

## Education and the Cognitive Revolution: Something to “Think” About

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In a recent document produced by the American Educational Research Association, cognitive psychologists Carl Bereiter and Marlene Scardamalia report on their massive review of the current literature on cognition and the curriculum.<sup>1</sup> In order to emphasize the increasing influence of cognitive research on educational theory and practice, Bereiter employs the analogy of a cognitive revolution, which he claims is “much in evidence in education.” Among the points raised to substantiate the analogy, three are particularly relevant to my philosophical interest, namely, the logical relationship between the concepts of mind, knowledge, and education. Bereiter claims; i) that educational decisions always involve, at least implicitly, notions about what goes on “in the mind”; ii) that what is new is the explicitness of the interest and effort to give mentalistic notions an empirical and scientific basis, and; iii) that an educational concern with cognitive processes or outcomes inevitably forces a confrontation with more “basic theoretical issues of cognition.”<sup>2</sup> Although I disagree in principle with these three points, they suggest that my deep concern about the implications of the information processing conception of mind (IP) for education is, in fact, warranted. I believe that an important role for philosophy of education lies in addressing the educational and philosophical issues which are central to the so-called “cognitive revolution.” This paper is divided into three parts. The first part is concerned with clarifying what is meant by the cognitive revolution and what changes have taken place in the way we think about thinking, that is, about the nature and function of the human mind. The second part looks first at several significant educational decisions that have been influenced by IP theory, that is, by “what goes on in the mind” and secondly, at the “effort to give mentalistic notions an empirical and scientific basis.” The final section “confronts” some of the “theoretical issues of cognition,” clarifies the formidable but necessary task for philosophers of education and offers some “common sense” suggestions for beginning that task.

### CLARIFYING THE ANALOGY

A “cognitive” revolution implies radical changes in institutionalized beliefs about cognition and cognitive development, that is, about our ability to think. Simply put, a cognitive revolution is a radical change in the way we think about “thinking.” If Bereiter’s analogy is apt, then one would expect that some radical changes have taken place in the way we think about the human mind and its development. Is this in fact, the case?

I suggest that such changes *have* occurred in respect to at least three traditions of thought on this topic. The first change might be described as *the psychological “explanation” for human action*, or more precisely, the demise of behaviorism and

the rise of cognitivism. On the tradition of psychological behaviorism as exemplified in the work of Watson, Skinner, and Thorndike, human action was explained as a causal response to environmental stimuli. The mind was held to be a mysterious "black box" which was either insignificant or irrelevant to why humans do the sorts of things they do.

The black box has now been opened. Not only is the mind now the primary subject of psychological research, the corollary is that the mind can *only* be studied by scientific empirical methods. A "scientific turn" has been made toward discovering truths about the mind as well as the physical world. For some researchers, the study of the mind is the scientific study of the operations of the brain, that is, neurophysiology. However, most cognitive psychologists have replaced the study of behavior with the study of cognitive and metacognitive processes, that is, second-order mental processes used to exert control over primary thinking processes. Cognitive science provides supporting research on the operational structures or architectures of cognition and is often taken to be synonymous with cognitive psychology. Scientific materialism has become the method of choice to discover the "truth" about mental events. As with behaviorism, the truth is found in causal theories, the difference is that instead of causal theories of human action, researchers now posit causal theories of human thinking.

The second radical change might be characterized as a change in *the prevailing metaphor of mind*. The relationship between mind, knowledge, and education is a central feature of the historical tradition of educational theory. For example, such imposing figures as Plato, Locke, and Dewey expressed the relationship between mind, knowledge and education in terms of *metaphors* of mind, for example, Plato's "well of knowledge," Locke's "blank slate" or "empty room," and Dewey's notion of a "biological system." In each case, the metaphor embodies a complex argument for the development of a particular sort of mind through a particular sort of education based on the acquisition of particular sorts of knowledge, or in Dewey's case, through a particular kind of "knowing."<sup>3</sup> Although they are not explicitly designated as such by Bereiter, there are good reasons to conclude that these metaphors and the arguments they embody are among the traditional theories of mind that have been overturned by the cognitive revolution. These reasons become obvious when we look at the revolutionary replacement, that is, the new and allegedly "better" metaphor of mind.

The cognitive metaphor of mind is often referred to as the computational analogy. On this metaphor, the operations of the human mind are taken to be analogous to those of a computer. The brain is compared to the hardware and mental operations are compared to the software or operating programs used in the computer. On this view humans are taken to be one example of an "IP system" and the study of the mind is focussed on the "mental" level of description through *models* and simulations. Models of IP range according to levels of concreteness, from mechanical models and flow charts to less concrete pictorial, symbolic, and verbal models. The predominant model is that of action as a result of IP, similar to that of a computer.

