Part II:

How to Teach for It

Instruction

✦✦ Chapter 16

The Critical Connection:
Higher Order Thinking That Unifies Curriculum, Instruction, and Learning

Abstract

"Though education by its very nature comprises a set of high order goals, actual school learning, given established practice, culminates in a set of lower order results." "The problem," in Paul's view, "is unambiguous. How can we reconceptualize and restructure what we presently do to narrow the gap between goals and results, to make high order goals a practical reality? ... What sorts of changes do we need so that in math classes students learn to think mathematically, in history classes they learn to think historically, in science classes they learn to think scientifically, and so that in general, not only in school but in their everyday lives as well, students begin to think critically in a disciplined, self-directed fashion?" Paul traces the problem to a tacit but large-scale acceptance of a network of uncritically held assumptions about instruction, knowledge, and learning. He argues for an alternative set of assumptions and spells out the kinds of changes needed in curricula and staff development for these more critically held assumptions about instruction, knowledge, and learning to become embedded in practice. Paul argues for long-term commitment to this process because of the deep-seated nature of the changes needed and the depth of resistance that can be expected.

✦ *Introduction*

The fundamental problems in schooling today at all levels are fragmentation and lower order learning. Both within and between subject areas there is a dearth of connection and depth. Atomized lists dominate curricula, atomized teaching dominates instruction, and atomized recall dominates learning. What is learned are superficial fragments, typically soon forgotten. What is missing is coherence, connection, and depth of understanding.

Recognition of the economic implications of the pervasiveness of lower order learning is illustrated in an open letter drafted by the president of Stanford University, Donald Kennedy, co-signed by 36 other college leaders from across the USA and sent to 3,000 college and university presidents (Sept. 18, 1987). It warned of,

> a national emergency ... rooted ... in the revolution of expectations about what our schools must accomplish ....

> It simply will not do for our schools to produce a small elite to power our scientific establishment and a larger cadre of workers with basic skills to do routine work. Millions of people around the world now have these same basic skills and are willing to work twice as long for as little as one-tenth our basic wages. To maintain and enhance our quality of life, we must develop a leading-edge economy based on workers who can think for a living. If skills are equal, in the long run wages will be too. This means we have to educate a vast mass of people capable of thinking critically, creatively, and imaginatively.

There are reasons why teaching and learning are lower order and reasons why they could and should be higher order. In this paper I explore both.

The bottom line, as we all well know, is not what is taught but what is learned. Students often learn something very different from what is taught. This dichotomy leads Alan Schoenfeld, the distinguished math educator, to conclude that math instruction is on the whole "deceptive and fraudulent". He uses strong words to underscore a wide gulf between what math teachers think their students are learning and what in fact they are. (Schoenfeld, 1982) He elaborates as follows:

> All too often we focus on a narrow collection of well-defined tasks and train students to execute those tasks in a routine, if not algorithmic fashion. Then we test the students on tasks that are very close to the ones they have been taught. If they succeed on those problems, we and they congratulate each other on the fact that they have learned some powerful mathematical techniques. In fact, they may be able to use such techniques mechanically while lacking some rudimentary thinking skills. To allow them, and ourselves, to believe that they "understand" the mathematics is deceptive and fraudulent. (p. 29)

Schoenfeld cites a number of studies to justify this characterization of math instruction and its lower order consequences. He also gives a number of striking examples, at the tertiary as well as at the primary and secondary levels:

> At the University of Rochester 85 percent of the freshman class takes calculus, and many go on. Roughly half of our students see calculus as their last mathematics course. Most of these students will never apply calculus in any meaningful way (if at all) in their studies, or in their lives. They complete their studies with the impression that they know some very sophisticated and high-powered mathematics. They can find the maxima of complicated functions, determine exponential decay, compute the volumes of surfaces of revolution, and so on. But the fact is that these students know barely anything at all. The only reason they can perform with any degree of competency on their final exams is that the problems on the exams are nearly carbon copies of problems they have seen before; the students are not being asked to think, but merely to apply well-rehearsed schemata for specific kinds of tasks. Tim Keifer and I studied students abilities to deal with pre-calculus versions of elementary word problems such as the following:
>
> *As 8-foot fence is located 3 feet from a building. Express the length L of the ladder which may be leaned against the building and just touch the top of the fence as a function of the distance X between the foot of the ladder and the base of the building.*

