer and also more organized form" (1938/1997, p. 74). Therefore, learning powerful concepts or ideas is "possible without departing from the organic connection with experience" (p. 74). He would have trouble with Bruner's notion of the translation of ideas or concepts into the lives of students. Without an organic connection with the present experience of students, the translation would not be educative and genuine because of "the problem of discovering ways and means of bringing them [ideas or concepts] within experience" (p. 73). These arguments and counter-arguments will be discussed further in the penultimate section, with reference to Dewey's principle of continuity of experience.

The second dualism, the one between subject matter and method, is inherent in Bruner's theory of instruction which was further articulated in his book *Toward a Theory of Instruction* (1966). His theory of instruction is premised in the curricular principle endorsing the supremacy of the structures of the disciplines in determining the school curriculum, in support of his curricular hypothesis.

At the heart of his theory is *method* concerning ways of *representing* and *sequencing* th subject matter so as to fit the thinking characteristics of the learner. According to Bruner, one can make the subject matter accessible to the learner through three modes of representation in accordance with the stages or steps in the intellectual development of the child, the *enactive,* the *iconic,* and the *symbolic:*

> Any domain of knowledge (or any problem within that domain of knowledge) can be represented in three ways: by a set of actions appropriate for achieving a certain result (enactive representation); by a set of summary images or graphics that stand for a concept without defining it fully (iconic representation); and by a set of symbolic or logical propositions drawn from a symbolic system that is governed by rules or laws for forming and transforming propositions (symbolic representation). (Bruner, 1966, pp. 44-45)

Furthermore, the subject matter needs to be taught through a particular sequence involving "statements and restatements of a problem or body of knowledge that increase the learner's ability to grasp, transform, and transfer what he is learning" (p. 49). The optimum sequence is likely to be the one moving from enactive through iconic to symbolic representation, in accordance with the general process of intellectual development of children. Subject matter and method (pedagogical representations and instructional sequences) are largely separate and independent.

At this point one might take issue with me by pointing out the link between subject matter and method implied in Bruner's theory. As Shulman and Quinlan (1996) would argue, in contrast to mainstream theories which are generic in nature, independent of any particular subject matter, Bruner's theory of instruction is subject matter specific, entailing the need to analyze the subject matter in terms of what key ideas constitute the structure of that subject matter, prior to the identification of pedagogical representations and instructional sequences. The pedagogical representations and instructional sequences, in turn, serve as the embodiments of the key ideas to be taught. In this sense, subject matter and method are connected together.

This connection, I argue, is inorganic and superficial from the perspective of Dewey. Bruner's theory falls well short of relating subject matter to method in any intrinsic way. The key problem, again, lies in his presupposition that the subject matter of the learner is defined, selected, and arranged according to the logical structures of the intellectual disciplines, without sufficient reference to the psychological considerations of the immature learner. As already mentioned, only the scholar and scientist are entitled to determine what ideas constitute the structure of the subject matter. Likewise, it is the task of the psychologist to "help invent ways of expressing the ideas so as better to fit the needs of a learner" (Bruner, 1966, p. 155). In other words, subject matter is something which could be settled on a purely external logical basis; method is primarily a psychological matter. As a result, the subject matter of the curriculum is something ready-made, something that "exist in an independent and external way, without organic relation to the methods and functions of mind" (Dewey, 1897/1972, p. 165). Method, on the other hand, is something supposedly identified primarily based upon the mental characteristics of the learner, consisting of merely pedagogical representations and instructional sequences that can be brought to bear upon an independent, external subject matter.

The above separation of subject matter and method, according to Dewey (1916/1966b), is "radically false." Subject matter and method are distinguishable for the purpose of analysis, but inseparable in action. For one thing, method involves an arrangement or an effective treatment of subject matter for achieving a desired aim. For another, subject matter is an embodiment of method because it implies ways of arranging and formulating that subject matter. This intrinsic connection of subject matter and method will be further elucidated in the next section.

So far I have discussed two dualisms inherent in Bruner's hypothesis. Analyzing the two dualisms brings to light Bruner's problematic assumptions about the subject matter of the school curriculum and the method of instruction. I shall now turn to examine Dewey's famous distinction between the logical and the psychological. The examination will highlight certain issues concerning subject matter of the school curriculum which are rather significant yet largely ignored in Bruner's theory of curriculum and instruction.