IP is a *functional* or operational view of mind, that is, it is concerned with *how* the mind functions as a system to access and process information and ultimately, to produce knowledge. IP is paradigmatic in the fields of cognitive psychology and cognitive science, that is, it is assumed to be the best operational view of mind upon which to base learning-theory research.

A third “radical” change is found in the position or *stance taken by philosophy regarding psychological research*. Although European or “continental” philosophy has deep psychological roots, traditional “Western” analytic philosophy has held what has been described as an anti-psychological and anti-scientific stance. Philosophy took an adversarial position regarding psychology and was rather, concerned with nonscientific problems such as dualism, that is, the “mind/body” problem, with the existence of God and free-will, or simply with linguistic analysis. However, the “new” scientific approach to the study of mind *is supported* by an increasing number of philosophers, specifically those advocates of what is called philosophical functionalism. The computational metaphor takes the form of philosophical functionalism in a relatively new and specialized branch of philosophy of mind. The term “functionalism” originated in the work of Hilary Putnam, and is currently advocated by other philosophers such as Jerry Fodor and Ned Block.<sup>4</sup> Functionalism is a sort of indirect answer to the mind-body problem, namely, “How is it that human physical movements or actions can be caused by mental states or events?” On the functional account, the answer is that the brain functions in a systematic way, responding to perceptual stimuli (in a “language of thought”) and processing representational symbolic information by means of unconscious mechanisms. In this way, the brain functions to cause our beliefs, desires, and so forth, which, in turn, cause us to behave in different ways.

In summary, there *are* radical changes evident in the way we now think about thinking. First, psychologists have replaced behaviorism — which held that matters of the mind were irrelevant to the study of human action, with cognitivism — which holds that not only *is* the nature and function of the mind relevant to human action, it is *all* that is relevant. Cognitivists hold further, that we can improve the way our minds function by “thinking about it” through metacognitive strategies. Secondly, the study of the development of mind has moved from comprehensive theories of its development through knowledge and education, which were embodied in a variety of metaphors, to a scientific computational metaphor and the view that the human mind is an IP system. Finally, the philosophical stance towards psychology has changed from one fundamentally opposed to scientific research to one in which some philosophers use such research to support their arguments for functionalism. In short, Bereiter’s analogy is alarmingly apt.

#### IP AND EDUCATIONAL DECISIONS

Bereiter claims that “Educational decisions always involve, at least implicitly, notions about what goes on in the mind. What is new is the explicitness of the interest and the effort to give mentalistic notions an empirical and scientific basis.”<sup>5</sup> As is well known, Bereiter’s use of the phrase, “*in the mind*” is philosophically suspect.

However, if he is suggesting that educational decisions are always based on a prior conception of mind, then his observation supports my fundamental premise. If he means that recent decisions in education reflect the scientific and empirical emphasis of IP, that is, the cognitive notion of what “goes on in the mind,” then again I must, albeit reluctantly, agree with his observation.

To summarize his observations, educational decisions have been influenced in three ways. The first is a curricular shift in educational practice from an emphasis on what Bereiter calls “formal” or “textbook” knowledge to mental models and metacognitive strategies for improving how we think. This is not simply an instructional or pedagogical shift — we are teaching students that this is the “proper” way to develop their minds. The second shift is one of values, particularly in respect to knowledge. Although Bereiter says that “knowledge is a central theme” of the revolution,<sup>6</sup> IP researchers have an extremely loose conception of knowledge which ranges from sensory or perceptual “information” to background or formal “knowledge.” Rather than regarding knowledge as intrinsically valuable, it is taken to be a “tool” we use to improve our thinking ability. Finally, empirical research now influences educational theory and policy directly through research done by cognitive scientists on the nature and function of the mind, and indirectly, through research on education as cognitive training and the development of cognitive strategies to be used by both students and teachers. As noted in the previous section, these are all aspects of cognitivism and IP theory.

Therefore, Bereiter is correct on both counts. Recent decisions in education *do* in fact, reflect notions about what goes on in the mind (IP) and mentalistic notions *do* in fact, have an empirical and scientific basis. If Bereiter is right and the changes in educational theory and practice presuppose the IP conception of mind, why should this be a matter of concern? I propose that we ought to be concerned about IP on both educational and philosophical grounds.