> We were not surprised to discover that only 19 of 120 attempts at such problems (four each for 30 students) yielded correct answers, or that only 65 attempts produced answers of any kind. (p. 28)

Schoenfeld documents similar problems at the level of elementary math instruction. He reports on an experiment in which elementary students were asked questions like, "There are 26 sheep and 10 goats on a ship. How old is the captain?" 76 of the 97 students "solved" the problem by adding, subtracting, multiplying, or dividing. (Schoenfeld, 1989)

Schoenfeld cites many similar cases, including a study that demonstrated that "word problems", which are supposed to require thought, tend to be approached by students mindlessly with the *key word algorithm,* that is, by reading problems like "John had eight apples. He gave three to Mary. How many does John have left?" and looking for words like 'left' to tell them what operation to perform. As Schoenfeld puts it, "... the situation was so extreme that many students chose to subtract in a problem that began 'Mr. Left'." (Schoenfeld, 1982) This tendency to approach math problems and assignments with robotic lower order responses becomes obsessive in most students.

Robotic lower order learning is not, of course, peculiar to math. It is the common mode of learning in every subject area. This results in a kind of global self-deception that surrounds teaching and learning, often with the students clearer about what is really being learned than the teachers. Many students, for example, realize that in their history courses they merely learn to mouth names, dates, events, and outcomes whose significance they do not really understand and whose content they forget shortly after the test. Our stated goal may be to prepare students to think historically when dealing with public and private issues and problems, but that is not what happens. That is not the bottom line.

In other words, though education by its very nature comprises a set of higher order goals, actual school learning, given established practice, culminates in a set of lower order results. The problem is unambiguous. How can we reconceptualize and restructure what we presently do to narrow the gap between goals and results, to make higher order goals a practical reality, to reduce lower order goals to what they should be: mere means for higher order ends. What sorts of changes do we need to make so that in math classes students learn to think mathematically, in history classes they learn to think historically, in science classes they learn to think scientifically, and so that in general, not only in school but in their everyday lives as well, they begin to think critically in a disciplined, self-directed fashion?

✦ *The Root of the Problem Is Our Confidence in Didactic Teaching*

Fundamental changes are needed, ones that require insight into a host of interrelated conditions. Consider some of the connections we need to grasp. We can improve student performance only by improving their thinking. We

can improve their thinking only by creating opportunities and incentives for them to think. We can provide them with opportunities and incentives to think only if their teachers have time to thoughtfully redesign their instruction. We can give teachers time to thoughtfully redesign their instruction only if they do not feel compelled to cover huge amounts of subject matter. We can reduce the obsession to cover huge amounts of subject matter only if the curriculum is restructured to focus on basic concepts, understandings, and abilities. We can restructure the curriculum to focus on basic concepts, understandings, and abilities only if we understand why such a focus is essential to higher order learning. We will understand why such a focus is essential to higher order learning only if we clearly understand the profound differences between the present didactic model of education, which confuses acquiring knowledge with memorization, and the critical model of education which recognizes that acquiring knowledge intrinsically and necessarily depends on higher order critical thought.

In education the whole is greater than the sum of the parts. We need to forge connections that shape the parts to form a coherent educational whole. To achieve this, nothing is more important than a clear conception of education explicitly embedded in curriculum, inservice, and instruction. No significant reform of education can occur unless we face the didactic lower order conception of education that informs daily practice. Present instruction implies that parroting information is equivalent to the acquisition of knowledge. Hence, teachers often feel compelled to cover information, even though they realize their students do not really understand and will soon forget it. Behind this practice is a network of uncritically held assumptions that need to be made explicit and unequivocally refuted, namely:

1) that students learn *how* to think when they know *what* to think,

2) that knowledge can be given directly to students without their having to think it through for themselves,

3) that the process of education is, in essence, the process of storing content in the head like data in a computer,

4) that quiet classes with little student talk are evidence of student learning,

5) that students gain significant knowledge without seeking or valuing it,

6) that material should be presented from the point of view of the one who knows,

7) that superficial learning can later be deepened,

8) that coverage is more important than depth,

9) that students who correctly answer questions, provide definitions, and apply formulae demonstrate substantial understanding, and

10) that students learn best by working alone.

