Inviting Critical and Creative Thinking into the Classroom

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INVITING CRITICAL AND CREATIVE THINKING INTO THE CLASSROOM

A Synthesis Project Presented
by
KELLEY A. FREEMAN

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Critical and Creative Thinking Program
INVITING CRITICAL AND CREATIVE THINKING INTO THE CLASSROOM

A Synthesis Project Presented

by

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In the field of education, there is much discussion around the subtleties of teaching critical and creative thinking. Surrounding the controversy are questions such as, are certain skills subordinate to others, and can best practices be fully described. Amidst this continuing discussion, most students are not being taught the necessary, fundamental skills that will allow them to become good thinkers; nor is curriculum being aligned to explicitly and systematically include thinking skills. In the interim
however, teachers can become aware of what is involved in critical and creative thinking and the dispositions, skills, strategies and environment that foster good thinking. Armed with this knowledge and understanding, teachers can mindfully and skillfully implement critical and creative thinking as part of the regular, mandated curriculum.

My concern with this issue, along with my belief that critical and creative thinking are crucial to reaching one’s full potential, impelled me to review various conceptions of critical and creative thinking by leading practitioners in the fields of education, philosophy and psychology. The writers include Paul, Ennis, Davis, Tishman, Starko and Marzano among others. From the literature I present a characterization of critical and creative thinking, a succinct description of the necessary dispositions for thinking in this manner, along with the skills involved. I also propose a number of strategies for instruction geared toward the development of critical and creative thinking.

Based on the literature review, I have distilled eight pervasively significant principles that teachers can employ to invite and implement critical and creative thinking in their classrooms regardless of grade level, subject area or the particular frameworks that dictate teaching. The principles, presented in the form of a practical handbook as my original contribution, are intended to provide teachers with knowledge and understanding of critical and creative thinking and the essential elements that sustain and propel such thinking.
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INTRODUCTION

"The planned curriculum is an educational response to the needs of society and the individual, and requires that the learner construct knowledge, attitudes, values and skills through a complex interplay of mind, materials, and social interactions" (Erickson 1995, 33). Examination of educational reform reveals an effort toward fulfilling the needs of both individuals and society. That need is for individuals and citizens who can and do think well. Recent educational reform shows a propensity toward teaching thinking skills as illustrated by the emphasis placed on teaching students to think independently rather than merely memorize and recall (Beane 1997).

In the history of education this realization has never been more crucial to students' futures. As we move away from the industrial age and into the information age, more is required of our students in school and in their lives after formal schooling. Students must be able to adapt to change, to apply skills and knowledge broadly and be flexible in thought and action. They must be able to think critically and creatively (Paul 1991; Beyer 1987; and Costa 1991). Jay McTighe, (Costa 1991) in his statement of rationale for teaching thinking, concluded that higher level thinking is needed across the curriculum. In too many classrooms thinking, especially critical and creative, is virtually absent (Hampel 1985). There is a need not only for specific critical and creative thinking skills, but also for mindful, skillful classroom implementation that works toward the development of the necessary skills and strategies that support such thinking.

New state curriculum frameworks provide the opportunity to embrace critical and creative thinking as a goal and practice of education. The new frameworks assert the need to guide students in inquiry, exploration, discovery, collaboration, problem solving, decision-making, and understanding (Massachusetts State Curriculum Frameworks 1996). These ideas are based on a constructivist theory of teaching and learning which is far removed from older, traditional theories of teaching.
Constructivist theory views students as emerging thinkers, active in the process of constructing meaning and understanding (Brooks and Brooks 1993). Constructivism also assigns new roles to teacher and students. Constructivist theory requires teachers to become facilitators of thinking, understanding and learning versus the traditional dispensers of knowledge. It also asserts that different teaching strategies are in order if teachers are to realize thinking as an educational goal. Strategies must emphasize active student engagement in the learning process so that students develop lifelong learning and thinking skills, which are essential in the presence of constant change, ever expanding fields of knowledge, and a global community (Paul 1993).

This shift in theory is both refreshing and welcome because it is compatible with human cognition in that it recognizes the active nature of the learning process and begins to remove us from educational practices that offer little in the way of understanding. Marlowe and Page (1998), in their research on teaching, claim that this theoretical change is necessary in light of research, which supports the need for active learning. They assert that if reform is to be effective and to last, teachers need to make necessary mind shifts. Finally, they are aware that teachers often feel overwhelmed by the demands and pressures brought on by the new frameworks and need support in the form of explicit guidelines as well as support from administrators.