My first concern is *the potential conflict between IP and liberal education*. On Bereiter’s account, educators’ beliefs about education and what constitutes “good” practice are, as a consequence of the revolution, influenced by empirical “evidence” of the nature of mind and scientific theories of “how” the mind works. However, on the other hand, a naive but relatively stable idea of liberal education is at the very least, an implicit ideal held by educators and thus affects their beliefs about what education ought to be. Of particular interest in this paper is the liberal view that education is the *development of mind* through the acquisition of worthwhile knowledge and understanding. For example, most educators believe that there is something intrinsically valuable about being educated distinct from its instrumental value. Such beliefs are similar to Oakeshott’s notion of becoming a participant in a conversation with mankind.<sup>7</sup> Oakeshott categorizes the “voices in the conversation” as distinctive inquiries, modes, or languages of understanding such as the natural sciences, mathematics, humanities and social sciences. On this account, what is valuable in education is a depth and breadth of knowledge of the various ways of understanding the world and one’s relationship to it. Hirst further distinguishes the inquiries as forms of knowledge and comments: “The forms of knowledge are (thus)

the basic articulations whereby the whole of experience has become intelligible to man, they are the fundamental achievement of mind. *A liberal education is, then, one that, determined in scope and content by knowledge itself, is thereby concerned with the development of mind.*<sup>8</sup>” The potential conflict raises two questions which must be answered. First, can we *reconcile* the new emphasis on how we think, that is, on cognitive processes, with the development of mind through worthwhile knowledge? I think not for several reasons.

First, when thinking efficiently is taken to be a matter of exerting executive control over hypothetical mental processes, the explanation produces a metaphor within a metaphor, that is, an homunculus within the system which monitors and supervises first order, unconscious mental processes. It is then claimed that what we call “intelligence” is in fact a measurement of metacognition, that is, we measure a person’s ability to think efficiently, an ability allegedly determined by the “executive” function of metacognitive processes.<sup>9</sup> What is important in liberal education is a depth and breadth of knowledge of the various forms of human experience and the ability to see relationships among the forms, that is, the development of what Peters calls “a cognitive perspective.”<sup>10</sup> What counts on IP is how “intelligently” we are able to process information, not what (if anything) we know, let alone whether what we know is worthwhile.

Secondly, “thinking about thinking” produces a plethora of pseudo-knowledge claims, ranging from a minimal view of knowledge as mere sensory information at the “system” level and varying in depth according to its level of abstraction from the architecture of the IP system. Finally, the emphasis on improving “natural” learning processes produces in turn, a limited and peripheral conception of education, for example, education as “cognitive training,” education for “expertise,” both of which presuppose that the development of mind is a matter of functional efficiency, assisted if and when it is necessary by some sort of “background knowledge.”

In other words, the conceptions of knowledge and education embodied in the two accounts are entirely different conceptions. On one hand are the liberal conceptions of knowledge and education, both of which are based on clearly-defined public *criteria* or standards for what counts as knowledge and education. IP on the other hand, holds that what counts as either knowledge or education is whatever can be *inferred from the empirical evidence* of the mental functions assumed by IP. In short, the argument for the IP conceptions of knowledge and education (if indeed it is an argument) is a circular argument based on empirical verification of its own presuppositions rather than on public criteria.

The second question raised by the potential conflict is one of *compatibility*. Why can’t IP theory guide our understanding of how we think and liberal education guide our decisions about what we think about? The answer here is short and simple. Not only do liberal education and IP hold conflicting conceptions of knowledge and education, they are based on conflicting conceptions of mind. They are talking about two fundamentally different things. On the liberal view, what we mean by mind, that is, our beliefs, desires, intentions, are developed through the acquisition of worthwhile knowledge and understanding. The necessary knowledge and understanding

is in turn, a function of our public language and intellectual inheritance. On IP the mind is an intangible, internal information-processing system, which operates on an equally intangible "language of thought."

As liberal education and IP appear to have "irreconcilable" differences, it seems that we must choose between them. Have educationalists been making an "uninformed" choice?

#### CONFRONTING THE ISSUES

Bereiter cautions: "An educational concern with cognitive processes or outcomes inevitably forces a confrontation with more basic theoretical issues of cognition. Educators cannot safely appropriate the tools and findings of cognitive research while ignoring the theoretical questions that lie behind them."<sup>11</sup> The arguments for liberal education do not need to be outlined to philosophers of education. However, even if one is not convinced by the arguments for liberal education, the question remains as to whether or not IP is a credible view of mind in the first place. There are good *philosophical grounds* for questioning whether this is in fact, the case. A clear coherent argument for IP seems to be unlikely for a number of reasons. The most pressing reasons are those related to conceptual confusion, questionable assumptions, and methodological constraints.

