Critical Thinking in Composition: Heuristics as Tools for Exploratory Discourse
by Richard Jewell *(content, 7-07; minor rev. 11-09, 11-11, & 6-20)*

 Aeschylus tells us that the first humans “had eyes” but “saw to no avail” and “ears, but they did not understand” until Prometheus brought fire, which helped them “discern the rising of the stars” and “the combining of letters . . . with which to hold all things in memory” (pars. 2-3). Promethean fire was heuristic: a tool–in this case symbolic and abstract–that caused learning. Many intellectual objects are heuristic if we perceive them not just as static abstracts but also as exploratory tools. This is true especially of exploratory discourse.

The Problem

 When Prometheus brought fire to humans, no doubt it singed many as they learned its use. This also often happens to composition instructors and students trying out critical thinking. Their difficulties are evidenced in part, at least, by the contraction of critical thinking in composition textbooks from the 1980s and 1990s, when perhaps a dozen composition textbooks were completely devoted to critical thinking, to the current situation in which, though many textbooks now refer to critical thinking, they usually do so for only one chapter or, more commonly, in a brief subsection in each chapter.

 My own first attempt in 1992 to add critical thinking to composition, unscripted by a textbook, was something of a disaster. The spring before–though my field is composition–I experimented with team teaching a philosophy course in problem solving with someone who thereafter became a six-year co-coordinator of a statewide, college-and-university Critical Thinking Initiative. My experience with the course was very positive. Moreover, in addition to my composition background, I once earned two philosophy degrees. I decided to read extensively during the summer and, in the fall, to convert my first-year, WAC-oriented composition course to a critical thinking focus. For my FYC section, I chose the rhetorical modes as a structure, using them as taxonomically ascending forms of critical enquiry, with argument at the end.

 However, teaching critical thinking terms and methods was much harder than I expected. I was able to convince my students of the importance of our work, but when I asked them every other week how they were doing, they often described how worn out they felt from "too much thinking.” (For a similar classroom situation, see Jewell, "Too Much"). I quickly found that writing comments on their papers seemed to take twice as long as normal, too. By the end of the term, the students and I were exhausted. I polled them and discovered contradictory effects. First, though very impressed with what they had learned, they had no idea how to apply it. Second, they perceived their workload as being, on average, twice that of any other course they'd taken; however, in separate, week-by-week polling, the actual number of their workload hours was no higher than that of my other composition students during the previous two years.

 Clearly, for these students, learning critical thinking was like starting fire with a bow and a stick instead of turning on the microwave. There also were the problems of transfer of learning and the extra time I was spending on papers. I decided to dump my new system, go back to my old one, and gradually find less obvious–and more organic–methods of introducing critical thinking.

 Too many systems of teaching critical thinking in composition have made similar mistakes, both in textbooks and pedagogy. It is difficult to categorize all systems and their combinations, but a simple summary suggests that two methodologies have dominated the pedagogy of critical thinking as it exists in composition in recent decades: (1) logical argument and fallacies, and (2) problem solving, either alone or as a response to case studies. I have come to believe that while critical thinking certainly involves both of these, it is a mistake to limit critical thinking pedagogy to these methods alone.

 Current composition textbooks are problematic, too. Most create what Xin Liu Gale calls a "discouragement of [the] critical thinking" (201) that is "one of the most important goals of freshman composition" (191). She uses the 1997 *St. Martin's Guide to Writing* as an example, calling the advice in such textbooks simplistic, reductive, conformist, traditional, and static; and she paraphrases Lester Faigley's contention that the *Guide* and like textbooks work, in Gale's words, "to reduce students to commodities and docile bodies" (202). While this criticism may seem rather harsh–and some textbook publishers recognize the holistic and process elements of critical thinking–still there is a tendency to turn critical thinking elements into static objects. What publishers–and instructors–need to recognize is the dynamic core of critical thinking: its explorative and metacognitive aspects and resulting heuristic nature.

Definitions

It may be helpful to define "critical thinking," "heuristic," and "exploratory discourse." Chet Meyers points out that critical thinking is neither simply formal argument nor problem solving, nor is it merely the study of logic, though all of these elements certainly can be part of it. Like the word "process" when applied to writing, the phrase “critical thinking” means something different in its details to each person who uses it. Some define it by Benjamin Bloom's well-known taxonomy in which each element includes all others below it:

**Bloom's Taxonomy of Thinking Skills**

* Evaluation
* Synthesis
* Analysis
* Application
* Comprehension
* Recall

 This is not unlike David Bartholomae's largely taxonomic elements of writing skills in "Inventing the University." He does not simply list them, so I have attempted to summarize them here with the highest element first:

**Bartholomae's "awareness of the codes . . . within a discourse" (521)**

* an very advanced writer who "can both define a position of privilege . . . against 'common' discourse, and . . . work self-consciously, critically, against not only the 'common' code but his own" (521)
* an advanced writer "consistently and dramatically conscious of herself forming something to say" (521)
* a somewhat advanced writer developing "an 'objective' analysis or a 'close' reading" (519)
* an early advanced writer who, as "Shaughnessy says, . . . can hear the 'melody of formal English'" (523)
* a basic writer imagining "the privilege of being [an] 'insider'" (516) who can begin to "establish authority" (523) using "the voice of the [academic or technical] community" (521)
* a basic writer offering "a Lesson on Life" (513) with "the articulation of the commonplace" (519)

Bartholomae also paraphrases Linda Flower's argument that "the difficulty inexperienced writers have [is] negotiating the transition between writer-based [self-centered] and reader-based [audience-centered] prose" (514).

Robert Ennis of the Illinois Critical Thinking Project adds, "Critical thinking . . . includes most or all of the directly practical higher order thinking skills [as in Bloom's Taxonomy]"; however, "critical thinking is not equivalent to the higher order thinking skills." Rather, it is (also) "reasonable reflective thinking that is focused on deciding what to believe or do." In fact, says Ennis, "critical thinking includes dispositions" (10).

Several common parameters do exist. The critical thinking movement of the past several decades gradually has developed a paradigm for good critical thinking. Such thinking is

(1) Broadly defined: Multiple definitions and interpretations of the subject are possible.

(2) Process oriented: It works best–and can be generally described–in stages or steps.

(3) Logical and expressive: Factual, emotive, and intuitive thinking all should be valued.

(4) Recursive: The best thinking often repeats some steps to examine a problem.

(5) Transferable: Most critical thinking patterns can be applied in other disciplines.

(6) Reflexive: Good critical thinking is self-aware of both its processes and public sources.

(7) Discursive: The best thinking often develops from a mix of private and public discussion.

A second term is "heuristic." Philosophy and the field of education often use the term to refer to systems that cause learning. "Heuristic" means "to discover or find," and heuristics sometimes are referred to as educational tools--tools that help discovery. In short, heuristics are tools for finding, discovering, or learning something.

Another term is the phrase "exploratory discourse." Exploratory discourse is, simply, discourse that explores a subject. James Kinneavy identifies exploratory discourse as "dialectical--probable (Aristotle and Aquinas)," "valuative (Morris)," and "questioning--interrogative (Russell)" (65); as an "opinion (Plato)" and a "way of invention (Cicero)"; and as involving "discovery (Bacon . . . , Descartes)," "proposing (Pierce)," and "inquiry (Dewey)" (98). Even "emotion is not entirely excluded . . . , e.g. Plato's dialogues" (68). As Nathan Crick says, exploratory discourse also is active as in Dewey's concept "that 'mind is primarily a verb' . . . , an action, not an entity" (268).

Thus we can define heuristics as active tools for exploratory discourse–methods of using discovery to probe for something more than what we know now. I like to use a metaphor suggested to me by Joel Peterson, Director of the MnSCU Critical Thinking Project: using heuristics is like having a toolbox. This is not the common "toolbox" of the St. Martin's Guide, whichaccording to Gale mostly contains tools for polishing, copying, and positioning. Instead, a heuristic toolbox contains tools that dismantle things, dig inside them, and enable users to build structures hitherto inconceivable to them.

Critical Thinking in the "Social Turn"

Unfortunately, some people believe critical thinking cannot be taught. One time I presented a short discussion of critical thinking at an English educators' state conference, and the keynote speaker of the conference, who will remain unnamed here, was the president of a national English education group. He attended my session and, at one point, said something like this: “I can agree with those who say that students can, indeed, be taught to write well, but I still don’t believe students can be taught to think.” I was dumbfounded. I thought that contemporary education recognized precisely that students can indeed learn to think; I had come to the conference to speak to the converted and offer new tools. Fortunately, others in the audience responded–some, I was glad to find, with the same level of discomfort as mine--and a lively discussion ensued.