The Logical and the Psychological

In Dewey's (1897/1972) article "The Psychological Aspect of the School Curriculum," the distinction between the logical and the psychological arises in his examination of the taken-for-granted dualistic presupposition which views the subject matter of the learner as being determined by the social and logical considerations, without reference to the psychological considerations of the child – method, on the other hand, by the psychological considerations, without reference to the subject matter concerned. It is interesting to see that this presupposition is indeed inherent in Bruner's curricular hypothesis, evident in his assumptions about curriculum and instruction already discussed above. With a view to show that "psychological considerations ... enter not only into the discussion of method, but also into that of subject matter" (p. 166), Dewey drew a distinction between a study as a "logical whole" and the same study as a "psychological whole:"

> We must take into account the distinction between a study as a logical whole and the same study considered as a psychological whole. From the logical standpoint, the study is the body or system offacts which are regarded as valid, and which are held together by certain internal principles of relation and explanation. The logical standpoint assumes the facts to be already discovered, already sorted out, classified, and systematized. It deals with the subject-matter upon the objective standpoint. Its only concern is whether the facts are really facts, and whether the theories of explanation and interpretation used will hold water. From the psychological standpoint, we are concerned with the study as a mode or form of living individual experience. Geography is not only a set of facts and principles, which may be classified and discussed by themselves; it is also a way in which some actual individual feels and thinks the world. It must be the latter before it can become the former. (p. 168)

This distinction brings to light the issue of whether the organization and formulation of the subject matter of the school curriculum regarding a particular subject (e.g., geography) area should be based upon the logical formation of the intellectual discipline or the psychological formation of the same subject. It is in this issue that the parting of the ways between Dewey and Bruner regarding theory of curriculum and instruction is found.

In contrast to Bruner, Dewey believed that it is the psychological, "not the logical" that provides the basis for the organization and formulation of the subject matter of the school curriculum. The logical

only provides a certain guidance and direction in developing the curriculum. The primary concern of education, according to Dewey, is "with the subject as a special mode of personal experience for children, rather than the discipline as a body of wrought-out facts and scientifically tested principles" (Dewey, 1897/1972, p. 169). Using the example of geography, Dewey pointed out that geography to the child is not and cannot be what it is to scholars who write academic papers on geography. "With the child, instruction must take the standpoint not of the accomplished results, but of the crude beginnings" (p. 169).

Therefore, the present experience of the child, rather than the subject matter of the intellectual discipline, provides the starting point for the development of the school curriculum. Teaching geography to the child *presupposes* the need to identify a special kind of geography that begins with the present experience of the child. As Dewey wrote:

> We must discover what there is lying within the child's present sphere of experience [or within the scope of experiences which he can easily get] which deserves to be called geographical. It is not the question of how to teach the child geography, but first of all the question what geography is for the child. (1897/1972, p. 169)

Identifying this special kind of subject matter entails addressing the *psychological question* concerning "How, out of the crude native experience which the child already has, the complete and systematic knowledge of the adult consciousness is gradually and systematically worked out," instead of the *logical question* concerning "What experience the adult has succeeded in getting together during his development from childhood to maturity" (p. 171). The subject matter of the intellectual discipline merely presents the "possibilities of development" inherited in the experience of the child, marking out the consummation of development and growth (Dewey, 1902/1990, p. 190). The subject matter of the school curriculum is selected and organized in connection with the existing experience of the child, following a certain process of growth and development which leads that experience toward the kind represented by the subject matter of the adult or scholar. It must be "differentiated out of that experience in accordance with its own laws" and "grow to include the systematic body of facts which the adult's consciousness already possesses" (1897/1972, pp. 170-171).

When the subject matter of the school curriculum is organized and formulated based upon a psychological basis, method does not need to be some external way of representing and reformulating a ready-made subject matter. "Method is the subject matter in so far as that subject

matter is capable of actual assimilation and incorporation into the experience of the pupil" (Dewey, 1899/1966a, p. 131). Method becomes intrinsically something inherent in the subject matter because the subject matter itself embodies a certain way of organizing, formulating, and guiding the present experience of the child toward a desirable end.

