✦✦ Chapter 18

The Art of Redesigning Instruction

Abstract

This paper is divided into two parts. The first part is entitled, "Why Should We Redesign Instruction?" Paul begins with an argument as to why reasoning should be recognized to be the essential mode of learning, for, only if we are reasoning while *we are learning, do we truly figure out* what *we are striving to learn, and, thereby, truly make it our own. Paul extends the argument by suggesting that in a literal sense no one can teach us anything of importance, again, because reasoning is essential to quality learning and no one can reason for us. The best they can do is reason in front of us. Paul then discusses addictive and pseudo-learning and links them to the theme of the paper.*

With this background established, Paul argues for three dimensions essential to education for reasoning: learning the principles *that underlie reasoning, learning the* moves *that those principles define, and learning the* standards *that one must use to assess reasoning. He then extends this analysis to include the basic* elements *of reasoning (the source of critical thinking moves), the* abilities *intrinsic to reasoning (which are the basic moves), the* modes of reasoning *(patterned sequences of moves), the abilities as regulated by* traits of mind *(the attributes that motivate making the moves), and* intellectual standards *(the standards used to assess the moves). He provides an extended analysis of reading as a mode of reasoning.*

The second part of the paper is entitled, "How Do We Redesign Instruction?" As you might expect, the idea of redesign follows from the argument developed in the first half of the paper. The crucial question for redesign is "How can I get my students to reason more and reason better?" As a teacher, you should be interested in the basic elements of reasoning "because they represent both a basic orientation and a resource for fundamental moves in reasoning". You will be interested in the component critical thinking abilities "because they represent the kinds of moves you want students to master". You will be interested in the modes of reasoning (reading, writing, speaking, and listening, for example) "because one cannot learn to reason without them."

Paul then provides a model for "Six Forms of Decision-Making in Designing Instruction", a sample redesigned lesson, a section on patterns in teaching, and a section on general recommendations for instruction. Paul's approach to the redesign of instruction "presupposes intellectual development on three fronts, a growing recognition of: 1) what is wrong with didactic instruction, 2) the nature and dimensions of critical thinking, and 3) pedagogical strategies that can be used to effectively integrate critical thinking into instruction (based on 1 and 2)."

✦ *Why Should We Redesign Instruction?*

THE PROBLEM OF "MOTHER ROBIN TEACHING"

Both teaching and learning today are desperately in need of restructuring. However, grasping the how and why of it requires rare insight into what is wrong with instruction: what is wrong with the way teachers typically go about teaching, and what is wrong with the way students typically go about learning. The essential insight requires understanding of the dual roles that teaching and learning can play in the lives of our students and how those roles correlate with very different, sometimes opposing, realities.

The most important starting point for that understanding is given in the following truth: teaching, learning, and knowledge can be either lower order or higher order, fragmented or organized, surface or deep. Though all teachers, in theory, aspire to teaching so that students gain higher order, organized, deep knowledge, the effect of most teaching is otherwise: lower order, fragmented, superficial, and often transitory. A significant part of this problem is due to what might be called "mother robin teaching".

When we teach in "mother robin" fashion — trying to mentally chew up everything for our students so we can put it into their intellectual beaks to swallow — students tend to become, if I can slightly mix my metaphor, "polly parrot" learners:

"I can't understand anything unless you tell me exactly how and what to say and think. I need you to figure out everything for me. I shouldn't have to do more than repeat what you and the textbook say."

Unfortunately, the more students grow in this direction, the more teachers try to amplify their mother robin teaching to accommodate it. Growth on either side produces a compensating growth on the other. By the middle school level, most students are deeply entrenched in learning, and teachers in teaching, nothing but lower order, fragmented, surface knowledge. Teachers feel by this level that they have no choice but to think for their students, or worse, that they should not require any thinking at all, that students are not really capable of it.

Rarely do students learn to reason well once such mutually-reinforcing, lower order habits develop. Rarely do they integrate what they are learning into what they already know or believe. Rarely do they learn to grapple with, or grasp the logic of, what they are learning. Content comes and goes as something independent of thought, dissociated from active engagement, from give-and-take, from disciplined reading, writing, speaking, or listening. Intellectual paralysis sets in. The trance-like state that students bring typically to class becomes permanent.

THE SOLUTION: REASONING AS A MODE OF LEARNING

To learn how to teach critically, teachers must abandon mother robin teaching and make every effort to discourage polly parrot learning. To learn to think critically, students must learn to use reasoning as a pervasive tool of learning.

What is reasoning? Expressed most simply, it is the art of "figuring things out for yourself". It begins when we, in effect, say to ourselves something like this:

"Let's see, how can I understand this? Is it to be understood on the model of this experience or that? Shall I think of it in this way or that? Let me see. Ah, I think I see. It is just so... but, no, not exactly. Let me try again. Perhaps I can understand it from this point of view, by interpreting it thus. OK, now I think I am getting it...."

When we reason we puzzle something out, work out our understanding of it in relationship to what we already know. Reasoning contrasts, therefore, with thoughtlessly accepting what others say. It intrinsically involves *testing as we learn* to see if this or that is so. There are two ways we go about testing as we learn, and the two often work together: physical testing and mental testing. We physically test things by trying them out in the physical world. We mentally test things by trying them out in our minds. Hence we test ideas and beliefs by ideas, beliefs, and experiences we already have. For example, you tell me that you've just met a really *perfect* person and I, by thinking of my experience of people and my conception of human nature, inwardly decide that what you are saying *cannot be true*. I have tested out what you said in my mind and what you said "failed" the test.

In everyday life, of course, we continually have to figure things out for ourselves — for example, what our mothers, fathers, brothers and sisters, friends and acquaintances are *really* like, how to deal with personal and social problems, how to get what we want and avoid what we don't want. We are forced to develop theories about the world we live in and, of course, to test them in the crucible of day by day experience. Admittedly, our tests are often ill-conceived, our criteria often irrational. Nevertheless, there is a difference between what we personally reason through and what we mindlessly take in.

There are things, of course, we don't have to figure out for ourselves, that we can pick up merely by dint of lower order absorption and blind imitation. Much of this may, of course, be dysfunctional in some respects even as it is functional in others: for example, learning to be aggressive or passive, to attack or flee, to express ourselves outwardly or to "keep it all in".

There are still other learnings between the two extremes of the thoughtful and thoughtless: things which we figure out partially by ourselves through reasoning — physical or mental testing — and partially through others by mindless imitation. The reasoned and the unreasoned are thus sometimes combined.

✦ *Learning from Others vs. Learning for Yourself*

Very significant consequences follow from how students learn. The depth with which they understand anything is in direct proportion to the degree to which they have engaged in intellectual labor to figure it out *for* themselves. Whatever is to have meaning *to them* must be given meaning *by them*. They must work new meanings into the network of meanings they already have. They must relate new experiences to experiences they have already had. They must relate new problems to problems they have already solved. To create new meanings, to understand new experiences, to solve new problems, they must actively and intellectually participate in the "figuring out" process, going up and back between what they have already figured out and what they have not. They must do intellectual work. They must *reason to learn* — and to learn *well* they must *reason well*.

THE ADDICTIVE ILLUSION OF LEARNING FROM OTHERS

Of course, there are limited ways in which it is possible to learn things from others. Others can often help us get started. They can frequently point to or model the way. They can create environments which help shorten the "figuring out" process. The anchor point is this: There is no way to teach *that which requires understanding* so as to eliminate the "figuring out" process for the learner. When a teaching mode attempts to by-pass the processes by which each person individually figures things out, a mere illusion of learning takes place. When students do not engage in intellectual labor, they do not meaningfully learn, their learning is falsified.