In this paper I will begin to address the needs of teachers by providing guiding principles for inviting and implementing critical and creative thinking in the classroom, based on the work of Paul (1993), Ennis (1986) Perkins (1986), Marzano (1988), Beyer (1987), Tishman (1995), Caine and Caine (1997), Costa (1991), Davis (1983) and Starko (1991). In the first chapter I will characterize critical and creative thinking by presenting various conceptions from the literature. In the second chapter I will illustrate the dispositions, skills strategies, and environmental conditions that sustain critical and creative thinking. In the third chapter, I will provide practical guidelines for inviting and implementing critical and creative thinking in the classroom. The final chapter provides teachers with a self-assessment tool for determining progress toward implementation of the guiding principles.
CHAPTER 1
CHARACTERIZING CRITICAL AND CREATIVE THINKING

The literature on thinking, its definitions, and dimensions is extensive. As one pours through this literature, several things become clear. First, although thinking is innate, good thinking is not. It can however, be taught in the context of our schools’ classrooms (Nickerson cited in Boykoff, 1987). Second, there is a need to teach thinking in our classrooms at all grade levels, but knowledge and theories about thinking have not been adequately applied to practice (ACSD 1985). And lastly, the need to teach thinking is a result of continuous changes in society and the increasing complexity of our world (Paul 1993).

Responding to the need to teach good thinking so that it becomes an educational goal and common practice requires consideration of what is meant by good thinking, what kind of thinking we want our students to do and how teachers can help students become good thinkers. We all have ideas of what good thinking is, but if we are to teach it skillfully and successfully, we must have a common notion of what good thinking embodies. That notion includes metacognition, dispositions, skills, strategies, and environmental conditions that foster and support the development of good thinking.

Prominent minds in the fields of education, psychology and philosophy have defined thinking in various ways, usually in terms of critical thinking or creative thinking. Regardless of the exact definition, all contain common threads that help characterize critical and creative thinking, dispositions, skills and strategies. Critical thinking can be characterized as deliberate, thoughtful “analysis, synthesis, and evaluation, which leads to informed, reasonable beliefs, actions or judgments” (Paul 1993, 110) guided by standards and criteria. Creative thinking can be characterized as imaginative, generative thinking in which novel ideas or products are produced as the result of recognizing a problem, defining a problem, and generating ideas for solving the problem (Davis 1983).
Richard Paul, director of the Center for Critical Thinking, defines critical thinking as, “the intellectually disciplined process of actively and skillfully conceptualizing, applying, synthesizing or evaluating information gathered from, or generated by, observation, experience, reflection, reason or communication as a guide to belief or action” (Paul 1993, 110). His definition is comprehensive and includes dispositions, skills, and standards for thinking. He and others contend that dispositions such as open-mindedness and empathy are essential for engaging in the thinking process. Specific thinking skills are employed in service of the process. His standards emphasize a commitment to “clarity, precision, accuracy, relevance, consistency, depth, and coherence” (Paul 1993, 92). Other definitions of critical thinking are consistent with these ideas. Most assert a need for dispositions, skills, strategies and standards in the development of good thinking.

Ruggiero’s (1988) definition centers on the resolution of problems and issues using a five-stage model of thinking. The first stage, exploration, is when a problem or issue is perceived. Usually wonderment or frustration drive motivation to deal with a problem or issue. The second stage, expression, articulates and captures the essence of the problem or issue. Investigation, the third stage, involves finding information, ideas, and evidence necessary for and relevant to solving the problem or addressing the issue. In the fourth stage, idea production, many possible solutions and alternatives are generated. Evaluation and refinement, the final step, consists of judgment of ideas and solutions. In essence, Ruggiero’s definition consists of production and evaluation, of divergent and convergent thinking, questioning, and response.

Bransford and Stein (as cited in Beykoff, 1988,163) also “emphasize five components of thinking that are applicable to a wide variety of situations.” The acronym “IDEAL” is used to represent this thinking process. “I” represents identification of problems; “D” refers to defining problems; “E” stands for exploration of strategies; “A” represents acting on the ideas; and “L”, looking at the effects of acting on ideas. This conception is similar to Ruggiero’s. Both propose a process for thinking about problems and issues as well as
production and evaluation of ideas and information. Further examination of their work reveals specific strategies, which will be discussed later, for developing the processes and dispositions necessary for learning and applying critical and creative thinking skills.

Robert Ennis defines critical thinking as “reasonable, reflective thinking that is focused on deciding what to believe or do” (Ennis as cited in Boykoff 1987,10). Nickerson conceives of thinking as practical, reflective activity that has reasonable belief or action as its goal (Costa 1991). Lipman, a leader in teaching philosophy to children, defines critical thinking as “skillful, responsible thinking that facilitates good judgment because it: 1) relies upon criteria, 2) is self-correcting, and 3) is sensitive to context” (Lipman 1991,116).