One who understands and values education as higher order learning holds a very different set of assumptions, namely:

1) that students learn *what* to think only as they learn *how* to think,

2) that one gains knowledge *only* through thinking,

3) that the process of education is the process of each student gathering, analyzing, synthesizing, applying, and assessing information for him or herself,

4) that classes with much student talk, focused on live issues, is a better sign of learning than quiet classes focused on a passive acceptance of what the teacher says,

5) that students gain significant knowledge only when they value it,

6) that information should be presented so as to be understandable from the point of view of the learner, hence continually related to the learner's experiences and point of view,

7) that superficial learning is often mis-learning and stands as an obstacle to deeper understanding,

8) that depth is more important than coverage,

9) that students can often provide correct answers, repeat definitions, and apply formulas while not understanding those answers, definitions, or formulas, and

10) that students learn best by working together with other students, actively debating and exchanging ideas.

These contrasting assumptions about education, knowledge, teaching, and learning have contrasting implications for how textbooks should be written, how teachers should teach, and how students should go about learning. Indeed they have very different implications for every dimension of school life. The first set of statements collectively define a *didactic* conception of education, the second a *critical* one. The first set encourages lower order learning, the second higher order. We must make a paradigm shift from a didactic to a critical model of education to make higher order thinking a classroom reality. This shift is like a global shift in our eating habits and lifestyle. It cannot be achieved in a one-day inservice or by any other short-term strategy. It must come over an extended period of time and be experienced as something of a conversion, as a new way of thinking about every dimension of schooling. Let us now consider some of the basic changes that must be made to effect this shift.

✦ *Step One: Reconceive and Redesign the Curriculum*

Curricula play a significant role in school life. Instruction arises from goals and objectives stated in them. When they are heavily loaded with lower order objectives and content, when higher order objectives are vaguely defined, when assessment is tied to content recall and lower order skills, a didactic conception of education, complete with extensive lower order teaching and learning, results.

As things now stand many teachers are — usually without knowing it — obsessed with the notion that they must cover so much content that they have no time to focus on depth of understanding at any point along the way, let alone at every point along the way. This compulsion blocks redesign of instruction. Teachers feel they have no time to focus on higher order learning and therefore on what has recently been called "high" content — the most basic ideas and issues within a content area approached in such a way that students think them through for themselves.

Only through an explicit shift to a critical conception of education, with an explicit critique and rejection of the assumptions of didactic education, can we achieve significant reform. Consider one of the conclusions of the studies conducted at the National Center on Effective Secondary Schools concerning teaching effectiveness in higher order thinking. These studies focus on high school social studies departments which have made an explicit commitment to teaching higher order critical thinking. They found, among other things, that even in departments with a special interest in higher order thinking numerous teachers lapse into didactic teaching and end up focusing more on coverage than depth. What is more, not only do didactic teachers score poorly on the teaching of higher order thinking, this failure correlates with their obsession with coverage:

> A careful interpretation of the above findings suggests that lower scorers, unlike high scorers, are caught in a contradiction. That is, lower scorers make the general statement that breadth of coverage is detrimental to thinking, yet at the same time: a) claim that specific breadth-oriented lessons enhance students' thinking, and b) impose coverage pressure on themselves equal to or greater than the coverage demands articulated by the department or district. (Newmann, 1988)

Similar conclusions are emerging in the field studies headed by Rexford Brown for the Policy and the Higher Literacies Project of the Education Commission of the States. Results of this sort underscore the need to attack the didactic model directly and explicitly. Subconscious habits of thought and instruction, internalized over many years of schooling, are not easily changed. Even with careful critique, ingrained habits of thought and behavior can only be abandoned by degrees as new ones take their place. The shift from a lecture-drill-recall paradigm to one focused upon engaged-deep-processing can only be achieved through long-term evolution. If we want a focus

on *high content* we must make the implications of that commitment explicit and detailed. With this in mind, let us consider the connection to curricula.