Pseudo-learning mimics genuine learning. For example, students have not really learned why the earth spins on its axis if, in the last analysis, they believe that it does because their sixth grade teacher said it does. Neither do they understand because they memorized, but can't explain in their own words, the explanation in their sixth grade science text. They understand if and only if they can think it through for themselves in terms, and in the light of experiences, meaningful to each of them individually. Good teachers arrange circumstances and design activities to facilitate this process of "thinking something through". Nevertheless, there is no way on this earth or in the heavens above to eliminate the need for the process to be significantly structured by the active intellectual labor of the learner.

Pseudo-learning is addictive precisely because it appears to provide substantial learning with little effort. It seems genuine — when only parroted responses are called for. It seems substantial — as long as no one asks the students to explain what they have learned in their own words. It seems easy — as long as no one figures out how much time is wasted teaching the same content over and over and how little students retain after their schooling is completed.

This is the most fundamental problem in education today, that most teaching fosters various forms of pseudo-learning. It is because of pseudo-learning

that most elementary students add, subtract, multiply, or divide when given the following "problem": "There are 75 sheep in the field and 5 sheep dogs. How old is the shepherd?" It is because of pseudo-learning that this tendency increases the more math instruction the students asked this question have had. It is because of pseudo-learning that most students are unable to explain in their own words what makes a scientific experiment scientific. It is because of pseudo-learning that most students are unable to solve problems that require more than one inference. It is because of pseudo-learning that students soon lose interest in the subjects they are "studying." (Who wants to study what one is not understanding?)

Most teaching attempts to achieve success without realistically taking into account the only conditions under which students can *genuinely* learn — and that is when they think things through for themselves. What most teachers fail to recognize, then, is that *students* (in the last analysis) *must teach themselves*.

Good teachers are not persons who know how to get students to learn without having to think. They are persons who know how to create conditions and activities, incentives and opportunities, in which those willing to think things through for themselves can achieve what they will. The statement "If you really knew how to teach, all your students would learn well and deeply" is as false as the statement: "If you really want to, you can bypass the need for students to think for themselves. There are ways to teach which automatically inject knowledge, understanding, and skill into people without their active involvement or interested consent. Knowledge can be force-fed if you really know how to teach effectively."

Make no mistake; mother robins can be very useful to baby robins. But let us also not forget that baby robins are hungry when fed and instinctively swallow what is put into their beaks. And more. If mother robins never pushed their babies out of the nest, or expected them to do their own digging for worms, or their own chewing once found, neither they nor their species could or would survive.

Figuring things out has a crucial role in learning the simple and the complicated, the surface and the deep, the theoretical and the applied. Only a few things can be learned with a minimum of reasoning (e.g., copying the shapes of letters and numbers for the first time, practicing how to tie our shoes, learning to throw and catch a fluff ball, putting different colored objects into different colored boxes). And even though quite a few things, once learned, can be done more or less automatically and robotically — walking up and down stairs, riding a bicycle, eating with knife and fork, driving along a largely empty freeway, carrying the trash out to the trash bin — very often thoughtful interventions are essential to avoid unpredicted negatives: drunk drivers, slippery steps, holes in the road, and defective trash bags.

Furthermore, most of the curriculum of schools as well as most of the philosophy that accompanies that curriculum, if taken seriously, cannot legitimately be reduced to what can be learned automatically and robotically. Most

of it, to be genuinely — i.e., meaningfully — learned, requires a lot of "figuring out" of things, a lot of good reasoning, a great deal of testing, much intellectual work. Unfortunately, research and experience tell us that good reasoning is about the last thing to expect in the typical classroom on a typical day.

There are a number of reasons for this. Most teachers are not aware of the nature and importance of reasoning — most teaching being a variation on a "mother robin" theme. And even when teachers do assign reasoning they frequently do not understand how to assess it appropriately. The result is that students rely on variations of "polly parrot" learning and save their reasoning for situations in which they must figure out how to subjectively please their teachers. ("I try to agree with my teachers, to say what pleases them.")

WHAT DO STUDENTS NEED TO LEARN — TO LEARN HOW TO REASON WELL?

We can best understand what is involved in teaching students to reason well by clarifying first what learning to reason is like. We can gain some leverage on this understanding by considering how reasoning well is analogous to doing a wide variety of things well.

Whenever one develops interrelated skills and abilities, there are three dimensions involved:

1) *broad principles* that articulate what is desirable, in general, in the light of the goals,
2) *skilled "moves"* based on "principles" that learners must practice in settings that enable them to assess the effectiveness of their performance by...
3) *appropriate "standards"*.

Unfortunately, we are more familiar with the mastery of skilled moves and strategies in the physical than in the intellectual domain. We are much better at disciplining our bodies than our minds. Let us therefore build an initial concept on this familiarity with the physical. If we keep in mind at least one clear example of the interrelation of *principles, moves,* and *standards* as formulated below, we will then have a benchmark in mind to guide us in thinking about the principles, moves, and standards to be learned in the art of reasoning well.

If students seek to join basketball, soccer, football, or tennis teams, they are well aware of the need to understand thoroughly the object of the game, the principles of sound play, the strategies and moves based on those principles, and the appropriate way to self-assess their moves in play. For example, for students to develop basketball skills and abilities, they must be willing to learn such principles as "square yourself to the basket whenever making a shot".

To learn this principle they practice by the hour doing what it calls for — squaring themselves to the basket — whenever they shoot. They also learn to integrate the skilled use of this move into a variety of strategic situations on the court. They do this with a combination of theoretical discussions and practical applications. They talk a lot about how to play the game — how to

make this or that move, how to work with this or that strategy, how to counter this or that opposing strategy. And they spend a lot of time actually playing the game, trying in the process to put good theory into practice. They also spend considerable time critiquing their performance, making reference to the standards of excellent performance, as well as to the moves, principles, and strategies intrinsic to that excellence.

In tennis, students learn such principles as "always return to the ready position at the center of the court", "keep your weight distributed", "bend your knees when stroking the ball", "follow through whenever possible", "watch the ball closely when you hit it", and so forth. These principles are translated into moves on the court which are subject to assessment using the standards and strategies of good tennis play.

In learning ballet, one learns ballet principles, ballet moves, and ballet standards. In learning chess, one learns chess principles, chess moves and strategies, and chess standards. In learning architecture, one learns the principles of architecture, strategies and moves in design, and design assessment. In domain after domain, this same general pattern prevails. It holds as well for the art of sound reasoning, the art of disciplining the mind.

CRITICAL THINKING: THE ART OF TAKING CHARGE OF YOUR MIND

Learning to think critically, and to reason well as a result, is the intellectual analog of learning to play basketball, tennis, or chess well. It is analogous to learning how to dance ballet or do architecture well. As in the other domains, there are general principles and strategies intrinsic to the doing of it. There are skilled "moves" — critical thinking moves — to be learned. One must find the time to practice the moves, to talk about the principles that underlie them, to critique and assess one's own, and others', use of them. One must commit oneself to standards — intellectual standards. One must not only practice, but strive continually for excellence in practice. One must be willing to make mistakes and to learn from one's mistakes, to grow progressively in ability over an extended period of time. Insightfully conceived instruction is designed to create all of the above conditions: to facilitate students' learning the general principles and strategies intrinsic to the disciplined mastery of a body of content; to facilitate students' actively making critical thinking moves in reading, writing, speaking, and listening; to facilitate students' talking about intellectual standards, assessing their own and other students' reasoning; and to facilitate students' intellectual development over an extended period of time.