I wish now that I had asked the speaker about his theoretical position. Given his level of importance, he must have been conversant with then-emerging 1980s-'90s paradigms. His statement is reminiscent of Thomas Kent's "paralogic" project in the early 1990s to show that composition is unteachable in composition courses, though the speaker seemed to apply that logic to thinking, not writing. On the other hand, he may have considered critical thinking part of an older, overly scientific paradigm in teaching. It is difficult in a few paragraphs to define writing pedagogies old and new that are still in use. However, with that difficulty in mind, a brief review of what they are and how critical thinking fits into them may be helpful.

Egon Guba, Professor Emeritus of Education at Indiana University, defines the two most common old paradigms still used in academic education as "positivism" and "postpositivism." The older group of the two, positivists (loosely defined as logical positivists, behaviorists, and empiricists), dominated the teaching of college writing through the early to mid-1970s (and, of course, in some places much later). According to Guba, they believe everyone must use science and logic exclusively to interpret what is an entirely objective reality. This positivist paradigm in writing studies is what we now call "current-traditionalism," which Joseph Petraglia describes as a "focus on the individual writer and how [to] shape discourse to gain the audience's assent" (40). It often led to the exclusive teaching of the rhetorical modes, grammatical usage, and editing–or to the belief that writing to literature provided sufficient training in writing, along with a handbook–such as Strunk and White's *The Elements of Style*–on making a point efficiently and editing well.

The limitations of positivist writing pedagogy helped foster the 1960s-'70s changes known as process, expressivism, and cognitive theory. These movements were part of what Guba defines as "postpositivism"–subjective additions to positivism. In writing pedagogy, they added internal, subjective procedures to the teaching of writing: internalized writing steps, self-expression and freewriting, and descriptions of writers' cognitive stages. However, Petraglia's "focus on the individual writer" producing "discourse to gain the audience's assent" remained. In addition, Carol Berkenkotter's criticism that the overall cognitive paradigm in psychology at that time was "exceedingly mechanistic" (153) can be applied to the many prescriptive systems of writing steps that arose, along with their often equally prescriptive demand that all writing must start with self-expression.

In the 1980s and '90s, writing studies took the oft-named "social turn," what Patricia Sullivan calls in a 1995 *College English* review "the default theory of the nineties" (950). Guba usefully divides it in two: "critical theory" and "constructivism." "Critical theory," he says, "is ideologically oriented inquiry"–"neo-Marxism, Freireism, participatory inquiry," et al. (23). Critical theorists believe we are part of the power systems in which we have been raised, and we need to become aware of their dynamics. Writing studies often has focused in particular on Paulo Freire's dialogic "critical consciousness" and the related "democratic pedagogy" of Ira Shor, James Berlin, and others.

Constructivists go a step further. Guba, who counts himself among them, says they "feel that the positivist (and postpositivist) paradigms are badly flawed and must be entirely replaced" (25). In writing studies, Petraglia says that constructivists (also called "social constructionists" and "social epistemists") believe "social forces . . . shape the writer's perception of reality" (51), "all reality is mediated through language" (45), and "knowledge [exists] through an individual's interaction with [a] 'discourse community'" and "resides in consensus . . ." (38). That is, words create and shape all intelligent perception, and each social group's words determine both its knowledge and its blindnesses. As Patricia Bizzell comments on her first year as a constructivist, "I believed that 'everything' was constituted by discourse" (8). In the classroom, some constructivists rely on deconstruction alone: a process of making students aware of the limits of their constructed social realities. Other constructivists help students learn to work with several realities or viewpoints. Still others guide students to learn and negotiate academic and professional realities.

More recently, a truce exists in the writing paradigm wars. Some say it is a pause for reassessment that may engender the "ecumenical climate" of "healthy eclecticism" Berkenkotter called for in 1991 (159). Kathleen Blake Yancey, CCCC Chair in 2005 and NCTE President in 2007, refers to our present climate as a "plural commons." Similarly, Pat Hutchings and Mary Taylor Huber of the Carnegie Foundation describe education theory in general as meeting in two such "commons": the traditional "academic commons" of "disciplinary scholarship" and a newer "teaching commons" where "educators committed to inquiry and innovation [can] exchange ideas. . . ." They are speaking of the teaching and learning movement, a loosely knit set of organizations and cross-curricular practices found especially in faculty development programs. Some practices include critical thinking, "brain" studies, and writing and thinking across the curriculum, thus making the question even more relevant of whether critical thinking can be taught with and in writing.

Does critical thinking fit into Guba's positivist and postpositivist paradigms? Current-traditionalists–the positivists of writing studies–borrowed emphases on logical argumentation and the logical fallacies from critical thinking. Later, process, expressivist, and cognitive instructors–the postpositivists of writing–used critical thinking to help describe the cognitive states of the composing process; to support self-expression by describing it also as intuition, emotion, and nonverbal forms; and to add case studies and problem solving to writing. Similarly, the critical thinking movement adopted process, expressivist, and cognitive methods in writing studies. It did so by emphasizing writing as a way to think more clearly, recursive steps as a method of problem solving, self-expression as a first step in problem solving, and cognitive states as forms of thinking.

However, possibly because of critical thinking's easy adaptation to positivist and postpositivist paradigms, some social turn theorists may have too easily considered it part of the individualist, mechanized past theory they so disliked. Fortunately, in more recent years, a number of theorists have recognized that the deeper explorative elements of postpositivist theories can fit well in social turn practices–e.g., Berkenkotter, Crick, Flower (Construction), Petraglia, Sullivan, and Yagelski, to name a few. In particular, though critical thinking and cognitive science are clearly different, still they have long been related because of their mutual concern with mental events; and a particularly fertile reassessment has been Linda Flower's project to unite older cognitive writing studies with social turn methods. She argues for a "social-cognitive" theory of "cognitive rhetoric" in which individual private acts of mental cognition are perceived as taking place within social contexts, and vice versa. As Sullivan says, "the cognitive and the social . . . interact in the construction of meaning . . . as both a private and a communal act" (954). While Sullivan argues Flower places too much emphasis on the private cognitive element, Berkenkotter suggests the problem lies more in the perceptions of two different types or schools of research, and she makes her own recommendation for more "sociocognitive research" (159). As Petraglia point out, contemporary cognitivists are no longer postpositivists; rather, they "concur that meaning is constructed both subjectively and socially [in] a constant interaction between . . . mind and . . . outside world" (46). Both Flower and Berkenkotter's theories translate to the classroom as an effort to help students better learn sociocognitive phenomena–both the internal and external events that affect them as writers. And this, in turn, requires critical thinking's heuristic discovery and metacognition.

Second, writing theory has used the phrase "critical thinking" with varied meanings: sometimes as a synonym for the social turn's "critical theory" and "critical discourse" (e.g., see "The Berlinean Movement" string in the 2002 WPA-L archives); for Freire's "critical consciousness" and Shor's "critical pedagogy" and "critical teaching"; and sometimes as a generic term referring simply to deeper or more thoughtful thinking. While critical thinking certainly can include all of these, the overall critical thinking movement–and the phrase–are like current writing studies: a "plural commons" of multiple ideas that adapt themselves to practices in many disciplines and theories. Critical thinking never was, as philosopher Derek Turner says, "simply about poking holes in other people's arguments" (5). For example, the 2004 NCTE position paper on teaching writing offers an entire separate category about writing as "a tool for thinking." It also adds that writing "involves thinking . . . about what strategies writers might employ to produce . . . texts," and examining those texts requires "the development of reflective abilities and meta-awareness about writing." In fact, the active core–the beating heart, so to speak–of critical thinking is not logic but rather heuristic and metacognitive activities. Both of these happen to be profoundly important in social turn pedagogy.