Since most complete curricula contain a complex of elements — philosophy, goals, standards, objectives, assessment, and instructional examples — their formulation provides an important opportunity to confront the didactic model head on, and make the shift from low to high content inescapable. Unfortunately the philosophy expressed in most district curricula is typically little more than a set of empty platitudes, not an articulate analysis of the general conditions necessary for knowledge acquisition and learning. Given vagueness at the outset, a crucial opportunity is missed to nail down and avoid the misconceptions about knowledge and learning embedded in most didactic teaching. Nothing is done to forestall common misconceptions because there is no significant awareness that such misconceptions need to be forestalled. Nothing is done to make high content a priority.

As a result, teachers typically interpret the various goals and objectives as so many bits and pieces of information to be implanted in the students' minds by didactic instruction. Furthermore, systematic assessment often concentrates on recall and lower order skills. The result: higher order critical thinking lost in the rush to cover extended lists of content in preparation for testing. For this reason a major emphasis needs to be put on a detailed formulation of philosophy, one which highlights the essential role of thinking in the acquisition of knowledge, and contrasts lower order with higher order learning. Let us see how this might be stated as philosophy in the curriculum.

✦ *Demonstrate How Knowledge Is Embedded in Thought: A Sample Curricular Statement*

Imagine the following included under "philosophy" in a curriculum:

> Higher order learning can be cultivated in almost any academic setting. By focusing on the rational capacities of students' minds, by designing instruction so that students explicitly grasp the sense, the logicalness, of what they learn, we can make all additional learning easier for them. Higher order learning multiplies comprehension and insight; lower order rote memorization and performance multiply misunderstanding and prejudice. Higher order learning stimulates and empowers, lower order discourages and limits the learner. Good teaching focuses on high content, basic ideas and issues taught in ways which actively engage student reflection and thought. Though very little present instruction deliberately aims at lower order learning, most results in it. "Good" students have developed techniques for short term rote memorization; "poor" students have none. But few know what it is to think analytically through the content of a subject, few use critical thinking as a tool for acquiring knowledge.
>
> We often talk of knowledge as though it could be divorced from thinking, as though it could be gathered up by one person and given to another in the form of a collection of sentences to remember. When we talk in this way we forget that knowledge, by its very nature, depends on thought. Knowledge is

produced by thought, analyzed by thought, comprehended by thought, organized, evaluated, maintained, and transformed by thought. Knowledge exists, properly speaking, only in minds that have comprehended and justified it through thought. And when we say *thought* we mean *critical thought.* Knowledge must be distinguished from the memorization of true statements. People can easily blindly memorize what they do not understand. A book contains knowledge only in a derivative sense, only because minds can thoughtfully read it and, through this analytic process, gain knowledge. We systematically forget this and design instruction as though recall were equivalent to knowledge.

We need to remember that all knowledge exists in and through critical thought. All the disciplines — mathematics, physics, chemistry, biology, geography, sociology, anthropology, history, philosophy, and so on — are modes of thinking. We know mathematics, not to the extent that we can recite mathematical formulas, but only to the extent that we can think mathematically. We know science, not to the extent that we can recall sentences from our science textbooks, but only to the extent that we can think scientifically. We understand sociology only to the extent that we can think sociologically, history only to the extent that we can think historically, and philosophy only to the extent that we can think philosophically.

When we teach each subject in such a way that students pass courses without thinking their way into the knowledge that these subjects make possible, students leave those courses with no more knowledge than they had when they entered them. *When we sacrifice thought to gain coverage, we sacrifice knowledge at the same time.*

There are numerous forms of lower order learning we must avoid. We can understand them by understanding the relative lack of student comprehension characteristic of them. Paradigmatically, lower order learning is learning by sheer association or rote. Hence students come to think of history class, for example, as a place where you hear names and dates and places; where you try to remember them and state them on tests, where you read that this event had this cause and that result. Math comes to be thought of as numbers, symbols, and formulas, mysterious things you mechanically manipulate as the teacher told you to get the right answer. Literature is often thought of as uninteresting stories to remember along with what the teacher said is important about them. Science means measuring, counting, and filling out graphs.