✦ *What Does a Mind Need to Know About Itself to Reason Well?*

It is important, then, to understand our minds as a potential repository of intellectual skills and abilities, of capacities that can be disciplined by critical thinking principles, strategies, and moves, and to begin to see why the mas-

tery of reasoning is intrinsic to the task of taking charge of our mind and thus taking personal responsibility for the quality of our own thinking. To do this we must develop an interest in all of the components of reasoned thought:

1) basic *elements* (the source of critical thinking moves),

2) the elements combined into *abilities* (which are the basic moves),

3) the abilities in *modes of reasoning* (a patterned sequence of moves as in reading critically or writing critically or questioning Socratically, etc.)

4) the abilities as regulated by *traits* of mind (the attributes that motivate making the moves), and

5) intellectual *standards* (the standards used to assess the moves).

Each of these dimensions of reasoning is explained briefly in what follows. Each is discussed in the light of the role it plays in the intelligent redesign of instruction. Once we whet your appetite and provide some initial basis for seeing why it is that teachers tend to find it difficult both to develop assignments that require student reasoning and to assess the students' "reasoning" once completed, the stage will then be set for understanding how to go about redesigning instruction.

THE BASIC BUILDING BLOCKS OF REASONING: MASTERING THE ART OF BREAKING REASONING DOWN INTO ITS COMPONENT PARTS

As students of the art of reasoning, we must learn to take our thinking apart at the seams, to see the nuts and bolts of it, the very stuff, the elementary stuff, out of which critical thinking moves are inevitably structured. This includes nine elements:

a) the purpose that guides it

b) the questions or problems on which it is focused

c) the information it gathers and uses

d) the ideas and concepts by which it shapes the information it uses

e) the conclusions and interpretations to which it comes

f) the reasons it gives in justification

g) whatever it takes for granted

h) whatever it implies (or leads to in the way of consequences)

i) the point of view in which it is embedded as a whole

If we want to develop as critical thinkers, we need to develop an interest in making moves that probe these basic structures implicit in all our reasoning. Let me illustrate. As good reasoners we should be ever ready and disposed to probe our thinking with questions like the following, each of which constitutes a critical thinking move:

a) What am I trying to accomplish?

b) What problem or problems am I solving?

c) What information do I need and where can I get it?

d) What basic concepts do I need to clarify and carefully use?

e) What conclusion or conclusions shall I come to?

f) What do I base those conclusions on?

g) What am I taking for granted? Should I?

h) What is implied in my reasoning? To what consequences does it lead?

i) From what point of view am I reasoning? Do I need to consider others?

These are some of the most basic and fundamental considerations continually used by good reasoners to keep their reasoning functioning well.

Each of the elements of thought defines a domain of "moves" that good critical thinkers effectively make. There are a variety of moves one can make concerning one's purpose, a variety concerning the question at issue, a variety concerning information, etc.

SYNTHESIS:
MASTERING THE MOVES THAT PUT THE PARTS OF REASONING TOGETHER

Each of these elements becomes a focus of skill and ability. Each becomes a shaping force in the nature of reasoning. By taking these elements into account in a variety of orchestrated ways, we are able to articulate a variety of important critical thinking moves in the process of figuring things out. We learn how to:

- uncover significant similarities and differences
- recognize contradictions, inconsistencies, and double standards
- refine generalizations and avoid oversimplifications
- create concepts, arguments, or theories
- clarify issues, conclusions, or beliefs
- clarify and analyze the meanings of words or phrases
- develop criteria for evaluation: clarify values and standards
- evaluate the credibility of sources of information
- compare analogous situations: transfer insights to new contexts
- compare and contrast ideals with actual practice
- analyze or evaluate arguments, interpretations, beliefs, or theories
- generate or assess solutions
- analyze or evaluate actions or policies
- rethink our thinking: metacognition
- question deeply: raise and pursue root or significant questions
- make interdisciplinary connections
- explore thoughts underlying feelings and feelings underlying thoughts
- design and carry out tests of concepts, theories, and hypotheses

- reason dialogically: compare perspectives, interpretations, or theories
- reason dialectically: evaluate perspectives, interpretations, or theories

Each of these abilities, depending upon the context and mode in which it is carried out, becomes a constituent in even larger structures of reasoning. We will touch upon these next.

MODES OF REASONING: LARGER STRUCTURES OF REASONING

All of the many component abilities of critical thinking, and the variety of critical thinking moves they presuppose, can be orchestrated in a number of basic ways. For example, reading, writing, speaking, and listening are four modes of reasoning. We reason while we do them and we use any of the full variety of critical thinking abilities and moves in the process. For example, if we were reading a book we might begin, for example, by trying to figure out the author's purpose in writing the book. In doing this we might make the following moves: What does the title of the book tell me about the purpose? What can I learn from the preface and introduction? Once we began to figure out the purpose, we might try to figure out the main question at issue and the main conclusion developed in relation to that question. Following any of a number of possible strategies, we would continue to reason through the text.

Consider the following example of two students engaged in reading a text. This example is taken from an important article by Stephen Norris and Linda Phillips ("Explanations of Reading Comprehension: Schema Theory and Critical Thinking Theory" in *Teachers' College Record*, Volume 89, Number 2, Winter 1987). Clearly the student who is reading the text well is reasoning his way through the text, carefully using the words of the text as "evidence" that must be taken into account in interpreting what the text means. We can see in these two readers a striking difference between good and bad reasoning embedded in the act of reading (the questions and commentaries within the text below are those of Norris and Phillips).

> In what follows we will present, episode-by-episode, Steven's and Colleen's thinking aloud as they work through the passage. The experimenter's questions are given in brackets. We have chosen to make our example detailed, because we see this as the best route for providing specificity to otherwise vague generalizations about the relationship between reading and thinking. To simulate the task for you we present the passage without a title and one episode at a time, as was done with the children.

EPISODE 1

The stillness of the morning air was broken. The men headed down the bay.

Steven

The men were heading down the bay, I'm not sure why yet. It was a very peaceful morning. [Any questions?] No, not really. [Where do you think

they're going?] I think they might be going sailing, water skiing, or something like that.

Colleen

The men are going shopping. [Why do you say that?] They're going to buy clothes at The Bay. [What is The Bay?] It's a shopping center. [Any questions?] No. [Where do you think they're going?] They're going shopping because it seems like they broke something.

Steven recognizes that there is insufficient information for explaining what the men are doing. On questioning, he tentatively suggests a couple of alternatives consistent with the information given, but indicates there are other possibilities. Colleen presents one explanation of the story, and seems fairly definite that the men are going to buy clothes at The Bay, a chain of department stores in Canada. On being queried she maintains her idea that the men are going shopping, but offers an explanation inconsistent with her first one that they are going to buy clothes. To do this she assumes that something concrete was broken, which could be replaced at The Bay.

EPISODE 2

The net was hard to pull. The heavy sea and strong tide made it even difficult for the girdie. The meshed catch encouraged us to try harder.

Steven

It was not a very good day as there were waves which made it difficult for the girdie. That must be some kind of machine for doing something. The net could be for pulling something out of the water like an old wreck. No, wait! It said "meshed catch." I don't know why but that makes me think of fish and, sure, if you caught fish you'd really want to get them. [Any questions?] No questions, just that I think maybe the girdie is a machine for helping the men pull in the fish or whatever it was. Maybe a type of pulley.