The above assertion can be illustrated by looking at the subject matter of the topic *color* discussed in Deng (2001). In the high school physics curriculum the subject matter of color consists of several basic ideas such as the combination of white light, primary colors, secondary colors, color by reflection, color by transmission, color mixing by subtraction, and color mixing by addition. These ideas, arguably, are selected on a psychological basis because they are within the sphere of experience which students can obtain, and are associated with their interests and curiosity; and they provide students with a foundation for the further study of *optics* at a deeper level. These ideas embody "method" in a sense that they provide the teacher with a scheme of reference for selecting, organizing, or creating experience that is meaningful and educative for students. Likewise, learning these ideas initiates students into a scientific way of describing and interpreting experience which, as a result, empowers them to explain a wide range of phenomena concerning color in their daily living, moving them to develop a more reasoned understanding about the nature of light.

The above basic ideas about color, however, would not make their way into a curriculum which is based upon the logical formation of the intellectual discipline of physics. In general, describing phenomena related to color at the macroscopic level is not the concern of optics at the disciplinary level. The subject matter of optics at this level primarily focuses on building mathematical representations for the propagation of light and its interaction with materials at the microscopic or atomic level, which can stand for contemporary scientific understanding of the behavior of light. This kind of subject matter is far beyond the reach of high school students, in terms of their experience and knowledge backgrounds. As a matter of fact, the above non-mathematical, macroscopic ideas about color were developed by scientists in the 17th and 18th centuries, which only represent historical scientific understanding. These ideas normally do not have a legitimate place in optics at the disciplinary level. The intellectual discipline of physics, Kuhn (1970) argued, only records the final versions of scientific understanding which represent "finished scientific achievements,"

neglecting how these versions were first discovered, and then developed and redeveloped by scientists.

The above discussion brings to light two essential psychological aspects involved in the organization and formulation of the subject matter of the curriculum if we are to make it educative and meaningful for the immature learner. One aspect concerns the experience of the learner as the starting point, and the other concerns the need to follow a certain process of growth and development of experience toward a desired end. The two aspects are apparently overlooked in Bruner's theory of curriculum and instruction. In what follows I will show how these two aspects pose a serious challenge to the Bruner hypothesis.

Continuity of Experience and Progressive Development of Subject Matter

The above two aspects can be viewed as two essential conditions concerning the subject matter of the school curriculum so as to render *educative* experiences for the learner, as required by the principle of continuity of experience. According to Dewey (1938/1997), an educative experience "arouses curiosity, strengthens initiatives, set up desires and purposes that are sufficiently intense to carry a person over a dead place in the future" (p. 38). A mis-educative experience, however, "has the effect of arresting or distorting the growth of further experience" (p. 25). The principle of continuity posits that "every experience both takes up something from those which have gone before and modifies in some way the quality of those which come after" (p. 35). To ensure the continuity of the educative experience, the subject matter of the school curriculum needs to be derived from the scope of the present experience of the learner, and allows a progressive development of what is already learned into a fuller, richer, and more organized form.

Therefore, from Dewey's perspective, in advancing the curricular hypothesis Bruner has not considered the condition concerning the present experience of the learner in determining what can be taught. For any ideas or topics that are outside of range of the present experience of the learner, the teacher would have the "problem of discovering ways and means of bringing them within experience" (Dewey, 1938/1997, p. 73). The failure of making an organic connection with the experience of the learner may cause learning experiences to be mis-educative.

Bruner would probably respond to the above criticism through two counter-arguments. First, a justification of the subject matter of the

school curriculum in terms of its relation to the immediate experience of the child would leave out many basic ideas of the intellectual discipline which are "as simple as they are powerful" and yet do not derive from the immediate experience of the child. For example, *set theory* – which lays a foundation for the understanding of order and number – would not be worth teaching if it had to be justified in terms of its relation to the immediate experience of the child (Bruner, 1962/1979). Second, he would argue further that construing learning readiness in terms of the child's present experience is at best limited, and at worst erroneous, in the light of what has been known about the nature of intellectual development in his day. The child undergoes a sequence of steps in cognitive development in terms of the enactive, the iconic, and the symbolic. By presenting the basic ideas of the intellectual discipline in the form and language which the child can grasp when he or she is in the enactive stage, for example, and again in the iconic, and again in the symbolic, the child gains greater "precision and power" in mastering them. The child moves from a weak and simple grasp of a subject to succeeding stages in which his or her grasp becomes increasingly powerful – perhaps even to the point of the frontier of knowledge (Bruner, 1966). It is here that lies the underpinning of the curricular hypothesis that "any subject can be taught effectively in some intellectual honest form to any child at any stage of development."