Paolo Freire's "critical consciousness" is an important example. He initially developed it as a process for teaching peasants. He avoided offering them traditional rote learning, instead encouraging them–through questioning and dialogue–to detach themselves from their social order so they could stand clear of it mentally and see their true relationship to their oppressive regime. Some theorists have said critical consciousness is not relevant in a democracy because democracy already fosters it. However, even if this were true, "critical consciousness" and "critical thinking" are not synonymous: the former may be defined as a single type of practice or event in one type of teaching, but the latter describes an entire movement and activity with much broader applications. Other practitioners of Freire's method such as Bizzell are now "dissatisfied with 'critical consciousness' as a . . . goal of my teaching" (3) because teaching academic discourse does not seem to lead automatically to critical consciousness, and any teaching with a "morally neutral tool" (287) is impossible. However, Freirean critical consciousness is not just an awareness of social ills; rather, like Thomas Dewey's "mind," it is a verb–an ongoing act of discovering truth. As Anthony Petruzzi argues in disagreement with Bizzell, critical consciousness is "not an object" but rather "the event of affective self-finding"–"truth is a verb," a process of finding new possibilities for existing (317). In critical thinking terms, it is a deep metacognitive disposition that, when in action, is heuristic–full of exploration and discovery.

Another important social turn concept, "democratic pedagogy," also involves critical thinking. Practitioners of democratic pedagogy use deep questioning and open-ended dialogue among students. In addition, say James Berlin, Bizzell, and others, teachers should be part of that dialogue by explaining their own political and cultural biases to their students, and how these biases will help the class reach democratic outcomes. Ira Shor, an early interpreter of Freire and one of the strongest advocates of democratic pedagogy, goes a step further in democratizing the classroom by offering students more power to determine their learning–and by breaking the pattern students fall into so easily of sitting back, not speaking, and not caring. All such instruction can create what Cynthia Lewis calls "exchanges in which positions [are] not fixed, but rather tentative, exploratory, and interdiscursive" (377). She refers specifically to a specific method, critical discourse analysis, but her comment applies to other forms of democratic pedagogy used by both students and instructors. Such conversation is open-ended and laden with discovery: heuristic and metacognitive.

Much as a result of social turn pedagogies, one of the most powerful critical thinking changes that has happened in writing classrooms in recent years is the replacement of traditional thesis papers in part or whole with assignments involving deeper analysis and dialogue. These deeper assignments, whether short or long and in rough or finished drafts, are transforming the teaching of writing from a persuasive individualist model to an exploratory social one. The better forms of such analysis are dialogic, whether directly or indirectly so, in their pursuit of differing viewpoints. Some classrooms even encourage dialogic papers–papers that discuss two or more opposing or differing viewpoints. The thinking expected for such papers requires students to go outside their normal frames of reference and to explore difference.

In fact, there is a very real sense in which critical thinking defines the difference between good and bad social turn instruction. Exploratory discourse creates a classroom community's expansion of knowledge, while teaching methods that avoid explorative thinking cause a classroom community to limit itself, to remain in stasis. What Charles Bazerman calls the "social reconstruction of knowledge" (as quoted in Sullivan 956) is a series of heuristic conversations with texts, other students, and communities. Students should move from being passive reproducers of knowledge to active negotiators of it. As Berkenkotter says, social turn instruction should help students "conduct multimodal inquiry": to "be epistemologically ecumenical, that is, to become conversant with more than one model of inquiry" (166). Though she writes this about graduate students, it also applies to undergraduates. This is exactly what explorative critical thinking hopes for, too: students capable of discussing different ways of seeing, thinking, being, and generating meaning.

Why Heuristics Work

Explorative discourse, as I mentioned above, can be viewed as a large toolbox with many heuristic tools. One proof of this in actual practice is how explorative tools work with basic college students–those once labeled “dumb” or, in more recent decades, "remedial." Such students often have different cultural references, languages, customs, or methods of thinking (including dyslexia), and many simply need to be shown the tricks of our trade–the methods we use for academic and professional discussion in this country–that happen also to be heuristic.

Mike Rose situates this problem well in *Lives on the Boundary* in his story of Millie, “whose test scores placed her . . . very low just about anywhere . . .” (218). Rose tried to show Millie how to handle a set of multiple-choice test questions. Each of these test questions asked Millie to give the meaning of the underlined prefix of a word: for example, for “unhappy,” her multiple-choice options were “*very, glad, sad, not*” (217). Many students in Millie’s class, like Millie herself, had already failed this set of questions. Rose explained to Millie in every way he could how to see the underlined prefix, and still she made her choices based on the entire word. Finally, in frustration and almost as an afterthought, Rose did “something the publishers of the test tell you not to do”: he circled the underlined prefix of one of the words in the questions. Millie immediately chose the correct answer (218-19). Then, just as Rose was ready to stop his session with her, Millie circled the next underlined prefix on her own. She then answered the question correctly. She proceeded, next, to circle several more prefixes and to choose the correct answers, and on the last question, she did so without needing to make a circle physically: she now could “see” what she was supposed to. Rose concludes, “Cognitive psychologists talk about task representation, the way a particular problem is depicted or reproduced in the mind. Something shifted in Millie’s conception of her task, and it had a powerful effect on her performance” (220). In the terms of critical thinking, Rose gave Millie a heuristic, simple in conception yet explosive in its small locus of impact. He taught Millie to think like an academic. More recently, Rose shows in *The Mind at Work* how post-secondary vocational instructors weave critical thinking into their classes. In an interview by Michael Eisenberg, Rose says that students in such classes learn "acuity in perception and observation," "skill in planning and prioritizing," "use . . . of symbols," "planning, troubleshooting, and problem solving," the ability to "reflect on their own actions and modify them to improve task performance," and "aesthetic and craft values" (Eisenberg 296). As Wayne Nelson says, "To design is to solve problems" (par. 1-3).

Rose reminds us of Jerome Bruner's famous statement in *The Process of Education*: “Any subject can be taught effectively in some intellectually honest form to any child at any stage of development" (quoted in Rose 142). Scientists now tell us that genetically modern human beings developed as long ago as 200,000 years (Wong). This means that if we could take a newborn from then and raise it–and if all else were equal medically–we would have a normally functioning human being, student, and thinking professional. If we should be able to do this with someone from the dawn of human existence, we should be able to do so with the majority of students today–and with most of those who enter college. My mother, an elementary school teacher for a number of years and then the founder and department chair of early childhood education at Carl Sandberg Community College in Illinois, claimed she could teach third graders thesis paper writing. She showed me her simple but effective method, which taught a basic argument structure. It used personal experience heuristically for proofs. I was surprised and wondered why more students were not receiving such basic instruction in their early years. Most instruction that is effective teaches heuristics; one can argue, in fact, that the primary difference between the traditional paradigm of learning by rote memory and more recent ones of learning to think–to analyze, compare and contrast, and synthesize–is a difference of heuristics.

In my own thinking and teaching, I imagine myself having a wide variety of heuristics–of tools in my intellectual toolbox. Some tools let me take apart the machinery of systems to see what makes things tick. Some are gardeners' tools with which I can go rooting about in the fertile dirt of ideas new and old, digging, planting, and examining roots and rocks. Some tools are simple, others marvelously complex; in any given task I am free to pull out several tools and see which help me the most in discovery.

I have four especially important sections in my own toolbox, and it is these four sections or elements that I have learned to address as I teach exploratory discourse to my students not only in composition but also in literature and the humanities. One element is that we can teach questioning. Second, we can harness freewriting, one of the most powerful tools available–but only if we use it heuristically. A third is to fill students' toolboxes with many tools by teaching them categories: forms, patterns, or structures. Fourth, we can help students become metacognitive about tool making: to make their own tools.

Asking Questions

The first of these four elements is questioning, a heuristic attitude basic to the critical thinking movement. So important is it that the authors of some composition and critical-thinking textbooks form their tables of contents by emphasizing questions (e.g., Anselmo, Bernstein, and Schoen; Mayfield; Winterowd and Winterowd). Consciously asking questions means, simply, that instead of giving students commands, we speak interrogatively: for example, instead of commanding, "Define love," we ask students, "What is love?" Instead of commanding, "Exemplify perfection,” we ask, "What are some good examples of perfection?" Such questioning empowers or emboldens students to respond more creatively and energetically, and the questioning form also may model real academic, professional, and personal situations more accurately than do command statements. In addition, both teacher and student tend to see the process of thinking and writing as open ended rather than closed: as discovery rather than repetition of photographically impressed knowledge.