Definitions of critical thinking differ somewhat but the locus of these definitions is that critical thinking is deliberate, practical, purposeful, reflective mental activity, which is goal oriented. The processes of conceptualizing, analyzing, synthesizing and evaluating in order to achieve desired goals likewise portray the active nature of thinking. Common goals of thinking include generating meaning, making decisions, solving problems, and constructing understanding. When we engage in these activities we pass through stages of convergent and divergent thinking. We generate and judge, speculate and scrutinize, in the course of deciding or creating. Divergent thinking requires the generation of many possible responses to a problem or question. It is broad and imaginative. Convergent thinking is oriented toward determining which alternative appears most justified as the best answer or conclusion. It is more focused and conclusive.

While they appear to be polar opposites, divergent and convergent thinking are in fact highly complimentary modes of thought (Gallo 1988). Although critical thinking is focused on practical, purposeful mental activity, which is usually associated with convergent thinking, there is a place for divergent thinking. Kerry Walters asserts that “the creative and logical aspects of thinking are inseparable” and both are “necessary for the possibility of genuinely good thinking” (Walters 1992, 131). Marzano (1988, 17), an influential leader in education, upholds the belief that people are “more or less creative; more or less critical” when solving problems or making decisions. He too finds the two
modes of thinking inseparable because they have similar purpose and direction. They are “both important to effective output in any endeavor” (Marzano 1988, 24) because they are based on standards and criteria for good thinking in process and product.

Though much of the literature on thinking addresses thinking in the critical or the creative sense, they are intimately connected. They are not separable, alternatives, or antithetical. Together they address the full spectrum of human cognition. They are encompassed in a single dimension of thought in which we use our natural capacities to understand and transform the world. The idea is clear that, in practice, critical and creative thinking occur together in virtually all situations. Exploring conceptions of creative thinking reinforces this sentiment.

Conceptualizations of Creative Thinking

Creative thinking has as many conceptualizations as critical thinking. Some view it as a process that takes place in steps or stages. Others view creative thinking in terms of creative product, some in terms of the creative person. Among those who view it as a process are Osborn (1963); Parnes (1981); Isaksen and Treffinger (1985); Torrance (1988); Wallas (1926); and Dewey (1938), all leaders in the fields of education and creativity.

Wallas’ (as cited in Davis, 1983) conception of creative thinking centers on process. It includes four stages: preparation, incubation, illumination and verification. The preparation stage involves exploration and clarification of the problem and requirements for possible solutions. The incubation stage is usually a period of subconscious activity much like reflection (Guilford as cited in Davis 1983). Illumination is when seemingly sudden ideas, connections and transformations take place. In the last stage, verification, the product is evaluated. John Dewey believed that there are only two stages, “a state of doubt, complexity or mental difficulty in which thinking originates; followed by an act of searching, hunting or inquiring to find material that will resolve the doubt, and settle and dispose of the perplexity” (Dewey as cited in Davis 1983, 100).
The Osborn/Parnes model, known as Creative Problem Solving (CPS), (as cited in Davis, 1983) is geared toward problem solving and consists of five steps: fact finding, problem finding, idea finding, solution finding and acceptance finding. Throughout the process it is necessary to generate and judge ideas to determine which are most fruitful in finding a solution to the problem. This model naturally includes divergent and convergent phases of thinking. The visual representation of this model clearly shows the speculation and scrutiny involved in thinking creatively. Other models also reveal the dynamic nature of creative thinking.

![Diagram of the Osborn/Parnes model]

Paul Torrance (1988) has also put forth a process model of creative thinking. His model is comparable to Osborn/Parnes but has only four stages: sensing a problem or gap in information, forming ideas or hypothesis, testing and modifying the hypothesis, and communicating the results. What is clear in all of these models is that in the process of thinking creatively, a problem or complexity must be recognized, then ideas are generated and finally a resolution is found and communicated. In that process both creative and critical phases of thinking naturally occur.

The product conceptions of creative thinking are not far removed from the process conceptions; rather it is a matter of emphasis. In producing some output, one must go through a process of generation and judgment, speculation and scrutiny, imagination and discrimination. It is likely that in going through the process, one will produce something. Barron actually defines creative thinking as “the ability to bring something new into existence” (Davis 1983, 24).
David Perkins (as cited in Boykoff, 1987) believes that, especially in evaluation, output is the ultimate criteria. His definition emphasizes this idea. He states that, “creative thinking is thinking that is patterned in a way that tends to lead to creative results” (as cited in Davis 1983, 104). His rationale is that thinking, no matter how diverse or unique, must result in some form of expression, either internal (idea) or external (painting) that must be communicated. This is parallel to the last stage of most of the process conceptions of creative thinking.