Colleen

I guess The Bay must have a big water fountain. [Why was the net hard to pull?] There's a lot of force on the water. [Why was it important for them to pull the net?] It was something they had to do. [What do you mean?] They had to pull the net and it was hard to do. [Any questions?] No. [Where do you think they're going?] Shopping.

For both children the interpretations of Episode 2 built on those of Episode 1. Steven continues to question what the men were doing. He raises a number of alternative interpretations dealing with the context of the sea. He refines his interpretations through testing hypothetical interpretations against specific details, and hypotheses of specific word meanings against his emerging interpretation of the story. At the outset he makes an inference that a girdie is a machine, but leaves details about its nature and function unspecified. He tentatively offers one specific use for the net, but immediately questions this use when he realizes that it will not account for the meshed catch, and substitutes an alternative function. He then confirms this interpretation with the fact from the story that the men were encouraged to try harder and his belief that if you catch fish you would really want to bring them aboard.

Finally, he sees that he is in a position to offer a more definitive but tentative interpretation of the word girdie.

Colleen maintains her interpretation of going shopping at The Bay. When questioned about her interpretation, Colleen responds in vague or tautological terms. She seems not to integrate information relating to the terms net, catch, and sea, and she seemed satisfied to remain uninformed about the nature of the girdie and the reason for pulling the net. In the end, she concludes definitively that the men are going shopping.

EPISODE 3

With four quintels aboard, we were now ready to leave. The skipper saw mares' tails in the north.

Steven

I wonder what quintels are? I think maybe it's a sea term, a word that means perhaps the weight aboard. Yes maybe it's how much fish they had aboard. [So you think it was fish?] I think fish or maybe something they had found in the water but I think fish more because of the word "catch." [Why were they worried about the mares' tails?] I'm not sure. Mares' tails, let me see, mares are horses but horses are not going to be in the water. The mares' tails are in the north. Here farmers watch the north for bad weather, so maybe the fishermen do the same thing. Yeah, I think that's it, it's a cloud formation which could mean strong winds and hail or something which I think could be dangerous if you were in a boat and had a lot of weight aboard. [Any questions?] No.

Colleen

They were finished with their shopping and were ready to go home. [What did they have aboard?] Quintels. [What are quintels?] I don't know. [Why were they worried about the mares' tails?] There were a group of horses on the street and they were afraid they would attack the car. [Any questions?] No.

Steven is successful in his efforts to incorporate the new information into an evolving interpretation. From the outset Steven acknowledges that he does not know the meaning of quintel and seeks a resolution of this unknown. He derives a meaning consistent with his evolving interpretation and with the textual evidence. In his attempt to understand the expression *mares' tails* he first acknowledges that he does not know the meaning of the expression. Thence, he establishes what he does know from the background knowledge (mares are horses, horses are not going to be in the water, there is nothing around except sky and water, farmers watch the north for bad weather) and textual information (the men are on the bay, they have things aboard, the mares' tails are in the north) and inferences he has previously made (the men are in a boat, they are fishing). He integrates this knowledge into a comparison between the concerns of Alberta farmers with which he is familiar, and what he takes to be analogous concerns of fishermen. On seeing the pertinence of this analogy he draws the conclusion that the mares' tails must be a cloud formation foreboding inclement weather. He claims support for his conclusion in the fact that it would explain the skipper's con-

cern for the mares' tails, indicating that he did not lose sight of the overall task of understanding the story.

Colleen maintains her original interpretation but does not incorporate all the new textual information into it. She works with the information on the men's leaving and the mares' tails, but appears to ignore or remain vague about other information. For example, she says the cargo was comprised of quintels but indicates no effort to determine what these things are. She cites the fact that the men were ready to leave and suggests that they have finished their shopping, but does not attempt to explain the use of such words as skipper, cargo, and aboard in the context of shopping for clothes. She interprets mares' tails as a group of horses that possibly would attack the men, but gives no account of what the horses might be doing on the street. Basically, she appears to grow tolerant of ambiguity and incompleteness in her interpretation.

Socratic questioning and role-playing are also modes of reasoning. The Socratic questioner orchestrates questioning in a variety of ways, using any of the full variety of critical thinking moves in the process. This is more obvious, of course, if we remember that typically Socratic questioning occurs during a discussion and therefore while both speaking and listening are going on. A similar point can be made for role-playing.

Criticality, Creativity, and the Standards of Good Thinking

Good thinking is thinking that does the job we set for it. It is thinking that figures things out, that poses problems to be solved and intricacies to reason through and then meets the challenge it has set itself with appropriate intellectual work. "Criticality" and "creativity" have an intimate relationship to this process. There is a natural marriage between them. Indeed, all thinking that is properly called "excellent" combines these two dimensions in an intimate way. Whenever our thinking excels, it excels because we succeed in designing or engendering, fashioning or originating, creating or producing results appropriate to our ends in thinking. It has, in a word, a creative dimension.

Like the body, the mind has its own form of fitness or excellence. Like the body, that fitness is caused by and reflected in activities done in accordance with standards (criticality). A fit mind can successfully engage in the designing, fashioning, formulating, originating, or producing of intellectual products worthy of its challenging ends. To achieve this fitness the mind must learn to take charge of itself, to energize itself, press forward when difficulties emerge, proceed slowly and methodically when meticulousness is necessary, immerse itself in a task, become attentive, reflective, and engrossed, circle back on a train of thought, re-check to ensure that it has been thorough, accurate, exact, and deep enough.

In a sense, of course, all minds create and produce in a manner reflective of their fitness or lack thereof. Minds indifferent to standards and judgment tend to judge inexactly, inaccurately, inappropriately, prejudicially. Preju-

dices, hate, irrational jealousies and fears, stereotypes and misconceptions — these too are "created", "produced", "originated" by minds. But they are not the products of "creative" minds. They reflect an undisciplined, an uncritical mode of thinking, and therefore are not properly thought of as products of "creativity". In short, except in rare circumstances, creativity presupposes criticality and criticality creativity.

INTELLECTUAL CHARACTER TRAITS

We can now begin to see why the mastery of reasoning is intrinsic to becoming a certain kind of person. At the highest level of development, the mastery of reasoning entails the development of a variety of interrelated character traits: intellectual humility, intellectual courage, intellectual perseverance, intellectual civility, intellectual integrity, intellectual curiosity, intellectual responsibility, intellectual autonomy, fairmindedness, and faith in reason.

Once we state the principles that underlie one of these traits, it becomes apparent what sort of critical thinking moves and strategies are intrinsic to them. Consider, for example, the principle behind intellectual humility:

> PRINCIPLE: Awareness of the limits of one's knowledge, including sensitivity to circumstances in which one's native egocentrism is likely to function self-deceptively; sensitivity to bias and prejudice in, and limitations of one's viewpoint. Intellectual humility is based on the recognition that *no one should claim more than he or she actually knows.* It does not imply spinelessness or submissiveness. It implies the lack of intellectual pretentiousness, boastfulness, or conceit, combined with insight into the strengths or weaknesses of the logical foundations of one's beliefs: knowing what evidence one has, how one has come to believe, what further evidence one might look for or examine.

Given an understanding of and commitment to this principle, critical thinkers make moves such as the following. They question what they think they know. They admit the limitations of their knowledge. They readily admit to appropriate qualifications to their knowledge. They admit to mistakes when they make them. They modify their beliefs when the evidence requires such a modification. They listen with an open mind to people who have different experiences and perspectives. The acts of an intellectually humble mind readily lead to the expansion of knowledge and the development of insight. Needless to say, intellectual moves based on understanding the elements of thought, abilities, and modes are intrinsic to the development of these intellectual character traits.