Consider history taught as a mode of thought. Viewed from the paradigm of a critical education, blindly memorized content ceases to be the focal point. Learning to think historically becomes the order of the day. Students learn historical content by thinking historically about historical questions and problems. They learn through their own thinking and classroom discussion that history is not a simple recounting of past events, but also an interpretation of events selected by and written from someone's point of view. In recognizing that each historian writes from a point of view, students begin to identify and assess points of view leading to various historical interpretations. They recognize, for example, what it is to interpret the American Revolution from a British as well as a colonial perspective. They role-play different historical perspectives and master content through in-depth historical thought. They relate the present to the past by discussing how their own stored-up interpretations of the events of their own lives shape their respons-

> es to the present and their plans for the future. They come to understand the daily news as a form of historical thought shaped by the profit-making agendas of news collecting outlets. They come to recognize that gossip is a kind of historical thought often shaped by bias.
>
> Learning to think historically is, in short, a very different and much deeper approach to history than that adopted traditionally. The one-dimensional didactic approach, wherein students quickly forget what the teacher or text said, is abandoned as a misconceived anachronism. When students learn to think historically, they not only acquire information and higher order knowledge, but also insights, skills, abilities, and values — learnings that serve them well in grappling with real problems in a historically complex world. They learn that history is not principally what is found in dusty books, but what is actively embedded in people's minds as they interpret and shape events in the world about them.

Including language such as this in curriculum philosophy would go far toward flagging the problem of didactic lower order teaching, sensitizing teachers to the crucial shift needed. Of course we must follow up this curriculum philosophy with a redesigned articulation of curriculum goals, standards, objectives, assessment, and instructional examples.

✦ *Step Two: Give Teachers Time to Thoughtfully Redesign their Instruction*

As teachers become increasingly aware of the difference between a didactic and a critical conception of education, and have a curriculum which articulates a coherent understanding of and commitment to higher order learning and high content for all students, they need the time and the incentive to thoughtfully redesign or remodel their own instruction. This is no simple, one-shot task. It must address deep-seated teaching habits and ways of thinking. It requires incremental change. It requires on-going critical thinking on the part of teachers and administrators. It requires long term planning. It requires a set of strategies for transforming instruction as well as an understanding of the nature of higher order thinking and of the conditions under which it can occur.

Consider this statement of what characterizes higher order thinking which Lauren Resnick made in a recent report on the research on the subject for the National Research Council (Resnick, 1987):

1) Higher order thinking is *nonalgorithmic.* That is, the path of action is not fully specified in advance.

2) Higher order thinking tends to be *complex.* The total path is not "visible" (mentally speaking) from any single vantage point.

3) Higher order thinking often yields *multiple solutions,* each with costs and benefits, rather than unique solutions.

4) Higher order thinking involves *nuanced judgment* and interpretation.

5) Higher order thinking involves the application of *multiple criteria,* which sometimes conflict with one another.

6) Higher order thinking often involves *uncertainty.* Not everything that bears on the task is known.

7) Higher order thinking involves *self-regulation* of the thinking process. We do not recognize higher order thinking in an individual when someone else "calls the plays" at every step.

8) Higher order thinking involves *imposing meaning,* finding structure in apparent disorder.

9) Higher order thinking is *effortful.* There is considerable mental work involved in the kinds of elaborations and judgments required.

This characterization warns us against conceptions of critical thinking that imply it can be proceduralized for students, reduced to predictable steps in a predictable order. Critical thinking needs to be understood globally not mechanistically. For example, we need to recognize that assignments that compel students to think their own way through the logic of the content, using their own experience, their own assumptions, their own ideas, call upon them to think in a higher order fashion virtually every step along the way. We also need to see that in doing such assignments no two students think it through in exactly the same way.

We cannot escape the brute fact that there are no algorithms for doing one's own thinking. Critical thinking is by its very nature *principled* not procedural thinking. Critical thinking requires thinkers to continually *monitor* their thinking by means of questions that test for clarity, accuracy, specificity, relevance, consistency, logic, depth, and significance. Since critical thinking often involves thinking within *multiple points of view and frames of reference,* it often yields multiple possible solutions. Since critical thinking enables a person to achieve *genuine knowledge* rather than mere recall, and since what one learns is always integrated into one's personal experience and previous knowledge, it always involves the *imposition of meaning.*

Critical thinking, in the deepest and fullest meaning of that phrase, is equivalent to higher order thinking. It engages us in an evolving process in which we progressively take control of our own thinking, disciplining it by degrees, making it more and more responsive to evidence and reason, and extending it to ever more domains and situations. We naturally use it to create, build upon, reform, modify, and redesign our beliefs and behavior. Teachers need time to assimilate this conception, to tie it into their experience, to try it out in their everyday life, to integrate it into their own thinking, to translate it into strategies for instructional reform.