With respect to the first counter-argument, I argue that Bruner, with the obsession with the basic ideas within the sphere of the established intellectual disciplines, has systematically overlooked the basic ideas that are near or within the realm of experience of school students and provides a necessary grounding for later learning those sophisticated ideas in the intellectual disciplines. In mathematics, for example, fundamental ideas exist not only in its advanced branches like topology, and probability and statistics, but also in elementary mathematics such as arithmetic and primary geometry which is within the grasp of ordinary elementary school students. As Ma (1999) pointed out, the three basic laws of algebra – communicative, distributive, and associative – are "naturally rooted" in arithmetic within the elementary school curriculum. As for the second possible counter-argument, I contend that Bruner has overlooked the need for a progressive and orderly development of subject matter as required by the continuity of experience. The growth of subject matter in the experience of the learner is developmental, and it begins with familiarity or acquaintance with the physical objects or phenomena "which calls out new powers, while the

exercise of these powers refines and enlarges the content of its experience" (Dewey, 1938/1997, p. 74). The primary form of subject matter, developed through manipulating physical objects and observing phenomena, is gradually enlarged, deepened, and refined through communication and discourse. It eventually leads to the development of what has been acquired into a fuller and richer and more organized form – a form that approximates the subject matter of the scholar (Dewey, 1938/1997). The continuity of experience, thus, requires a progressive order in the selection and organization of the subject matter of the school curriculum: The simpler, more elementary, and less intellectual forms of subject matter come first, and the higher types in their order. This progressive order is *psychological* in a sense that it follows the growth of subject matter in the experience of the learner.

The above argument can be strengthened by looking at the epistemology of science. For the subject matter of science, there is an epistemological sequence, for the validity of a certain level of understanding requires the validity of others. According to Harré (1986), the subject matter of science contains three different types of theories.

Type 1 theory enables classification, explanation, and prediction of observable phenomena. An example of a typical Type 1 theory is *Classical Kinematics.* Different kinds of macroscopic motion can be differentiated by reference to velocity, acceleration, and so on.

Type 2 theory enables representation of a certain kind of unobservable entities which can be made available to human perceptions through scientific experiments and a source analogue. A typical Type 2 theory is *Physical Optics.* By using the electromagnetic model of light as the source analogue, scientists develop representations for the Realm 2 entity, the propagation of light and its interaction with materials at the microscopic or atomic level, which cannot be observed by an unaided observer and yet manifest observable phenomena under certain conditions (e.g., interference fringes).

Type 3 theory enables representation of the kind of mathematical entities which cannot be observed by human beings through abstract mathematical structures. A typical example of a Type 3 theory is *Quantum Field Theory.*

Corresponding with the above three types of scientific theories are three kinds of referents relative to the possibilities of human experience, the ordering of which reflects an ontological continuity and an epistemological progression in the development of scientific discourse. Theories of a lower type are the basis for theories of the next

successively higher type, and therefore, all three types of theories are grounded in the physical world in varying ways. For Type 1 theories, scientists are committed to the existence of observable phenomena. The referents of Type 1 theories belong in *Realm 1*, the realm of actual objects or common-sense experience. The moon, the sun, and tables belong in Realm 1. For Type 2 theories, scientists are committed, not only to the ontology of Realm 1 but also to entities that are available to the amplified human sense through necessary instruments or experiments. The referents of Type 2 theories belong in *Realm 2*, the realm of possible objects of experience. Electromagnetic waves, atoms, and electrons belong in Realm 2. For Type 3 theories, scientists are committed not only to the ontologies of Realm 1 and 2, but also to entities which cannot become phenomena of human observers. The referents of Type 3 theories belong in *Realm 3*, the realm of entities beyond all possible experiences. Quantum states and naked singularies belong in Realm 3.

In short, there is an order of priorities inherent in the subject matter of a particular intellectual discipline of science which is in essence epistemological. The order of epistemological priorities suggests that learning the subject matter of the higher form requires understanding the subject matter of the lower forms. If Harré's theory is correct, as I think it is, it is epistemologically impossible to learn Type 3 theories without learning related Type 1 and 2 theories beforehand, or to learn Type 2 theories without previously learning pertaining Type 1 theories. In other words, no Type 3 ideas, in whichever "intellectually honest form," can be taught to the learner without having him or her understand certain Type 2 and 3 ideas in advance.