✦ *How Do We Redesign Instruction?*

The Basic Idea

The redesign of instruction is based upon a judgment as to what students are presently not learning that they should be learning. We have argued at length that the most fundamental failure in education is the failure to teach students to reason well. Reasoning, we have contended, is the only means by which people acquire knowledge, master content, and solve problems. If students become proficient in figuring things out — while reading, writing, speaking, and listening, while studying the subjects they should master, while tackling the problems of everyday life — then they get precisely what it is that schooling at its best should be "giving" them but is not.

As teachers, therefore, we should continually be asking:

How can I get my students to reason more and reason better?

How can I get my students when "studying" science to reason scientifically? How can I get them enthusiastic about and skilled in scientific reasoning? To pose scientific questions? To seek scientific data and information? To acquire scientific concepts? To question their non-scientific assumptions? To grasp scientific truths?

How can I get my students when "studying" math to reason mathematically? How can I get them enthusiastic about and skilled in mathematical reasoning? To pose mathematical questions? To seek mathematical data and information? To acquire mathematical concepts? To question their false mathematical assumptions? To grasp mathematical truths?

How can I get my students when "studying" history to reason historically? How can I get them enthusiastic about and skilled in historical reasoning? To pose historical questions? To seek historical data and information? To acquire historical concepts? To question their false historical assumptions? To grasp historical truths?

How can I get my students when "studying" geography to reason geographically? How can I get them enthusiastic about and skilled in geographical reasoning? To pose geographical questions? To seek geographical data and information? To acquire geographical concepts? To question their false geographical assumptions? To grasp geographical truths?

It is questions and concerns such as these that are essential to the successful redesign of instruction. If we put these questions continually at the center of our thinking as teachers, we will progressively move toward a model for instructional design and redesign which helps transform students into better thinkers and learners.

WHAT DOES THIS BASIC IDEA OF DESIGN ENTAIL?

If as a teacher you are continually concerned to get your students to reason while learning, in order to learn well and deeply, then you will be keenly interested in a variety of other concerns as a matter of course. You will be interested in *the basic elements of reasoning,* because they represent both a basic orientation and a resource for fundamental moves in reasoning. You will be interested in understanding the various *component critical thinking abilities,* because they represent the kinds of moves you want students to master. You will be interested in the *modes of reasoning* — reading, writing, speaking and listening — because one cannot learn without reasoning well within them. You will be interested in intellectual *traits of mind,* because without them students will be unmotivated to practice the abilities they initially learn. You will be interested in *intellectual criteria and standards,* because without them reasoning cannot be assessed.

Our idea for instructional design is built on a systematic approach that includes all of the dimensions above. The logic of the teaching process should reflect the logic by means of which students ought to learn.

✦ *Six Forms of Decision-Making in Designing or Redesigning Instruction*

There are six forms of decision-making in designing instruction:

I) Get Clear About What the Students Have to Reason About (the domain, the topic and the issue).

1) What is the domain about which the students will have to reason (e.g., within what subject or field: historical reasoning, economic reasoning, biological, anthropological, reasoning about a poem, about a short story, about...)?

2) Express, as specifically and as clearly as you can, the precise question at issue.

3) Ask yourself what sorts of things a person must do to reason well about this question (include here what sorts of facts persons must have, the understandings they must possess, the motivations or values they must have, the skills, etc.).

II) Find Something That Students Are Already Familiar With to Use as a Bridge or Crutch to Help Them Learn What They Are Not Familiar With

Decide where in their lives the students already deal with this question.

1) Once you have the problem or question-at-issue clearly in mind, scan the life-world of your students looking for questions in their lives that logically mirror or are analogous to the question at hand.

2) Two Back-Up Strategies: If for some reason you can't find a problem in the life-world of your students that mirrors the question at hand, consider two back-up strategies: *a)* Could you help them to reason to the answer on the basis of what they have already learned about the

subject or *b)* Could you give them a group of examples from everyday life that they could examine and come to a conclusion about, pro or con?

III) Make Decisions About How You Are Going to Use Large and Small Groups

1) Typically you should begin with a large group Socratic discussion that helps the students to locate themselves with respect to the subject. Describe how you will do this.

2) As soon as the basic framework for the question is set in large group discussion, switch to small group discussion (groups of 3 or 4). The groups should have a specific amount of time and a specific task. They should have a clear sense of what is expected of them and of how they will have to report back.

3) You might from time to time have the groups report to another group, having the groups give feedback to each other. Describe.

IV) Get Clear About Assessment Issues

You should always think about how you are going to get the students to reason with discipline, how they are expected to get into the elements of what they are thinking about, how they are expected to use critical thinking abilities, what critical thinking standards are most important, and what traits can be cultivated. Decide on your overall plan for getting the students to reason with discipline in the lesson or unit, keeping in mind the major obstacles to disciplined reasoning about the topic.

V) Include Critical Writing as Well as Critical Speaking and Listening

The working groups should often culminate in an individual or group writing assignment. You should spell out what you want carefully and clearly, taking the time to make sure that the students understand what you are asking for and how they should assess themselves along the way.

VI) Gathering and Interpreting Information

At some point along the way, it will often be necessary to have the students gather and interpret information. When you do so, the students need to gain an appreciation of precisely what the task entails and what is expected of them. How will you do this?

NOW LET US GET CLEAR ABOUT WHY EACH OF THESE DIMENSIONS IS IMPORTANT:

1) Getting clear about what the students have to reason about forces us to become clear about the logic within which we want students to reason. The requirements for the reasoning will be importantly determined, first, by the general logic of the domain, and second, by the specific logic of the particular question at issue.

2) Finding something that students are already familiar with to use as a bridge to help them learn forces us to consider how to make the learning real and meaningful.

3) Making decisions about how we are going to use small and large groups forces us to consciously consider how to maximize the active

involvement of the students in the learning process and maximize the knowledge base and idea pool available to all students.

4) Getting clear about assessment issues forces us to decide on how we are going to help the students to assess their own reasoning.

5) Getting clear about how and when students will read and write, as well as engage in Socratic questioning or role playing, forces us to decide on which of these important modes of reasoning the students will engage in.

6) Trying to find opportunities for students to gather information on their own forces us to maximize the extent to which our students will free themselves from dependence on others for information.

✦ *A Sample Redesigned Lesson*

Let us now look at a sample redesigned lesson to see what the end product of this process might look like.

Geographical Thinking and Human Welfare

Deep Point: Getting insight into how "geographical thinking" is essential to human welfare.

Central Concept: geographical features

Central Issue: What is the relation between geographical features and the conditions of human life?

Present Practice

> Geography is often taught, like many other subjects, as a conglomeration of factoids that students are given to memorize and be tested upon. Rarely do students have to reason geographically in such instruction.

Critique

Geographical facts and concepts play an increasingly important role in schooling, and rightly so, but when they are taught didactically, students rarely learn how to *reason geographically.* Consequently, students rarely acquire geographical insights or an enthusiastic sense of how and why geographical thinking is essential to human welfare. Etymologically, the word 'geography' means "a description of the Earth". In fact geographers are most principally concerned — in contrast to, say, geologists — with the implications for human life of facts about the Earth. In studying the Earth from the geographical standpoint, one can concern oneself with mathematical questions (about the size, shape, and movements of the Earth), about "physical" questions (about the layers of the Earth's surface and about the forces histor-

ically shaping those surfaces), or about "biological" and "human" questions (about the life conditions of plants, animals, and humans). The result is that good geographical reasoning presupposes some ability to reason geologically, astronomically, zoologically, botanically, meteorologically, and historically. The central concept is "the Earth in evolution" and the central impact of informed reasoning with respect to that concept is insight into the way in which the evolution of the Earth has shaped and transformed, and continues to shape and transform, conditions for life on Earth.