At the simplest level, heuristic questioning leads to freewriting. In fact, as Thomas Hilgers points out regularly, it is reasonable to rename prewriting and freewriting "pre-thinking" and "freethinking," for that is exactly what such activities foster. We know now that writing is thinking. We also need to remember that just as good writing often uses freewriting, good thinking often uses freethinking. Freethinking in a questioning mode is heuristic: it asks for discovery. It encourages opening up, not narrowing or limiting, expansion rather than contraction, and tentativeness rather than assurance. Peter Elbow defines such thinking as "first-order thinking" in Embracing Contraries and suggests that all generating is a form of thinking (55). Tom Anselmo, a leading expert in the field of critical thinking and writing, has described "much of the best thinking" as generative. He says, with Leonard Bernstein and Carol Schoen in their textbook, Thinking and Writing in College, that it consists of "non-logical, free-associational, and intuitive leaps of the mind" (vi). And Edward de Bono, whose work initially helped define the contemporary field of critical thinking, more recently calls critical thinking "generative thinking": "practical, creative, and constructive, . . . messy, imperfect, impure and perhaps difficult to teach" (16).

In the classroom, this means encouraging the kind of "freethinking" that leads students to open-ended exploration and new possibilities instead of mere confirmation of what they already think, know, or feel. While the latter–confirmation–may help, neither student nor teacher should learn to consider it the end; instead, heuristically, what is already known is at best a beginning, something that necessarily should lead to other possibilities, questions, and positions.

A form of asking questions called “Socratic questioning” is especially popular in critical thinking. In Socratic questioning, the discussion leader most often leads by asking questions rather than making statements. Richard Paul, a leader in the field of critical thinking, and A.J.A. Binker describe the Socratic method as being "at the heart of critical teaching” (360). They suggest flexibility so it can occur in many ways–“from the teacher or from students, . . . in a large group discussion, in small groups, one-to-one, or even with oneself”–such that the questions “can have different purposes” (361). Shirley Shiever recommends varying the types of questions: recall, inference, and implication (80).

Another issue is reading. Questioning makes it heuristic. Nancy Sommers and Laura Salz found in their study of Harvard writing students that students who participated in deep, ongoing research–often on just one or two specific topics in a course–believed they learned more about writing and research than did other students. Part of the value of such research is the deeper reading; another value is increased interest among students in what they are reading. Both are more heuristic in that they create more questioning. Heuristic reading also can be achieved by choosing challenging readings. Joseph Harris describes, for example, how he paired contrasting readings–e.g., Stevenson's Dr. Jekyll and Mr. Hyde and Martin's Mary Reilly (which speaks from the viewpoint of Dr. Jekyll's servant)–in a class for at-risk students. He then encouraged students to examine the differing points of view in order to have them "focus as directly as we can on the unstable workings of writing itself . . ." (582).

Similarly, Mariolina Salvatori suggests we ask students to "perform . . . introspective reading” (446) that “engage[s] texts responsibly and critically” by making “readers articulate a reflexive critique” of the textual arguments and their own responding ones (444). She offers exercises and activities that force students to question both their texts and their own readings of them using methods similar to Ann Berthoff’s “close reading" technique, which encourages constant heuristic questioning at both simple and metacognitive levels.

In my own first-year Composition II course, I assign Bergner's *In the Land of Magic Soldiers*, a literate and deeply disturbing account of the 1990s civil war in Sierra Leone, West Africa, and a related book of each student's choice. In class discussions, I speak mostly by posing questions, sometimes stopping to provide background facts, and I ask everyone to participate at some point. I also state several times, "If you have more questions after we are done talking than before, this is a sign of progress."

Turner offers two interesting methods of responding to formal student papers using questioning. "Instead of asking students to revise their papers," he says, "why not ask them to write replies to [five or six of your own] questions about their arguments" (6)? He suggests doing so "virtually eliminates" plagiarism because students do not want "to write replies to questions about somebody else's paper," and the practice "does not take much more time than writing marginal comments." He recommends "tailor[ing] the questions to each student's needs and abilities." He adds, "Instead of asking students to edit each other's papers, why not have them swap papers and raise questions about each other's arguments" after they first write "a brief summary of the other person's main argument" (7)?

Stephen Brookfield and Stephen Preskill state that "the heart of sustaining an emerging discussion are the skills of questioning, listening, and responding. . . . Of the three learning to question takes the most practice and skill. . . ." Indeed, as Barbara Palmer has noted, how we ask questions can make the difference between a discussion that goes nowhere and one that turns into a "complex communal dialogue that bounces all around the room." Brookfield and Preskill list several types of questions and recommend "skillfully mixing" them:

 Questions That Ask for More Evidence

 Questions That Ask for Clarification

 Open Questions

 Linking or Extension Questions

 Hypothetical Questions

 Cause-and-Effect Questions

 Summary and Synthesis Questions

The goal of such questioning always is to encourage students to extend and expand their thinking, to perceive in new ways, and to develop a heuristic attitude of questioning. This develops the habit in students of not presuming that their writing–and their thought–is completed.

Freewriting Heuristically

Freewriting is a second heuristic tool, one that the critical thinking movement has adopted wholeheartedly, in part because freewriting is by definition supposed to be exploratory. I say "supposed to," however, because it also can become a disappointingly limiting structure. In the 1970s and 1980s, students often welcomed the new experience of freewriting and the parallel expressivism it offered. However, by the 1990s, our culture of education and even, arguably, TV and music, had come to value creative self-expression. In addition, many secondary and even primary schools taught freewriting. I began to find my own students groaning when asked to use it. Part of the problem was that many had practiced it so much that they had come to think of it as simply producing summaries of their thoughts or feelings. Others, sufficiently experienced in the "liberation" of self-expression, wanted more sophisticated and concrete purpose or method for their writing–what Bazerman calls "a persona, a public face" that is appropriate to the author, audience, and situation (25).

How, indeed, can we reinvigorate freewriting? Simply, it needs to be heuristic: to become or be reinvigorated as discovery.

There are several specific ways to encourage exploratory freewriting. First, students can use freewriting as a form of answering or even asking questions as briefly mentioned above in "Questioning." However, as the above makes clear, the questions must be truly open-ended, not only by encouraging students to think of subjects in new ways but also by giving them sufficient direction or structure–which can be accomplished by offering students a variety of possible questions.

More specifically, in the classroom a structured heuristic approach to freewriting avoids overally generic directions and commands–such as "Write about your favorite experience this week"–and instead asks more specifically and with a variety of question options, "Answer one or more of these questions: 'What was your best experience this week, your worst, your most intense, or your most memorable, why, and/or how?'" "Instead of stating, generically, "Write what you know about abortion," a heuristic approach asks specifically and with more options, "What experiences have you or your friends had with abortion–as a man or woman, a friend or enemy, a relative or a boyfriend/girlfriend? How would you feel and respond (and why) if you found out one of your parents had considered aborting you? What should a pregnant fifteen-year-old runaway who uses drugs do if offered an abortion, and how or why?"

In other ways, too, freewriting should be heuristic and reflective–discovery-oriented–rather than forced, summative, laden with a feeling of purposelessness, or used only to stake out an irrevocable individual position. In other words, we should help students learn to turn freewriting into the art of being tentative. Elbow himself, the publication of whose *Writing without Teachers* in 1973 was the flashpoint for the freewriting movement, has always argued for openness. In *Writing*'s chapter "The Teacherless Writing Class," he strongly encourages interest in as many reasonable viewpoints as possible, along with a tolerance for many diverging viewpoints. Robert Yagelski points out in a recent review reevaluating "The Writing Process Movement after the Hurricanes" that Elbow, like many social turn theorists who came later, "is advocating a kind of epistemology in which knowledge is a function of reflection on one's own experience" (537). That is, though Elbow's "experience" is of a more personal and broader nature, still Elbow is suggesting a kind of learning that Diana George identifies as good social construction teaching: "the ability . . . to appreciate complexity and difference, a tolerance for ambiguity, or an understanding of conflicting ways of interpretation" (2). Of course, the prompts that encourage freewriting must be pertinent, as Meyers suggests (48). More important, though, is the emphasis on asking students to think with an open stance before making final decisions (29). Because what students are saying is tentative–and especially if the prompts are both difficult and interesting–students learn to allow themselves the openness to say much more, explore more, and perceive an expanded field of inquiry.