The notion of thinking about thinking is conceptually confused. Not only does it give rise to the spectre of a vicious regression, the notion is inherently ambiguous. Are we talking about conscious intentionality or unconscious mental processes? Are "mental processes" the kind of thing one *can* talk about? Can we, in fact, use the instrument (thinking) to measure or analyze its own functions (thoughts)? Ambiguity is not taken to be a serious problem by cognitive researchers. On the contrary, a fundamental assumption of the advocates of IP is that either such questions are irrelevant, or that the answers to the questions either have been or will soon be, discovered by empirical research.

The "case" or argument for IP as a conception of mind is based on, among others, several controversial assumptions; i) that the "mind/body" problem is a legitimate *problem* and that the relationship between mind and body can be discovered by means of scientific methods, that is, by empirical investigation; ii) that the scientific explanation of the mind is the "best" explanation available, that is, that there are no alternatives; iii) that models of the mind will in fact, make learning processes intelligible, thereby accounting for the development of knowledge; iv) that such a model is computational, that is, that mental activity is essentially a symbolic language of thought, and; v) that there is a relation between the unconscious computational processes and what we take to be conscious and intentional goal-directed behavior. These assumptions are essential elements in the missing "manifesto" of Bereiter's cognitive revolution. The implicit "policy" of IP is that mental events are related to the brain by the fact that the brain is an IP mechanism. Thus, mental events can be "explained" by describing what the unconscious processes do, that is, how they function to process information. The explicit intentions of IP researchers are to document the "truth" of their claims by means of empirical evidence.



Empirical research is subject to serious methodological constraints, of which five are worthy of note; i) we have no way of knowing that the model is isomorphic with the phenomena being represented. Further, although the terms or labels used to make the model intelligible are programmatic, that is, they embody an implicit theoretical position, they are nevertheless taken to be further features of a real phenomenon; ii) although a model is taken to represent a discovery of a previously unknown phenomenon, a general template of the model is necessary to drive the research in the first place. Thus, there is a sense in which the research is circular or theory-driven; iii) empirical research necessarily focuses on similarities and generalizations rather than differences. For example, IP theory argues that human thinking can be characterized as IP because there are similarities a, b, and c, and so forth. Anyone who has ever heard the “why is an x like a y” joke, can realize that although similarities are entertaining and even thought-provoking, the differences between human and computational thought are at least equally, if not more worthy of consideration; iv) over time, certain models can become institutionalized, that is., publicly accepted, and are taken to represent scientific truths. When this feature is added to the emphasis on similarities, little, if any attention is given to the negative consequences of taking this conception on board, and; v) cognitive research is concerned with what are allegedly internal, private aspects of the individual mind. Notwithstanding the arguments that such an internal private realm of thought is logically impossible, this focus ignores the important public aspect, that is, the individual as a social being.

When Bereiter warns that “educators cannot safely appropriate the tools and findings of cognitive research while ignoring the theoretical questions that lie behind them,” it is highly unlikely that he is advocating the sort of theoretical questions that I have raised. However, I heartily endorse his caution. Having said that, I now ask if educators can afford to appropriate such tools and findings under any circumstances? It might be (and undoubtedly will be) pointed out that if my characterization of IP is correct and my argument sound, then IP is, at best, irrelevant to education. It is precisely because I believe this to be true, that I am so deeply concerned. Given its irrelevance to education, its pervasive influence on educational theory and practice noted by Bereiter et al, coupled with its uncritical acceptance in the public and academic domains, IP is misleading and miseducational, if not pernicious. That fact, I suggest, is *profoundly* relevant. What then, is the alternative?

I propose that the alternative presents a formidable but necessary task for philosophers of education. The task can be described as “using common sense.” We already know what we mean by mind, that is, our beliefs, desires intentions, goals, and fears. Our everyday common sense tells us that we are not computerized automatons whose ordinary thoughts and actions are governed by some mysterious inexplicable forces that cause us to think and do this rather than that.

The obvious first step is to clarify the problem. It is not a problem with genuine science or empirical research in education, for example, the influence of class size on instructional methods. The problem is rather; i) the reification of the mind in cognitive research, and; ii) the undue *educational emphasis and significance* that is