Let us now look briefly at both the cognitive and affective dimensions, and the insights that underlie them. This will clarify the sort of reflective process teachers must go through.

✦ *Provide Opportunities for Teachers to Learn How to Teach for the Affective Dimensions of Higher Order Thinking*

No one learns what they do not in some sense value. Knowledge has value because of its use. Consider, for example, things that students value, how quickly they learn them, how much they know about them, and how well they retain and use what they know. A list would include sports, music, television, movies, fashions, styles, video games, and so on. Taking any one of these, say skateboarding, we can easily see the connection between the cognitive and the affective. Students who value skateboarding spend much time and energy learning the differences between available wheels, trucks, and boards, the advantages and disadvantages of each, the kind of riding best suited to each, and how these components work together. They then use this knowledge to assemble a board appropriate to the kind of riding they prefer. Difficulties do not dampen their enthusiasm.

If we want students to learn to think in higher order ways we need to cultivate the traits essential to such thinking. Consider, for example, the most fundamental disposition necessary for all higher order thinking: the drive, disposition, or will to think independently. It is always easier in the short run to try to get someone else to do our thinking for us, for someone else to tell us what to do, for someone else to solve our problems for us, for someone else to figure out life for us. Students habitually expect the teacher or text to solve their scholastic problems for them — though they rarely expect teachers or texts to solve their real-world problems. In school, they look for algorithms, formulas, and fail-safe recipes or procedures. They expect to act robotically. Faced with problems at home or on the street they often, in contrast, show real independence of thought. Yet teachers rarely tap this independence. They rarely harness or discipline it. They cave in to the students' demand for mindless short-cuts, re-enforcing the students' expectations that they ought to have them. Indeed, teachers continually look for algorithms, formulas, and fail-safe recipes or procedures. They wrongly feel that this helps their students. Ironically and painfully, many teachers today are now looking for robotic procedures to teach higher order thinking.

Of course there are many ways teachers *can* cultivate independence of thought in their students, though none of these strategies involve formulas or mindless rules. Consider the following examples:

1) Rather than simply having students discuss ideas found in their texts, have them brainstorm their own ideas and argue among themselves about problems and the solutions to problems.

2) Routinely ask students for their point of view on issues, concepts, and ideas.

3) Before reading a section of text that explains a map, chart, time-line, or graph, have the students read and discuss what the map, etc., shows.

4) Whenever possible give students tasks that call upon them to develop their own categories and modes of classification instead of being provided with them in advance. For example, rather than providing them with ways of classifying literature, lead a discussion on how students *do* classify what they read, calling upon them to justify whatever labels they already use.

5) When giving written assignments, give the students a larger role in gathering and assembling information, in analyzing and synthesizing it, and in formulating and evaluating the conclusions or interpretations of others.

6) In science classes, have students devise their own hypotheses and experiments or seek out what they take to be examples of pseudo science, explaining how they came to this conclusion.

7) In math classes, devise activities that lead students to argue and debate various possible ways to solve standard math problems before you give them access to algorithms and formulas.

Teachers can devise innumerable such scenarios for the cultivation of every essential trait or disposition available. When teachers understand the importance of the affective dimension of thought and have some start-up examples, they are very creative in devising such strategies. Every teacher can devise ways of cultivating fairmindedness, intellectual humility, intellectual courage, intellectual perseverance, intellectual integrity, and confidence in reason, but only if they understand them, see them as important, and feel free to take the time to do so.

Of course, lest we be taken to be fostering an atomization of higher order thinking, it should be emphasized that the affective traits and dispositions we advocate are interdependent. Consider intellectual humility. To become aware of the limits of our knowledge, we need courage to face our prejudices and ignorance. To discover our prejudices, in turn, we often must empathize with and reason within points of view toward which we are hostile. To achieve this end, we must typically persevere over a period of time, for learning to empathically enter a point of view against which we are biased takes time and significant effort. That effort will not seem justified unless we have the confidence in reason to believe we will not be "tainted" or "taken in" by whatever is false or misleading in the opposing viewpoint. Furthermore, merely believing we can survive serious consideration of an "alien" point of view is not enough to motivate most of us to consider it seriously. We must also be motivated by an intellectual sense of justice. We must recognize an intellectual responsibility to be fair to views we oppose. We must feel obliged to hear them in their strongest form to ensure that we do not condemn them out of our own ignorance or bias. At this point, we come full circle back to where we began: the need for intellectual humility.