I have found, however, that when encouraging tentative freewriting and discussion, I must require two preconditions in my classroom, both of them constructivist and democratic. First, I make it clear to my students that their own beliefs are acceptable if supportable with rational proofs, and I make clear what "rational" means to me. (And I exclude such topics as the drinking age or abortion–unless the writer has had one–and simplistic methods of support such as a standard dictionary or scripture.) Second, I expect my students to tentatively experiment with the stance that knowing differing positions is useful: at the least, for being better able to disprove an opposing argument; in the longer view, for improving one's own intelligence, fairness, and civic virtue; and, in short or long run, for being able to change one's mind. Explaining this kind of stance to students may seem like teaching the obvious, but it is, in itself, a metaheuristic skill–the ability to maintain a position intellectually open to a variety of possibilities–a skill needing separation and development. This tool itself can be taught as one of the most important skills learned in a college education, and it allows students to feel they are in an environment that is safe enough for them to try exploring opposites.
 The next step is to ask students to harness freewriting heuristically to understand differing positions. If students know nothing about a subject, they may first need exposure to it through reading, practice, or other methods. Once they have had exposure, they may next need to explore their own understanding, feelings, or beliefs before they can explore others' or–if they are capable of doing so comfortably and fairly–of exploring together through discussion. Freewriting used as a tentative art with heuristic questioning can help them establish baselines for their thoughts.

How can students comfortably explore opposites? One method is to have them freewrite an opposite. For example, I often ask students to describe the kind of person who, they think, believes the opposite, and then to try to describe as rationally and fairly as possible why this person might take that position. Again, a number of open-ended questions can help. In addition, free speaking often is helpful: asking students to work in discussion groups to discuss opposites, with freewriting coming before, after, or both. Student groups and oral discussions need to be carefully structured and monitored to insure fairness, balance, and exploration. Some groups–and some subjects–may be so strongly positioned that oral discussion may not be possible until later in the term.

Another method is to situate students in a reading or case study, or a role-playing or service-learning activity–one that will create obvious intellectual or emotional tension. The role of emotional tension in particular is often too easily discounted. Rather, we should consider, as Petraglia points out, that "emotion shapes knowing. . . ." He categorizes this shaping of knowledge by emotion into "perception," "avoidance," and "memory" (48). All three are important in contributing to positive (or negative) tension in learning and discovery.

Role play can be especially powerful, too, when it is used to ask students to assume experts' roles and give the students opportunities and methods to use experts' thinking tools (see Jewell, "Role Playing"; Palmer). One such method is to provide organizational thinking tools, such as scientists' IMRaD (introduction, methods, results and discussion) or police work's MMO–means, method, and opportunity–and a situation in which students can apply it as a class, in small groups, and individually.

Another is to provide students with an imaginary situation. For example, to teach a taxonomy of thinking skills, I often have created on paper a family with a young teenager in trouble and then have asked students to write the discourse individual family members would use, their replies to each other, how friends of the family might present differing arguments, how expert outsiders might judge the situation, and how the family members might then evaluate it. This exercise is but one example of a case study: a carefully controlled form of role play, real or imaginary, that provides a situation or event with built-in intellectual (and sometimes emotional) tensions that students are asked to study and discuss. Case studies are highly popular in legal studies and the criminal justice field, and some proponents of critical thinking have encouraged their use in all fields. It is possible to choose or create a case study to challenge introductory or advanced students, and those in general courses or specific disciplinary activities.

Yet another form of role play for introductory or advanced situations is storytelling. It requires detailed application; more importantly, it is a natural form of critical problem solving because of its classic narrative pattern of person, problem, and solution. While all such forms of role play can exist at many stages of the discourse process, they tend–when they challenge students–to create heuristic freethinking, free talking, and freewriting.

What other freewriting forms can be heuristic? Some are nonlinear and even initially nonverbal. The freewriting movement in its many guises–in post-secondary, secondary, and primary pedagogy, both within English/composition and in other fields that have adopted its techniques–has given birth to many of these. A few examples are clustering, using idea trees, and mapping; use of automatic writing, feelings, pictographic storytelling, and intuition; writing with the help of music, food, drink, and ambient noise; listening to music, touching art, and watching body language and responding by writing; et al.). On the one hand, such techniques may, as mentioned above, remain as overly closed or repetitive as more academic/verbal ones. Students who are told for the twentieth time, for example, that they must "listen carefully to this song and state what emotions it contains" may feel bored, frustrated, or stubbornly unsure of what they should feel. However, the same freewriting assignment may become much more heuristic if students are asked (not told) to imagine or explore (not state), "What kind of person might listen to this music, when, and why; what might it help you imagine or do (and how, when, and why); or what do you imagine the people who play or dance to this music are like (and how, when, and why)?"

In short, freewriting is never "free" unless it is liberating. Often heuristic freewriting also is–or feels–difficult. Cognitive scientists now understand that when new thinking occurs, brains literally grow as neurons stretch toward each other to connect. This would explain why my first class of students to learn critical thinking in composition felt it was working so very hard when in actuality the students were committing no more time to homework than in an average composition class. They were literally–physically–experiencing more rapid than usual brain growth. Freewriting is an especially useful way to "grow brains" because most students consider exploratory discourse pleasurable if the subject challenges and interests them.

Structuring Heuristically

The third element in my teaching toolbox is the use of tools or structures. Such use assumes that questioning does not stop after freethinking is completed. Rather, questioning extends into the early stages of revision and becomes an application of form, pattern, or structure. David Perkins, who teaches thinking skills at Harvard's Graduate School of Education, calls such thinking "design." He says, “Understanding any piece of knowledge or any product of human intellect involves viewing it as a design, a structure shaped to a purpose” (64). Heuristics are structures “shaped to a purpose,” organizational or design forms that act as tools of discovery, and it is this understanding–intellectual design structures can be used to develop knowledge–that students need to learn.

Some of us in the field of writing are uncomfortable with using forms or patterns for our rhetoric. We have this discomfort in common with many people in the field of thinking. As de Bono notes, "in the field of thinking there is an instinctive dislike of structure and jargon." However, he says, "We can distinguish between *restricting* structures and *liberating* structures" (135; emphasis mine). "Tools," says de Bono, "are liberating structures. With the proper tools, students will surprise themselves "with ideas they had not had before" (136). Elbow also emphasizes the importance of using structures, forms, or patterns. He defines this kind of thinking and writing as "second-order thinking" (*Embracing* 55), and he argues that for learning to exist, there must be categories. He calls this "Learning as the Acquisition of Categories": "You only teach someone if you affect the way he files his data, processes his information, or makes his inferences. Teaching or learning involves introducing categories" (11). In other words, the very nature of learning--and therefore of critical thinking--is the use of patterns, designs, or structures. Thinking assumes not only a content but also a structure by which we view the content. As Kant, Hume, and social theorists alike might argue, we see the world through a colored lens and shape our world accordingly: our experience, expectations, and discourse communities give shape and form to how we perceive, and with these shapes we then order our world. The particular shapes–the designs that we use–are heuristic: we use them not only to order our world, but also to discover, explore, and make sense of it.

What kinds of structures should we introduce? One of the most popular in the critical thinking movement, whether among communications or other instructors, is problem solving. Problem solving is a method of asking questions: its very nature is heuristic and open-ended. A typical problem-solving structure often involves a process as follows (to which I have added writing steps that are similar):

(1) exploring all aspects of the problem (freewriting),

(2) developing a goal, a list of solution paths, and a description of each path (organizing), and

(3) choosing the best path(s) and evaluating possible outcomes (revising).

Like good writing, good problem solving is recursive. Problem solving is in particular a practical application of critical thinking, and teachers in many disciplines and in interdisciplinary instruction have developed problem-solving courses and units at colleges and universities throughout the nation. Many writing instructors in particular have modified their teaching by adding problem-solving and case-history elements; others present social differences as multidimensional problems that students may first think can be "solved" but later learn may yield only to several sometimes dissimilar "solutions."

 Such instruction, when it teaches specific structures for pursuing solutions, allows students to perceive thinking in a purer form even as its practical uses also become more obvious. Flower in Problem-Solving explains, for example, that she tells her students that “problem solvers are characterized by two things: a great deal of knowledge about their topic and a large repertory of powerful strategies for attacking their problems. Good writers share these qualities. . . . In the long run, this sort of knowledge about why things work is the best knowledge, because it lets you continue to teach yourself” (3).

There are many other structural forms commonly used in writing classes, from traditional rhetorical patterns to the 5 W’s, and from the inverted pyramid of journalism (and upside-down triangle of the paragraph) to heuristic patterns of questioning used by researchers. In a sense, any time we require organizational structure of our students, we are introducing categories, even if on the simplest level. In fact, often it is the introduction of such categories that many writing teachers most quickly identify as having something to do with thinking skills in writing, especially, for example, in expecting students in research-writing courses to demonstrate higher-order thinking. Such higher-order thinking is exemplified most commonly, perhaps, in the critical-discourse techniques of the social turn;, more traditionally, in Bloom's Taxonomy of Thinking Skills (see above), the three highest of which are analysis, synthesis, and evaluation; and also in the traditional rhetorical modes (with argument often considered the highest mode because it requires the use of the others).