Should the organization and formulation of the subject matter of a school curriculum (e.g., physics) follow the epistemological order inherent in the intellectual discipline? Or should it follow the historical process through which the discipline was developed and formulated? In what ways should it follow the psychological progression as required by the continuity of experience? These are very meaningful and complex issues, discussion of which is beyond the purpose and scope of this article. What I attempt to bring to light is that psychological and epistemological issues exercise constraints on pedagogical representations and instructional sequences. Bruner's curricular hypothesis, although inspirational, risks engendering dishonest methods of instruction, because it is out of touch with psychological and epistemological possibilities. Without a proper epistemological (and

psychological) analysis of what is involved in knowing a subject matter, a theory about teaching and learning that subject matter could be misguided and even misleading (Gregg & Leinhardt, 1994).

Conclusion

As revealed in the above analysis, Bruner's curricular hypothesis is inherent in a set of assumptions that entail the untenable dualisms between the logical and the psychological, subject matter and method. Its root problem lies in the presupposition that the organization and formulation of the subject matter of the school curriculum is normatively determined by the logical structures of the established intellectual disciplines, involving neither a psychology nor an epistemology. As a result, in advancing the curricular hypothesis Bruner has not considered adequately the role of the present experience of the learner and the need for a progressive selection and organization of subject matter in the making of the school curriculum.

The analysis so far has focused primarily on psychological and epistemological issues concerning the organization and formulation of the subject matter of the school curriculum. There are, of course, social and political issues which are equally important to curriculum development. For example, one can argue that Bruner's curricular hypothesis and principles are deeply political, because national security was a primary justification for the curriculum reform movement after the successful launch of Sputnik by the Soviet Union in 1957 (DeBoer, 1991). One can also argue that with a focus exclusively on developing the intellectual power of students through emphasizing the structures of the intellectual disciplines, Bruner's theory has overlooked other social responsibilities of schools, such as citizenship and vocational education. Because of space limitations, the article does not discuss these issues in detail.

It is also important to point out that the analysis has not explicitly touched on curriculum syntheses or integration, which was indeed something important in the mind of Dewey (1897/1972) when writing about the psychological aspect of the school curriculum. The curriculum based upon the psychological formation of experience makes it possible for curriculum synthesis or integration, because many school subjects – such as arithmetic, biology, chemistry, and geography – could grow out simultaneously from the present experience of the child. As Dewey wrote:

> Take a square mile of territory, for example; if we view it from one interest, we may have trigonometry; from another standpoint we should label the facts regarding it botany; from still another, geology; from another, mineralogy; from another, geography; from still another standpoint it would become historical material. (p. 169)

On the other hand, the curriculum based upon the logical structures of the discrete disciplines makes curriculum integration very difficult. As Tanner (1971) pointed out, such a curriculum would increase the fragmentation of knowledge and widen the gap between pure knowledge and applied knowledge, and consequently, it diminishes efforts toward integrating the curriculum. The limited space at my disposal precludes any detailed discussion of this issue.

Needless to say, to explode the fallacies of Bruner's curricular hypothesis is to challenge the uncritical acceptance of Bruner's hypothesis by contemporary educational scholars. Furthermore, it entails a challenge to the notion that a school subject is not fundamentally different from an academic discipline in substance and practice. Such a notion tends to reinforce the presupposition that the subject matter of the school curriculum is defined, selected, and organized according to logical formations of the intellectual disciplines. It overlooks the need for developing a school curriculum which is psychologically and epistemologically appropriate for students of various ages. It tends to ride roughshod over certain psychological and epistemological issues essential to the organization and formulation of the subject matter of the learner.

What we come to understand about psychological and epistemological issues concerning the subject matter of the learner has everything to do with what we come to understand about the making of a school curriculum. Curriculum development is central if we want to break with the tendency of viewing the subject matter of the learner as something normatively defined by the established academic disciplines. There is a need for a developmentally appropriate curriculum which "harmonizes with the growth of the child in capacity and experience" (Dewey, 1900, p. 226). The development of such a curriculum, I think, calls upon two major areas of research and theory: cognitive developmental psychology, and epistemology. Cognitive developmental psychology provides insight into student learning, thinking, and intellectual development in a given culture; epistemology sheds light on the nature and development of knowledge in various disciplines. These

two areas have been infrequently associated, and we need to bring them together in order to understand the making of the school curriculum. Furthermore, the psychological and epistemological view needs to be supplemented by the logical, the social, and the political perspectives. The making of the curriculum thus involves coordinating the psychological, the epistemological, the logical, the social, and the political factors, which is a rather complex and challenging task. More research needs to be done in relation to this undertaking.

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