For a large catalog of examples K–12 the reader may want to consult the *Critical Thinking Handbook* series published by the Center For Critical Thinking and Moral Critique. They provide a "principled" rather than a "procedural" approach throughout.

The crucial point is this. Teachers need time to become aware of the variety of strategies available for cultivating the affective traits of mind essential to higher order thinking. They also need incentives for cultivating these traits. Ultimately, of course, teachers must come up with their own particular redesigned lessons. They must develop confidence in their own thinking, their own capacity to take a new idea and make it a reality in practice. Teachers who do not think independently and critically about their own instruction will never be able to teach independent critical thought to their students. No formulas, procedures, or recipes can substitute for independent critical thinking on the part of each and every teacher and, of course, each and every student.

✦ *Provide Opportunities for Teachers to Learn How to Teach for Higher Order Cognitive Abilities*

There are a variety of critical thinking principles which can be transformed into teaching strategies for fostering higher order cognitive abilities and skills. These principles apply on the micro as well as the macro level. That is, in addition to developing the skills of identifying assumptions, evidence, conclusions, implications and consequences, and so forth, students have to learn to orchestrate those skills into more extended thought processes. They need to be able to read and write critically, to engage in Socratic discussions, to reason dialectically, to pursue root questions, and so forth. The upshot is that teachers have to learn how to teach for higher order cognitive abilities and skills. To do this they need to have the principles that underlie them spelled out with examples of the sorts of classroom activities and assignments that foster them.

Consider, for example, the concept of critical reading. Some people think of it as reading in an argumentative mind frame. This misses the essence of the process. Though critical readers do read with a healthy skepticism, their fundamental purpose is to understand the text, to grasp what is being said from the point of view of the person writing. They appreciate how, when humans think, they think within a point of view. Unless we sympathetically enter into the perspective of a writer we cannot make the best and most accurate sense of what is being said. Furthermore, a critical reader recognizes that whenever important ideas are dealt with they have important connections that a critical reader needs to determine. For example, all writers have a basic goal or purpose, make fundamental assumptions, reason from the assumptions they make, come to conclusions, and generate implications and consequences. Hence, a critical reader reads with a view to identifying these important elements, reads so as to better understand what precisely is being said, what portion should be accepted and what should be questioned and followed up with further reading.

When teachers have this principle of critical reading in mind, there are a number of things they can do to foster critical reading on the part of their students:

1) Call attention to the difference between uncritical impressionistic reading, on the one hand, and critical reading on the other, pointing out the differences between the two so that students begin to think about their own reading habits with a greater sense of what specific things they might try to do.

2) Have student's identify the author's point of view, purpose, conclusions, reasons given, assumptions made, issues raised, basic ideas used, and so forth.

3) Teach students to question as they read: "Can I summarize the last paragraph in my own words? Can I relate it to my experience? Can I see what the author is implying? Can I see reasons for what is said? Are there objections I might raise? Is this consistent with other things I know or believe?"

4) Lead a discussion on the relation of reading and listening. Compare asking questions of a speaker to asking questions while one reads.

5) Show by demonstration examples of poor and good reading.

6) Read aloud expressing your own questions as you proceed, using provisional answers expressed aloud to guide you in interpreting the text. Make your own critical reading explicit by thinking aloud. Have students take turns doing the same.

Teachers can take strategies such as these and work out the details with their own students, recognizing thereby that there are no formulas or pat procedures for producing critical readers. Each teacher committed to critical reading develops somewhat different ways of encouraging it. When teachers have time to exchange ideas on how to cultivate critical reading, they learn from each other and achieve higher levels of success.