However, we must be very careful to separate the concept of structure from the concept of heuristics. What is structured is not always what is heuristic. In other words, it is quite possible to use structure without it involving the heuristic process of search and discovery. As de Bono says, "We often mistake fluency and argumentation for thinking skill. . . . Error-free thinking is not necessarily good thinking" (15). We should not forget de Bono's distinction between liberating and restricting structures (135). Often, the difference is one of method rather than content. For example, instead of asking students to use the rhetorical device "definition" restrictively–to define the meaning of something already well known–we can use the device in a liberating manner in a quest for students to discover the defining parameters of some hitherto unexamined idea, perception, feeling, or experience. Again–as with freewriting and freethinking–much of the heuristic use of structures depends on questioning. If we conduct discovery by the use of questioning, the structures often become liberating. This is, for example, the method Anselmo, Bernstein, and Schoen use in their critical thinking and composition textbook. They started the book by looking for what they call the "controlling question":

The strategy we concentrate on is a carefully controlled questioning process. . . . To discover what questions would be most useful for this purpose, we read exam questions and term-paper assignments from professors in a wide range of disciplines. . . . We noticed that four patterns seemed to predominate--definition, process, comparison/ contrast, and cause/effect. . . . To probe more deeply . . . a second level of questioning [uses] the four basic patterns combined with other sorts of questions they suggest. (vi)

Much of the best thinking is generative, they write: "[T]o produce clear, coherent writing is equally vital and this process grows organically from the questioning strategies" (vi).

Heuristic structures take many forms in the classroom. In my composition classrooms, for example, they may be socially based, asking students to dialogue, step back from their beliefs, and step back from their stepping back. However, they also may as easily be rhetorical mode based or more loosely based on cumulative thinking skills such as analysis, synthesis, and evaluation. Sometimes, instead, they may be discipline based, using such genre-oriented discovery patterns as experiment, client observation, aesthetic analysis, event analysis, or storytelling. I try many structures in a variety of situations but try to teach all heuristically.

One of the most important keys to making such structures heuristic rather than restrictive has been to require students to use critical thinking on subjects they have never considered. In other words, I encourage students to work with subjects for which they do not yet have clear working definitions and classifications. I ask them to avoid objects and work instead with their lesser-explored feelings, beliefs, people, or events. Then we apply questions. For example, one time I asked a group of first-term college composition students to compare and contrast an idea, belief, feeling, or person to three similar subjects. One of my students wrote about her relationship with her boyfriend, comparing and contrasting it to relationships with her parents, her dog, and her best friend. She suggested that all four relationships "involve care, trust, compassion, and most of all, love." She had several interesting insights: for example, at one point she commented that she and her dog play by barking at each other and, on occasion, her boyfriend and she "also . . . will get in a little tiff and bark at each other." She finally concluded in a discussion section that each relationship "involve[s] a different kind of love" which is "well suited for the relationship." These ideas were, for an eighteen-year-old freshman learning to think about her life, far more than formulaic writing. The thinking and writing for her was at the heart of the discovery process.

Developing Metaheuristics

The fourth element of my teaching toolbox is to show students how to build their own tools. Giving them heuristic tools is not enough. In other words, students may learn structural patterns of questioning from us; however, in other courses and in life, they will find situations in which the structures do not fit. Our goal in teaching metaheuristics is, as Edith Weinstein says, to make “critical thinking [become] its own reservoir of learning that students draw upon not only to measure rigorously the logic of ideas in all disciplines but also to scrutinize constantly their own thinking” (287). Thus students should learn how to create structure itself, rather than just specific structures. That is, we want them to learn tools for making their own tools–in short, to learn metaheuristics.

One metaheuristic involves questioning and establishing relationships between questions. We need to teach students to identify the basic questions being asked in an academic, professional, or personal situation. One way to teach them how to do this is to train them to list or diagram (e.g., as in clustering) all the questions they believe an assignment or situation demands. Next, they should try to identify the main question and organize other questions into groups. Sometimes this process of identifying questions should be preceded by freewriting or followed by it; sometimes there needs to be a recursive process of writing, questioning, writing, and revising the questioning. Once they have grouped the questions, students can then decide which heuristics to use to seek answers to the questions–and what clarifying questions they may need to ask of others. However, the overall structure they have created–their choice of a main question and their organization of groups of other questions–will have been metaheuristically determined.

A second metaheuristic is structuring by analogy. This means that a student can decide what kind of structure to use in one situation by looking at similar situations in his or her past and examining what structures she used in those other situations. If, for example, we ask a student to write creatively about a tree, the student should analogize to past situations in which teachers have asked for creative expression and past situations in which teachers have asked for writing about trees, and then assume that a non-botanical, non-mechanical description is appropriate. This seems simple; however, students miscue frequently enough to suggest that specific training in analogy is appropriate. In general, a majority of students have difficulty transferring what they have learned about how to write (Beaufort, McCarthy, Sommers and Salz, Tebeaux). This seems especially true when we describe such transfer as an analogical task: students might know, for example, how to analyze conflict between Hamlet and Ophelia, but they still might easily fail to transfer this analogically to a conflict at work or in their personal lives. We also need to teach students to analogize from personal or professional situations to academic ones. Analogical thinking can work in two opposite directions to help students develop critical thinking skills, but for this to occur, we must isolate and teach analogy as a specific meta-tool.

One particularly useful concept in teaching students to analogize is the idea of the hierarchical taxonomy. A taxonomy is a classification or division of something into parts, and a hierarchical taxonomy has its parts classified in order, from lower to higher (or the reverse) with each higher part including or assuming all of those that are lower. A well-known hierarchical taxonomy in writing is process: generation, organization, and revision. Similarly, a simple, three-part hierarchical taxonomy of process in thinking skills includes observation, deductive and inductive thinking, and evaluation. One used in critical reviews is summary, arguments/interpretations, and judgments. A well-known hierarchical taxonomy in the field of thinking is Bloom's Taxonomy of Thinking Skills (see above). How can hierarchical taxonomies be useful to students? Most people use them–often unconsciously or in rough and halting conscious ways–to solve problems. Solving problems starts with recalling an experience, moves on to analyzing data about it and relating it to past experiences, and concludes with proposing tentative decisions. We can teach students to identify the process itself and thereby to control it metaheuristically for more accurate retrieval of data, better analogizing, and more careful evaluation. This process, in fact, is quite similar to the process of writing, including recursive work. Here are some questions to offer students that teach them hierarchical and taxonomic thinking:

1. What is your problem or question? Please write/talk about it.
2. What are some previous problems you handled well?
3. What steps did you use to solve one? What steps were common to more than one problem?
4. How would you name and describe–as in a recipe–each step?
5. How can you order them so that each one requires the others that come before it?
6. How would these steps work in your present problem or question?

One of the elements of such a process is that it is reflexive: it requires students to think about their thinking. This is metacognitive thinking, what Robert Marzano defines as "being aware of our thinking as we perform specific tasks and then using this awareness to control what we are doing" (9), or Robert Sternberg as "executive processes . . . used to plan, monitor, and evaluate one's thinking" (252). When students become increasingly reflexive–increasingly metacognitive–they begin to take over their critical thinking and make patterns belong to them. There also is recent evidence that reflexivity is a tool typically used by good communicators. According to Nance Van Winckel, “Pausing, or the act of reflection during writing, is one step in the composing process that many protocol analysts now agree helps distinguish good writers from poor writers.” This agrees with anecdotal information I collected from hundreds of upper-division writing students at a Level 1 research university at which I taught for five years regarding their writing steps. The better these beginning-expert students were at writing, the more likely they were to include in their writing steps a waiting period, pause, or rest between drafts that, they believed, enhanced their unconscious processing.

A third metaheuristic is metaphor. Metaphor often has been considered one of the most important of the Greek figures. The power of metaphor, it also has been suggested, comes from its multi-modal nature: that is, in the brain, metaphor partakes of two very different ways of thinking, the perceptual/holistic and the verbal/logical: it gives image to abstract concept. As Ross Winterowd asks, "Does bi-hemisphericity explain the power of metaphor, which, Longinus tells us, simply sweeps us away and thus is the most rhetorically cogent of the figures” (167)? According to Hildy Miller, “Metaphor . . . enables us to acquire new knowledge, since the unknown is information for which we as yet have no context. . . . [M]any psychologists working with the role of metaphor in cognitive development theorize that it is this basic metaphorical capacity [that] enables children to learn at all” (15). My own experience in teaching the use of metaphor is that young children in my week-long residencies in arts-in-the-schools programs naturally and intelligently use metaphor more easily than do college students: the younger, the more so.