attributed to such research. The second part of the task is clarification of IP theory, the allegedly “missing” manifesto in Bereiter’s “cognitive revolution.” The central concepts, assumptions, and methods foundational to IP must be made explicit. Next both the positive *and* negative educational consequences of IP require close scrutiny. There are grounds for rebuttal. Notwithstanding the “disciplinary isolation,” a small group of philosophers have noted several deficiencies related to IP. Searle challenges four fundamental assumptions of the computational metaphor, which he calls the “worst mistake in cognitive science.”<sup>12</sup> Scheffler criticizes the notion of knowledge as narrow “information”<sup>13</sup> and Phillips and Valentine have noted several theoretical constraints and problems with cognitive methodology.<sup>14</sup> The work of these philosophers provide both a starting point and some substantial support for a critique of IP on methodological, epistemological, and educational grounds. The third step for philosophers of education is to recognize that the “common sense” conception of mind is fundamental to liberal education. It provides logical criteria for the cognitive development of human rational, linguistic, and social capacities, and points to the centrality of knowledge and language. This view accords with what Searle calls the “proper study” of mind, namely, the study of human intentionality. In other words, a consistent and coherent account of the relationship between the concepts of mind, knowledge, and education is embodied in liberal education.

It is important to note that although cognitive researchers refer to a “common sense” view of mind and use what might be called a “belief-desire” vocabulary, they are referring to a *theory* of common sense folk-psychology, a theory which significantly, presupposes the IP conception of mind. In a recent argument against this “scientized” view of common sense, Baker draws on the work of Wittgenstein, Ryle and Searle, and argues for the importance of language and knowledge of the various forms of human experience.<sup>15</sup> Her argument supports Hirst’s claim that a liberal education is “concerned with the development of mind.” The purpose or function of mind on the Common Sense argument, is to direct action and, “ultimately, to allow us to flourish as human beings.” On Baker’s view, common sense is “embodied in natural language,” it is the “sea in which we all swim — scientists and nonscientists alike.”<sup>16</sup>

Among other things, this paper is about the notion of thinking. I have noted some “revolutionary” changes in how we think about thinking and some of the educational consequences of thinking about “how” we think. Finally, I have suggested that philosophers of education think critically about IP on educational, methodological and philosophical grounds. As Hacker observes: “The task of philosophy is not to construct theories about cognitive processes which scientists can then elaborate and test; it is rather to destroy those illusions.”<sup>17</sup>

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1. Carl Bereiter and Marlene Scardamalia, “Cognition and Curriculum” in *AERA Handbook of Research on Curriculum*, ed. Philip Jackson (New York: MacMillan, 1992), 517. For simplicity the references to this article will use the first author’s name only.

2. Ibid.



3. See Francis M. Cornford, *Plato's Theory of Knowledge* (New York: Bobbs-Merrill, 1957); John Locke, *An Essay Concerning Human Understanding: Volumes One and Two*, ed. Alexander Campbell Fraser (New York: Dover Publications, 1959); John Dewey, *How We Think* (Boston: D.C. Heath and Company, 1933); and *John Dewey on Education*, ed. Reginald Archambault (New York: Random House, 1964).
4. See Hilary Putnam, *Mind, Language and Reality, Philosophical Papers*, vol.2 (Cambridge: Cambridge University Press, 1975); Jerry A. Fodor *The Language of Thought* (Thomas Y. Crowell, 1975); and Ned Block, "The Computer Model of the Mind," in *Thinking: An Invitation to Cognitive Science*, ed. D.N. Osherson and E.E. Smith (Boston: MIT Press, 1990), 819.
5. Bereiter, *Cognition*, 517.
6. *Ibid.*, 521.
7. See Timothy Fuller, ed., *Michael Oakeshott on Education* (New Haven: Yale University Press, 1989), 39.
8. Paul Hirst, *Knowledge and the Curriculum* (London: Routledge and Kegan Paul, 1974), 41.
9. See for example, A.L. Brown, J. Bransford, R. Ferrara, and J.C. Campione, "Learning, Remembering, and Understanding," in *Handbook of Child Psychology*, vol. 3, ed. P.H. Mussen (New York: Wiley, 1983), 140.
10. R.S. Peters, *The Philosophy of Education* (Oxford: Oxford University Press, 1973), 245.
11. Bereiter, *Cognition*, 518.
12. John Searle, *The Rediscovery of the Mind* (Boston: MIT Press, 1994), 222.
13. Israel Scheffler and V. Howard, *Work, Education and Leadership* (New York: Peter Lang, 1995).
14. See Denis Phillips, *Philosophy, Science, and Social Inquiry* (Oxford: Pergamon Press, 1987) and Elizabeth Valentine, *Conceptual Issues in Psychology* (London: Routledge, 1992).
15. Lynne Baker, *Explaining Attitudes* (Cambridge: Cambridge University Press, 1995), 223.
16. *Ibid.*
17. P.M.S. Hacker, *Wittgenstein: Meaning and Mind*, vol. 3, part I (London: Blackwell Publishers, 1990), 145.
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