Now since all reasoning involves basic fundamental structures or elements (*elements of thought*), and since these elements are essential to reasoning well, it is important that, as we cultivate geographical thinking, we cultivate students' awareness, not only of their use, but of the need for *standards* in their use of these decisive structures. So, because all reasoning serves a *purpose* which directs it, we want our students to have a *clear* purpose in mind as they go about *reasoning geographically.* Because all reasoning generates *questions* that need to be expressed *clearly* and *precisely* in order to be answered, we want to teach in such a way that students get experience in putting their *geographical questions* into clear and precise form. Because all reasoning depends upon *accurate* and *sufficient information* about the "things" we are reasoning about, it is important that we design instruction so that students have opportunities to *gather, interpret,* and *assess geographical information.*

It is important that the specific content that we are focusing on — land forms in this case — not become an end in itself, that is, not be reduced to a series of surface facts about the shape and character of land. Finally, it is important that we not overwhelm our students with either questions or facts, nor proceed so quickly that they are not able to *reason* their way into the content on the basis of their previous *knowledge, beliefs,* and *experiences.*

Proposed Design for Instruction

I will bring some globes into class, divide my class into groups of four or five, and ask that each group figure out what they can tell about the planet from what they see on the globe itself (*collaborative learning, dialogical thinking, critical listening, independence of thought, intellectual perseverance*). I will ask, "Based on what you know right now about interpreting what you see represented on the globe, figure out what conclusions you can justifiably come to concerning the Earth and the conditions for life on it." I would stimulate thinking with more specific questions like this: "For example, are there areas of the world that you can see that you believe would have very few plants and animals? Are there areas of the Earth where people could not live except under very special circumstances?" (*Thinking aloud*), etc.

I would give the groups a set amount of time to prepare a short report on the conclusions they came to and when the groups reported I would encourage the class to question how the individual groups came to the conclusions they came to and whether or not those conclusions were, in their view, justified (*formulating questions at issue, distinguishing evidence from conclusions, assessing inferences, noticing and questioning assumptions, analyzing concepts, critical listening, critical speaking, and dialogical, perhaps even dialectical, thinking*). As the reports and probings into the reports were taking place, I would be writing on the board the geographical *concepts* that were occurring, and *questions and problems* that were arising, in the *geographical reasoning* being presented.

Subsequent to this activity, I would lead a general discussion on the *assumptions*, including the assumed geographical *ideas*, implicit in their group's *reasoning* as well as in the subsequent *questioning* of that reasoning (*Socratic questioning*). I would outline the *issues* that arose (*identifying and clarifying issues*). I would ask the class to help me divide the issues into those that have to do with the nature of the Earth as a whole and those that have to do with specific areas of the Earth (*analyzing and classifying questions*). On the basis of the division I got, I would ask the group to choose which cluster of *questions* they wished to explore in working groups (which would be assigned as library research as the basis of a further report to the class as a whole) (*critical reading, collaborative learning, dialogical thinking*). I would underscore the importance of discussing in the group what to include and why (*seeking and giving good reasons*). I would ask the students to pay attention to what questions or issues they feel they have answered or resolved and which questions or issues they have not (*intellectual humility*).

The report would be a written report and I would spell out to the class how the report should be structured and why (*critical writing, asking root questions, clarifying purpose*). In doing this last, I would periodically stop and ask the question, "Why do you think it is important to do this in writing up your report?" For example, "Why do you think it is important to identify your sources?", "Why do you think it is important to put into quotes what you take literally from outside sources?", "Why do you think it is important to separate the conclusions you come to from what you are basing your conclusions on?", "Why do you think it is important to make us a short glossary of the important technical terms that you are using in your report?" (leading to *assessing the credibility of sources, clarifying evidence, making well-reasoned inferences).*

Four copies of each report would be made and each group would now become an assessment group for the report submitted by another group (*assessing reasoning, utilizing elements of thought and intellectual standards*). Before each group proceeded with the assessment, I would hold a discussion with the class as to how to go about assessing the reports (*designing and analyzing standards for evaluation*). This would involve, ultimately, detailed suggestions as to what to look for and why. The emphasis, of course, would be on constructive suggestions as to how the report could have been made more useful to the class, including comments on what further research would be required in the light of what the report did and did not accomplish (*intellectual civility, intellectual responsibility, intellectual humility*). I would emphasize the importance of trying to figure out what further questions or issues are raised in the light of the findings of the groups (*intellectual curiosity, intellectual perseverance*).

The next activity would be the reading, by a representative of the research group, of their report to the class as a whole (*critical speaking, critical listening*). The floor would then be opened for questions (because everyone has already served as part of an assessment team on some groups' report I would expect every group report to generate some good probing questions) (*dialogical thinking, asking root questions, analyzing and assessing reasoning, clarifying concepts, identifying assumptions, tracing implications, developing one's perspective*). After each report and question and answer period, a representative of the assessment team for that report would summarize the assessment teams' findings (*critical speaking*). The class would be given an opportunity to comment on the assessment (*critical listening, analyzing and assessing reasoning*, etc.). In this period any member of the group whose report was assessed could respond as well, agreeing or disagreeing with elements of the assessment (*critical speaking, dialogical and dialectical thinking, assessing reasoning, developing one's perspective).*

In the light of the issues and questions that arose from the reports, assessments, and discussions, new clusters of problems would be generated, new groups formed, and new research projects begun, leading to new assessments, new discussions, and yet further questions and issues. From this design for teaching "land forms" it is apparent that a conception is being formed that could be generalized to a whole semester. It illustrates therefore how, given skill in the art of instructional design based on critical thinking, one can avoid detailed lesson plan design for each class, and of how well-conceived overall design strategies can simplify, when they don't obviate entirely, the tasks of day-to-day design.

✦ *Patterns in Teaching*

Every teacher teaches in a patterned way, though few teachers are explicitly aware of the patterns implicit in their teaching. For many teachers the pattern consists in nothing more than this: lecture, lecture, lecture, quiz; lecture, lecture, lecture, quiz; lecture, lecture, lecture, mid-term exam, with occasional question and answer periods focused on recall with respect to lectures and the textbook. It is important for teachers who aspire to take command of their teaching to foster higher order learning to begin to develop a sense of the patterns implicit in their own instruction, to critique those patterns, and to begin to experiment with patterns that enable them more readily to cultivate the critical thinking of their students. For one thing, once one discovers one or two powerful patterns of teaching with which one can successfully work, it is possible to structure a whole semester of teaching around that pattern.

Assuming that one has accepted the view that students must reason through what they are learning, there is a basic logic to deciding on the pattern of instruction to use. The basic logic comes in three variations (or schemas):

Schema One: Thinking to Conceptual Understandings and Insights

1) Decide upon some kind of "start-up activities" (which will help the students to begin thinking about the subject—typically this involves linking the subject with their experience).

2) Now, given that the thinking of every person is "individual" and some "diversity" of conclusions is to be expected from having thought about a topic, decide upon some way for the students to synthesize the insights, collect information together, or analyze what they have come up with, including identifying any conflicts or contradictions that have emerged.

3) Now develop an activity which will help the students to assess what they have successfully figured out and what still remains to be figured out.

On this model, our patterns of instruction should reveal many episodes of individuation, reconciliation, and assessment. The students begin their thinking on a topic, develop it, and then test it (figuring out at the end what they have learned and what is still to be learned). This pattern would hold whether or not the topic was a technical one — just so long as it required that they develop their concepts and understandings of something.