Teaching metaphor is simple, especially if we present it instead as simile. The formula for a simple but fully realized simile might begin like this: “[Concept/event] is like a [thing/animal]: both are \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.” This is a fresh, creative, and interesting method of having students use the creative elements of their critical thinking skills (see also Miller). MacArthur Foundation Fellow Patricia Hampl argues that the best kinds of metaphors are those that are active: they involve verbs, the less participial, the better. Thus, for example, instead of saying that heuristics as tools are like fire, we could state–more strongly–that heuristics are fire, or even that heuristics flame at the center of good thinking. Creating active similes and metaphors develops in students a sense of activity and of process in their understanding, in addition to the visual picture or other sensory image also created.

Elbow calls creative thinking such as that developed in metaphor an inductive "aha!” or "nonverbal experience" rising from the mind's "capacity to construct new experience from symbols" (*Embracing* 16-18). Metaphoric "aha!" experiences are simple analogies, yet in creating them, people often use a wild or unplanned element that leads them to leap beyond their normal analogical processes. Once they make the initial leap, they can bring more mundane discovery tools to bear to explain it in more detail–to discover why and how the analogy came to mind and how well it fits. Metaphor also can be used reflexively by students to describe their own thinking and acting processes. De Bono uses metaphor metacognitively in his own work when he gives names to specific thinking processes: for example, "north-south," "bird-watching," and "apple-boxing" (142-9). Here is a description of the process he calls "bird-watching":

Bird-watchers learn to recognize the characteristics of the different species so that they can spot them at once. This recognition process involves making a deliberate attempt to look for certain features. In learning to think we need to recognize certain “species” of thought: some of these species are well established but others have to be created deliberately. . . . [For example,] pupils are given practice in spotting “facts” and “opinions.” (145)

 Similarly, we might want to describe our own thinking patterns to students, using metaphors of searching and sorting, the elements of nature, the actions of animals, etc. Having given students several examples, we can then ask them to create their own metaphors for some of their thinking and problem solving, positive and negative. We then can ask them to project these metaphors to the exploration of a present or future problem or need. Finally, we can ask each student to create a more analytic tool from his or her metaphor: a tool that describes in her own language how she structures her conscious discovery.

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In conclusion, this paper offers four methods of using heuristics: questioning, heuristic freewriting, heuristic structuring, and the development of metaheuristics. These activities form major parts of the core of teaching writing using critical thinking. It is worth emphasizing that the use of critical thinking in teaching writing, when defined as driven by heuristics, exists in most present systems of teaching composition. Whether a course uses expressivism, writing to literature, social-epistemic or critical-response learning, or even primarily the rhetorical modes, eventually what most teachers desire about thinking is that students learn not only to think well in a variety of ways, but also to transfer what they have learned to other situations–to own the lessons themselves. Elbow says of this that two abilities exist in real learning: "the ability to apply already-learned concepts" and “the ability to construct new concepts . . . when a person comes upon data that can't be processed with the concepts he has” (*Embracing* 14). These abilities are not just the result of good teaching of thinking and of writing, but of their combination.

Zeus punished Prometheus for stealing fire and sharing it by having him bound to a rock in the Caucasian Mountains where daily an eagle pecked out his liver–a fate, one hopes, no other instructors have suffered. It was too late, however, for Zeus to recover the fire and its social results. In critical thinking and exploratory discourse, once students know how to think about their thinking, write about their thinking, and think about their writing, they are on an irreversible path of heuristic power to mastery and transference.

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*A much shorter, earlier version of this paper was presented at the Conference on College Composition and Communication in 1993. Short sections of this essay also appear in the online textbook* [*www.WritingforCollege.org*](http://www.WritingforCollege.org) *in "Theory."*

Appendix: A Table of Thinking and Writing Taxonomies

 The following are taxonomical lists of thinking and writing that are roughly comparable to Bloom's Taxonomy of Thinking Skills (on the left). I certainly do not intend it to be strictly accurate: for example, I could just as easily have represented Bloom's six Thinking Skills as occurring in each single stage of the writing process. However, the lists may be useful for consideration of writing and thinking patterns.

Table of Thinking and Writing Taxonomies

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Bloom’s****Taxonomyof Thinking Skills** | **Three mental activities and their questions** | **Related thinking skills** | **Rhetorical skills** | **Writing process (rhetorical intent/need)** | **Metacognitive dialogic/textual (socially constructive)questions** |
| **recall****comprehension****application** | Seeing: What do you observe? | Observation,intuition, sensation | Description,summary, narration, directions | Expressing,freewriting, thinking (purpose) | What are your/ the text's  viewpoints and those of others? |
| **analysis****synthesis** | Determining patterns: What are new parts and wholes? | Deduction,induction, oppositions, similarities | Classification,analysis,comp./contrast,definition,cause-effect | Macro-organizing/ revising (audience) | How do theseviewpoints con- trast, compare, operate, and/orinteract? |
| **evaluation** | Judging: What are evaluations of the possible proof sets? | Negotiation, balance,resolution | Argument,pros/cons,dialectic/dialogue | Macro-& micro-organizing/revising, editing (style) | What are compromises and higher resolutions, and why? |

Works Cited

Aeschylus. *Prometheus Bound*. Ed. and trans. Herbert Weir Smyth. Cambridge MA: Harvard UP, 1926. *Perseus Digital Library*. Ed. Gregory Crane. Tufts U. 14 July 2006 <http://
www.perseus.tufts.edu/cgi-bin/ptext?lookup=Aesch.+PB+436>.

Anselmo, Tom., Leonard Bernstein, and Carol Schoen. *Thinking and Writing in College*. Boston: Little, Brown, 1986.

Axelrod, Rise B., and Charles R. Cooper. *The St. Martin's Guide to Writing*. 5th ed. New York, St. Martin's, 1997.

Baron, Joan Boykoff and Robert J. Sternberg, eds. *Teaching Thinking Skills: Theory and Practice*. New York: W.H. Freeman, 1986. 9-26.

Bartholomae, David. "Inventing the University." *Literacy: A Critical Sourcebook*. New York: Bedford, St. Martin's, 2001. 511-24.

Bazerman, Charles. *Shaping Written Knowledge: The Genre and Activity of the Experimental Article in Science*. Madison: UW P, 1988.

Beaufort, Anne. *Writing in the Real World: Making the Transition from School to Work*. New York: Teachers College P, 1999.

Berkenkotter, Carol. "Paradigm Debates, Turf Wars, and the Conduct of Sociocognitive Inquiry in Composition." *CCC* 42 (1991): 151-69.

Berlin, James. *Rhetorics, Poetics, and Cultures*. Urbana: NCTE, 1996.

"The Berlinean Movement." String. Online posting. Mar. 2002. WPA-L Listserv. 15 Aug. 2006 <http://lists.asu.edu/archives/wpa-l.html>.

Berthoff, Ann E. “Reclaiming the Active Mind.” *College English* 61 (1999): 671-80.

Bizzell, Patricia. *Academic Discourse and Critical Consciousness*. Pittsburgh: U Pittsburgh P, 1992.

Bloom, Benjamin S. *Taxonomy of Educational Objectives: The Classification of Educational Goals*. New York: David McKay, 1965.

Brookfield, Stephen D., and Stephen Preskill. "Keeping Discussion Going Through Questioning, Listening, and Responding." *Tools and Techniques for Democratic Classrooms*. San Francisco: Jossey-Bass, 1999. 27 June 2006. Tomorrow's Professor Mailing List. 27 June 2006 <http://
ctl.stanford.edu/Tomprof/postings/736.html>.

Crick, Nathan. "Composition As Experience: John Dewey on Creative Expression and the Origins of 'Mind.'" *CCC* 55 (2003): 254-75.

de Bono, Edward. *Teaching Thinking*. London: Penguin, 1991.

Eisenberg, Michael. "Cognition and Vocation." Rev. of *The Mind at Work*, by Mike
     Rose and interview of Rose. *Journal of Learning Sciences* 15 (2006): 293-300.

Elbow, Peter. *Embracing Contraries*. New York: Oxford UP, 1986.