✦ *Step Three: Take the Long View*

Short-term reform can do no more than foster surface reform. Deep change takes time, patience, perseverance, understanding, and commitment. This is not easy in an educational world saturated with glossy, superficial, quick-fixes and plagued historically by a very short attention span. Nevertheless, a well-devised long-term educational reform program, focused on the progressive ameliorization of instruction through the development of the critical thought of teachers, promises the kind of multiple long term payoffs that make in-depth reform cost-effective. Furthermore, the amount of money invested is in fact secondary, if the motivation and leadership are present.

A case in point is the Greensboro Plan, a reasoning and writing project which began in the city of Greensboro in the spring of 1986 and has been gathering momentum ever since. It was initially proposed by Associate

Superintendent Sammie Parrish and approved by the Greensboro board of education as the spearhead of a commitment to infuse critical thinking and writing into K–12 curriculum. To ensure that the reform project had a life of its own, two full-time facilitators were hired: Kim DeVaney, an experienced elementary school teacher, and Janet Williamson, a high school teacher who had just completed a doctorate with a special emphasis on critical thinking. Williamson and DeVaney nurtured the project as a creature of the teaching staff. From the start they knew that the project needed a solid foundation. Accordingly, they began with a small group of 14 volunteers. These 14 read widely and diversely about critical thinking, developing their own thinking as they critically analyzed a variety of proposals for infusion. (For details about the Greensboro plan, see Chapter 27.)

I have included the Greensboro Plan in this anthology for a reason. It illustrates well the style, flavor, and thrust of a well-devised, well-run reform effort, tuned into the multiple connections that must be made to carry it through. Furthermore, Greensboro is not a wealthy suburban district. It is a medium sized urban district with 21,000 students and 1,389 classroom teachers. The students come from diverse economic and racial backgrounds. 46% of the student population is White; 52% Black; and 2% Asian, Hispanic, or Native American. Almost 28% of the student population has a family income low enough for them to receive either free or discounted lunches.

The Greensboro teachers and administrators know that even though they have been working hard for some three years, they are still, comparatively speaking, at the beginning of fundamental change. This is not a source of discouragement but of strength, of knowing what real change requires and how it comes to pass.

✦ *Conclusion*

There are a number of connections we must make conceptually and pragmatically to successfully reform education. All fundamental school practices presently cluster around or emerge from a didactic conception of education. The dominance of lower order learning is inevitable given this fact. Unless teachers and administrators come to terms with this dominance and its foundation in a mistaken conception of education, they will never be able to make the shift to higher order teaching and learning. Curricula will remain cluttered with details, superficial content, and low level skills. Schooling will remain a hurried race through undigested content. Students will remain largely passive and indifferent.

Substantial change can occur only by restructuring math classes so that students learn to think mathematically, history classes so that students learn to think historically, science classes so that students learn to think scientifically, and so that in general, not only in school but in everyday life as well, students — and teachers — begin to think critically in a deeply internalized,

self-directed fashion. This requires that curricula be reconceptualized and recast by a critical model of higher order teaching and learning. It also requires long-term, in-depth staff development programs that remain focused on higher order learning for the forseeable future. Teachers need years of practice critiquing and remodelling their instruction, to grow out of deeply ingrained compulsive didacticism. The obsession with didactic instruction is such that many will periodically relapse and begin again to treat the basic acquisition of knowledge as a mode of lower order memorization.

In this process it is important to involve the widest possible spectrum of people in discussing, articulating, and implementing the effort to infuse critical thinking. This includes teachers, administrators, board members, and parents. Incentives must be provided to those who move forward in the implementation process. Many small changes will be necessary before larger changes take place. Do not rush implementation. A slow but steady progress with continual monitoring and adjusting of efforts is best. Provide for refocusing on the long-term goal and ways of making the progress visible and explicit. Work continually to institutionalize the changes made as the understanding of higher order thinking grows, making sure that the goals and strategies being used are deeply embedded in school-wide and district-wide statements and articulations. Honor individual differences among teachers. Maximize the opportunities for teachers to pursue critical thinking strategies in keeping with their individual differences.

As you pursue these evolutionary changes, you will recognize additional implications and connections attendant on the process: a natural link with cooperative learning, with professionalizing teaching, with responsible assessment, with teacher involvement in school and district management decisions, and, not least, with preparing students to participate in a world — vocationally, personally, politically, and socially — in which fundamental change, adaptability, and higher order thinking are pressing needs in every dimension, in every conceivable domain of thought and action.