However, there are two other basic alternative schemas which we should also be aware of (in addition to the "thinking-to-conceptual-understanding" schema). The first is based on all those occasions in which we are teaching the students to think through doing "research" on a topic and those in which we are teaching them a skill or ability by modeling it for them.

Schema Two: Thinking Through Research

The research schema also has three parts: *1)* start-up thinking, *2)* fact or information gathering, and *3)* analysis and assessment of information or facts gathered.

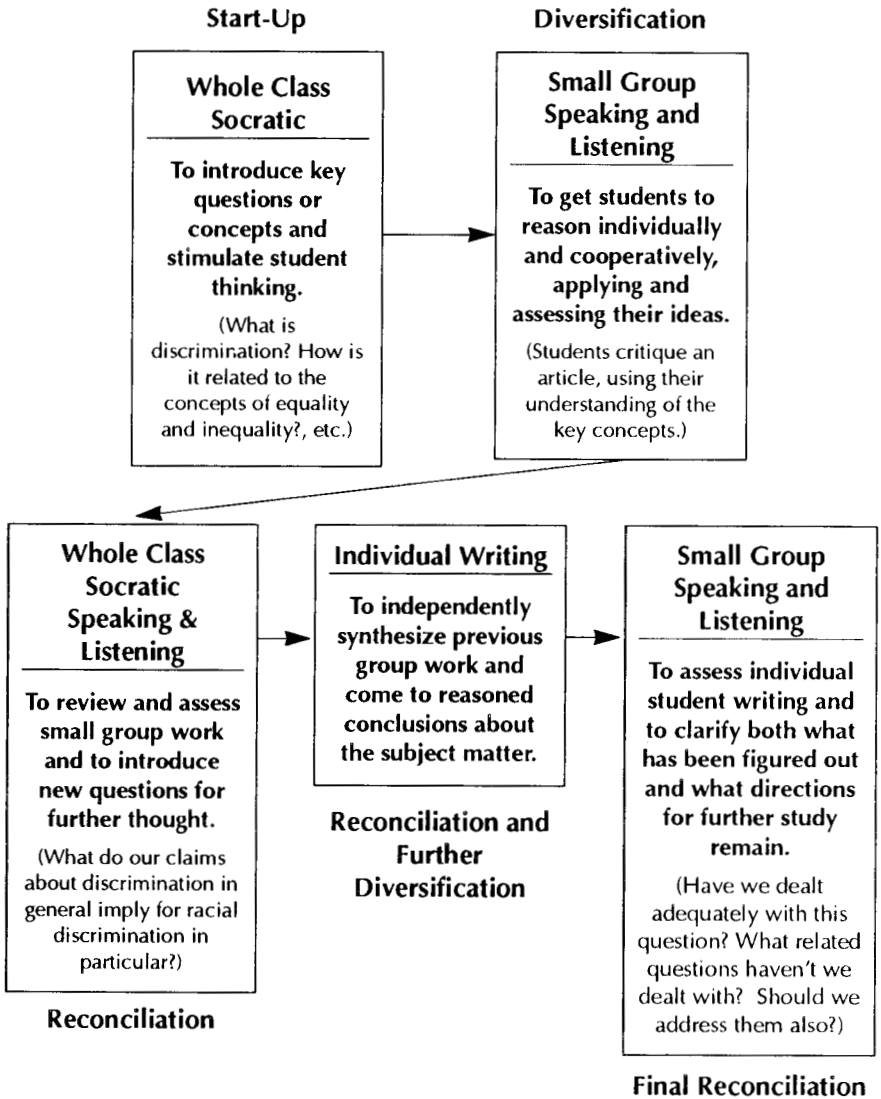
Schema Three: Reflective Modeled Practice of Skills

The skill-development schema has three parts as well: introduction (what are we going to try to learn), modeling (I model the skill slowly and carefully

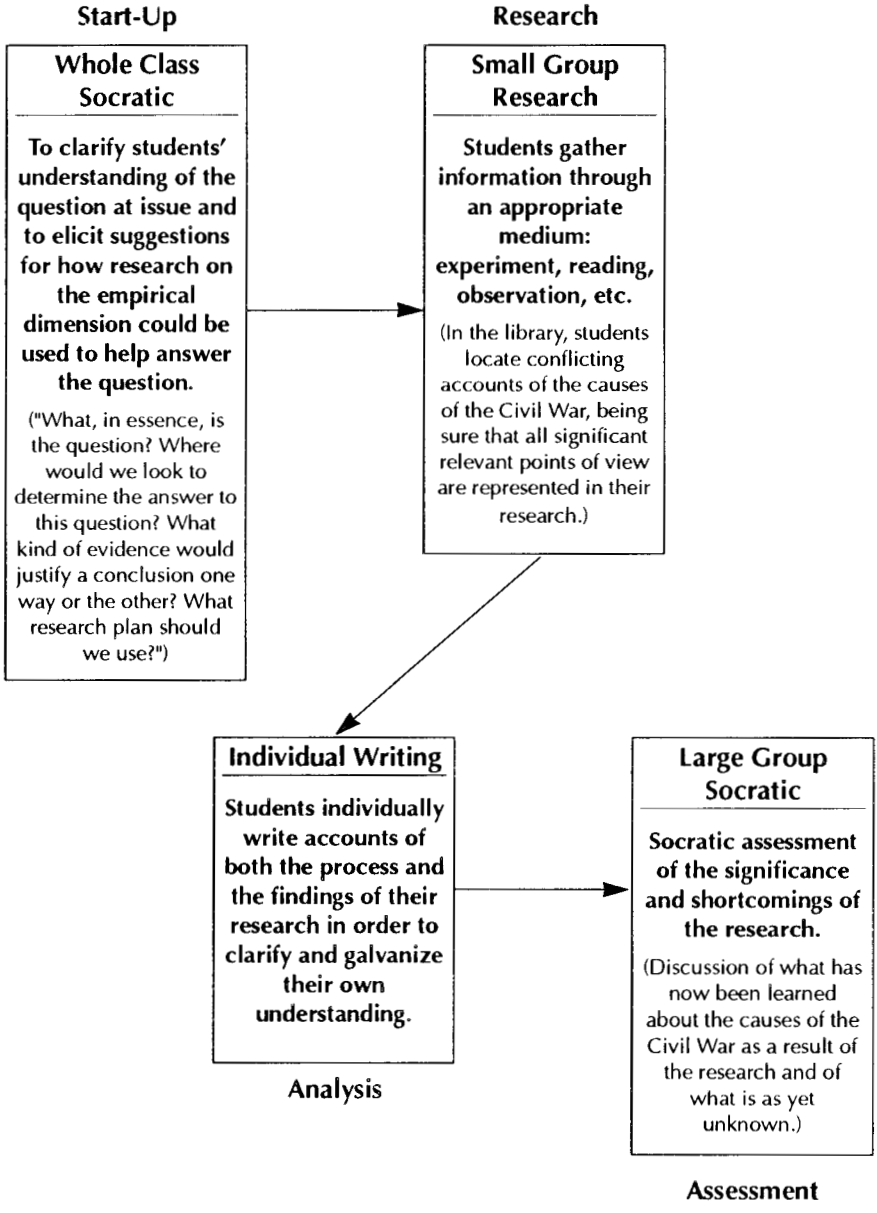
in front of the students), and practice (the students try to emulate my example). The second two phases of this schema may well be repeated multiple times: "I do it — they do it — I do it — they do it — I do it — they do it."