---. *Writing without Teachers*. 1973. 25th Anniversary ed. New York: Oxford UP, 1998.

Ennis, Robert H. "A Taxonomy of Critical Thinking Dispositions and Abilities." Boykoff and Sternberg 9-26.

Flower, Linda. *The Construction of Negotiated Meaning: A Social Cognitive Theory of Meaning*. Carbondale: Southern Ill. UP, 1994.

---. *Problem-Solving Strategies for Writing*. 2nd Ed. San Diego: Harcourt, 1985.

Freire, Paulo. *Pedagogy of the Oppressed*. 1968. Trans. Myra Bergman Ramos. Thirtieth Anniversary ed. New York: Continuum, 2001.

Gale, Xin Liu. "The 'Full Toolbox' and Critical Thinking: Conflicts and Contradiction in The St. *Martin's Guide to Writing*." *(Re)visioning Composition Textbooks*. Ed. Xin Liu Gale and Fredric G. Gale. Albany: SUNY P, 1999. 185-213.

George, Diana. "The Politics of Social Construction and the Teaching of Writing." *Journal of Teaching Writing* 8 (Spring-Summer 1989): 1-10.

Guba, Egon G. "The Alternative Paradigm Dialog." *The Paradigm Dialog*. Ed. Egon G. Guba.Newbury Park, CA, 1990. 17-27.

Hampl, Patricia. Poetry Reading. Creative Writing Program, St. Cloud State U. St. Cloud, Minn. Nov. 1985.

Harris, Joseph. "Revision as a Critical Practice." *College English* 65 (2003): 577-92.

Hilgers, Thomas Lee. "Training College Composition Students in the Use of Freewriting and Problem-solving Heuristics for Rhetorical Invention. *RTE* 14 (1980): 293-307.

Hutchings, Pat, and Mary Taylor Huber. "Building the Teaching Commons." *Perspectives, The Carnegie Foundation for the Advancement of Teaching* (Oct. 2005). 16 Aug. 2006 <http://
www.carnegiefoundation.org/perspectives/sub.asp?key=245&subkey=800>.

Jewell, Richard. "Case 7. Too Much Thinking." *Dilemmas in Teaching--Cases for Collaborative Faculty Reflection*. Comp. The Collaboration for the Advancement of Teaching. Ed. Chris M. Anson, et al. Madison: Mendota P, 1998.

---. "Using Role Playing to Teach Critical Thinking." *Innovation Abstracts* 20.9 (1998): 1-2.

Kinneavy, James L. *A Theory of Discourse*. New York: Norton, 1971.

Lewis, Cynthia. "'What's Discourse Got to Do with It?' A Meditation on Critical Discourse Analysis in Literacy Research." *RTE* 40 (2006): 373-9.

Marzano, Robert J., et al. *Dimensions of Thinking: A Framework for Curriculum and Instruction*. Alexandria: Association for Supervision and Curriculum Development, 1988.

Mayfield, Marlys. *Thinking for Yourself*. Belmont: Wadsworth, 1993.

McCarthy, Lucille Parkinson. “A Stranger in Strange Lands: A College Student Writing Across the Curriculum." *Landmark Essays on Writing Across the Curriculum*. Ed. Charles Bazerman and David Russell. Davis, CA: Hermagoras P, 1994. 125-55.

Meyers, Chet. *Teaching Students to Think Critically*. San Francisco: Jossey, 1986.

Miller, Hildy. "Thinking and Writing Critically with Metaphor." *Minnesota English Journal* 25.1 (Fall 1994): 10-20.

NCTE. "NCTE Beliefs about the Teaching of Writing." *National Council of Teachers of English*. Nov. 2004. 16 Aug. 2006 <http://www.ncte.org/about/over/positions/category/write/118876.htm>.

 Nelson, Wayne A. "Problem Solving Through Design." *Problem-Based Learning in the Information Age*. Ed. David S. Knowlton and David C. Sharp. New Directions for Teaching and Learning 95. San Francisco: Jossey-Bass, 2003. Tomorrow's Professor Mailing List. 15 Nov. 2004 <http://ctl.stanford.edu/Tomprof/postings/607.html>.

Palmer, Barbara. "Award-winning art history teacher Wanda Corn plays at pedagogy." *Stanford Report* 17 May 2006. Stanford U. 14 Aug. 2006 <http://news-service.stanford.edu/news/2006/may17/
corn-051706.html>.

Paul, Richard with A.J.A. Binker. "Socratic Questioning." *Critical Thinking*. Ed. Richard Paul and A.J.A. Binker. Santa Rosa: Foundation for Critical Thinking, 1992. 360-90.

Perkins, David N. "Knowledge As Design: Teaching Thinking Through Content." Op. cit. Ennis. 62-85.

Petraglia, Joseph. "Interrupting the Conversation: The Constructionist Dialogue in Composition." *JAC* 11 (1991): 37-56. 17 Aug. 2006 <http://jac.gsu.edu/jac/11.1/Articles/2.htm>.

Petruzzi, Anthony P. "Between Conventions and Critical Thinking: The Concept of 'Limit-Situations' in Critical Literacy and Pedagogy." *JAC* 18 (1998): 309-332. 17 Aug. 2006 <http://jac.gsu.edu/
jac/18.2/Articles/7.htm >.

Rose, Mike. *Lives on the Boundary*. New York: Penguin, 1990.

---. *The Mind at Work*. New York: Viking, 2004.

Salvatori, Mariolina. "Conversations with Texts: Reading in the Teaching of Composition." *College English* 58 (1996): 440-53.

Schiever, Shirley W. *A Comprehensive Approach to Teaching Thinking*. Boston: Allyn, 1991.

Shor, Ira. *When Students Have Power: Negotiating Authority in a Critical Pedagogy*. Chicago: U of Chicago P, 1996.

Sommers, Nancy, and Laura Salz. “The Novice as Expert: Writing the Freshman Year.” *CCC* 56 (2004): 124-49.

Sternberg, Robert J. "Teaching Intelligence: The Application of Cognitive Psychology to the Improvement of Intellectual Skills." Boykoff and Sternberg 182-218.

Strunk, William, Jr., and E. B. White. *The Elements of Style*. 1918. 4th ed. New
     York: Longman, 2000.

Sullivan, Patricia A. "Social Constructionism and Literacy Studies." Rev. of *Constructing Experience*, by Charles Bazerman; *Collaborative Learning: Higher Education, Interdependence, and the Authority of Knowledge*, by Kenneth Bruffee; and *The Construction of Negotiated Meaning: A Social Cognitive Theory of Meaning*, by Linda Flower. *College English* 57 (1995): 950-9.

Tebeaux, Elizabeth. “The Trouble with Employees’ Writing May Be Freshman English.” *TETYC* 15 (1988): 9-19.

Turner, Derek D. "Thinking Across the Disciplines." *NEA Higher Education Advocate* 22.5 (June 2005): 5-8.

Van Winckel, Nance. "The Role of Preconscious Thought in the Composing Process." *JAC* 3 (1983): 14 Aug. 2006 <http://jac.gsu.edu/jac/3/Articles/11.htm>.

Weinstein, Edith K. "Questions and Answers to Guide the Teaching of Critical Thinking." *TETYC 19.4* (Dec. 1992). 284-8.

Winterowd, Ross. "Brain, Rhetoric, and Style." *Linguistics, Stylistics, and the Teaching of Composition*. Ed. Donald McQuade. Akron: Dept. of English, U. of Akron P, 1979. 162-7.

Winterowd, W. Ross., & Geoffrey R. Winterowd. *The Critical Reader, Thinker, and Writer*. Mountain View: Mayfield, 1997.

Wong, Kate. "South Asia and the Dawn of Modern Thinking." *ScientificAmerican.com*. 26 Dec. 2005. 14 Aug. 2006. <http://blog.sciam.com/
index.php?title=south\_asia\_and\_the\_dawn\_of\_modern\_thinki&more=1&c=1&tb=1&pb=1>.

Yagelski, Robert P. "'Radical to Many in the Educational Establishment': The Writing Process Movement after the Hurricanes.'" Rev. of *Writing without Teachers*, by Peter Elbow; *Pedagogy of the Oppressed*, by Paulo Freire; and *A Writer Teaches Writing*, by Donald M. Murray. *College English* 68 (2006): 531-44.

Yancey, Kathleen Blake. “The Plural Commons: Meeting the Future of English Studies.” *The Relevance of English*. Ed. Robert Yagelski. Urbana: NCTE, 2002. 382-401.