Now consider the following variations on the three schemas above, each with different "modules" of instruction (each one of which we represent with a box).

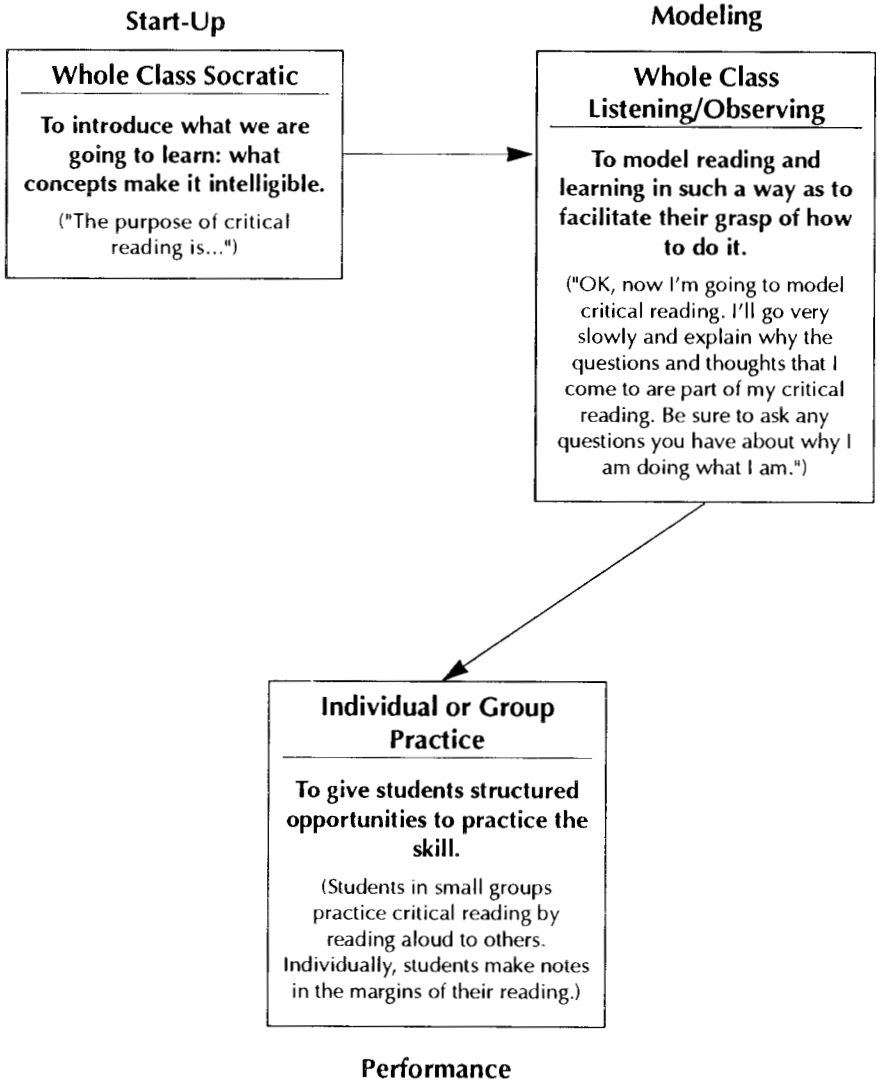
Schema One: For a lesson on discrimination: The main objective is to have students engage in moral reasoning, we might use the following pattern:



Schema Two: For a lesson on the civil war: The main objective of this lesson is to teach students how researching historical events can lead us to a better understanding of them, and how this in turn can lead us to benefit from that understanding. We might use the following pattern:



Schema Three: For a lesson on critical reading: The main objective of the lesson is to get students to gain skill in critical reading through practice.



Given the analysis of teaching and learning, the following general recommendations for instruction represent important needed changes that should now be intelligible to the reader:

TACTICAL AND STRUCTURAL RECOMMENDATIONS

1) *Design coverage so that students grasp more!* Plan instruction so students attain organizing concepts that enable them to retain more of what you teach. Cover *less* when *more* entails that they learn *less.*

2) *Speak less* so that they *think more!* (Try not to lecture more than 20% of total class time.)

3) *Don't be a mother robin* — chewing up the text for the students and putting it into their beaks through lecture! Teach them instead how to read the text for themselves, actively and analytically. Focus, in other words, on how to read the text, not on "reading the text for them".

4) *Focus on fundamental and powerful concepts with high generalizability.* Don't cover more than 50 basic concepts in any one course. Spend the time usually spent introducing more concepts applying and analyzing the basic ones while engaged in problem-solving and reasoned application.

5) *Present concepts,* as far as possible, *in the context of their use* as functional tools for the solution of real problems and the analysis of significant issues.

6) *Develop specific strategies for cultivating critical reading, writing, speaking, and listening.* Assume that your students enter your class — as indeed they do — with limited skills in these essential learning modes.

7) *Think aloud in front of your students.* Let them hear you thinking, better, *puzzling* your way slowly through problems in the subject. (Try to think aloud at the level of a good student, not as a speedy professional. If your thinking is too advanced or proceeds too quickly, they will not be able to internalize it.)

8) *Regularly question your students Socratically* — probing various dimensions of their thinking: their purpose; their evidence, reasons, data; their claims, beliefs, interpretations, deductions, conclusions; the implications and consequences of their thought; their response to alternative thinking from contrasting points of view, and so on.

9) *Call frequently on students who don't have their hands up.* Then, when one student says something, call on other students to summarize in their own words what the first student said (so that they actively listen to each other).

10) *Use concrete examples whenever you can* to illustrate abstract concepts and thinking. Cite experiences that you believe are more or less common in the lives of your students (relevant to what you are teaching).

11) *Require regular writing for class*, but grade using random sampling to make it possible for you to grade their writing without having to read it all (which you probably won't have time for). Or have the students themselves select their best work for you to assess.

12) *Spell out explicitly the intellectual standards you will be using in your grading*, and why. Teach the students, as well as you can, how to assess their own work using those standards.

13) *Break the class down frequently into small groups* (of two's, three's, four's, etc.), give the groups specific tasks and specific time limits, and call on particular groups afterward to report back on what part of their task they completed, what problems occurred, how they tackled those problems, etc.

14) *In general, design all activities and assignments, including readings, so that students must think their way through them.* Lead discussions on the kind of thinking that is required.

15) *Keep the logic of the most basic concepts in the foreground,* continually re-weaving new concepts into the basic ones. Talk about the whole in relation to the parts and the parts in relation to the whole.

16) *Let them know what they're in for.* On the first day of class, spell out as completely as possible what your philosophy of education is, how you are going to structure the class and why: why the students will be required to think their way through it, why standard methods of rote memorization will not work, what strategies you have in store for them to combat the strategies they use for passing classes without much thinking, etc.

✦ *Conclusion*

The redesign of instruction presupposes intellectual development on three fronts, a growing recognition of *1)* what is wrong with didactic instruction, *2)* the nature and dimensions of critical thinking, and *3)* pedagogical strategies that can be used to effectively integrate critical thinking into instruction (based on 1 and 2). Problems of understanding on any of these fronts can produce problems in implementation. It is not enough for our hearts to be in the right place. Nevertheless, it is possible to begin the process of moving forward on each of these fronts *simultaneously*. Indeed, that is the only way that significant progress can be made. We must continually teach with three considerations in mind: Am I falling into the traps of didactic instruction? Are the students reasoning their way through the class, or are they falling back into roles of passivity? What strategies and what patterns of instruction am I using to keep students involved in disciplined critical thinking?