Other definitions of creativity that emphasize product exhibit the same sentiments, although some are more focused on the practicality of the output. For example, Lasswell defines creative thinking as “the disposition to make and recognize valuable innovations” (Devis 1983, 8). I agree that creative products should be useful, but that leaves open the question, “Useful to whom?” When trying to develop creativity in our students, products may be useful or they may be plain old fanciful. As long as the goal of developing creativity is strived for and products are not outright deviant, we need not over emphasize practicality.

Ultimately, creative thinking is a combination of process and product influenced by personality, cognitive ability, thinking style and environment. Therese Amabile supports this conception. Her definition of creative thinking is comprised of person, process and product. Her theory of creativity “involves a process (evidenced by products) that can be influenced by both internal and external factors – by cognitive skill, work habits, and social environmental variables – as well as by personality dispositions” (Amabile 1983, 373).

Before we can translate these characterizations of critical and creative thinking into classroom practice, we need to consider five essential elements in the development good thinking: 1) metacognition and transfer, 2) the dispositions students exhibit when approaching thinking tasks, 3) the skills necessary for good thinking, 4) strategies used to accomplish thinking tasks, and 5) the environmental conditions in which thinking takes place. All of these elements are discussed in detail in Chapter Two.
Defining reason and imagination is a complex task, as illustrated in the previous chapter. Thinking is multifaceted sometimes discrete, sometimes overlapping. Though definitions of thinking differ, there is general agreement as to the essential elements that promote critical and creative thinking. Among them are certain habits, attitudes, skills and strategies that propel and sustain thinking. They are discussed below.

Metacognition

In answering the question, “What do we want our students to think about?”, we can turn to that aspect of cognition known as metacognition. In cognitive psychology metacognition is defined as “knowledge, awareness, and control of our cognitive processes” (Matlin 1998, 256). It is an important component in learning to think critically and creatively because it is the means by which we reflect on our own thinking, where we have been in our thinking, where we are going, and how we can improve our thinking. Although metacognition has slightly different meanings to different authors, many definitions include planning, monitoring, revising, and assessing one’s thinking processes.

Costa defines metacognition as “our ability to plan a strategy for producing what information is needed, to be conscious of our own steps and strategies during the act of problem solving and, to reflect on and evaluate the productivity of our own thinking” (Costa 1991, 211). This portrayal includes all aspects of metacognition, planning, monitoring, revising and assessing. Tishmaan’s (1995) definition further develops the concept of metacognition by providing details about the stages of metacognition. She calls it mental management, which occurs before, during and after thinking. The before stage refers to mental preparation, a clearing of the mind and focusing prior to engaging in the task ahead. During thinking, mental monitoring of goals and progress take place. After thinking, reflection on the outcomes, accomplishments and any pitfalls occurs.
By encouraging students to set goals, plan strategies, and self-assess, it is conceivable that they may become aware of and improve their thinking processes (Presseisen 1987). In addition, metacognitive practices give students an active role in and responsibility for thinking and the construction of meaning and understanding. Giving students responsibility for their learning has practical uses for promoting critical and creative thinking. First of all, it shows that the teacher believes in the students' abilities to think and learn and that it is an expectation. Secondly, it gives students a sense of empowerment in constructing knowledge and understanding. Lastly, it promotes independence. All are essential to becoming a good thinker and compatible with constructivist theory, which emphasizes the active role of the student in constructing meaning and understanding.

Consequently, in the process of teaching thinking, it is important to guide students in learning and practicing metacognitive strategies, that is, in thinking about their thinking. “There is much evidence to demonstrate that those who persevere in problem solving; who think critically, flexibly and insightfully; and who can consciously apply their intellectual skills are those who possess well-developed metacognitive abilities” (Whimbey as cited in Costa 1991, 211). Studies in cognitive psychology also indicate that metacognition improves thinking processes (Matlin 1998). Through metacognition students become aware of their own style and pattern of thinking. They can reflect on what strategies help or hinder their learning. They can iron out misconceptions and misunderstandings as well as clarify, refine and explain their thinking.

A metacognitive technique already very popular is the use of journals in all subject areas and grade levels. There is an understanding that journals provide teachers and students with a ‘picture’ of thinking. Journals alone, however, are not enough to paint the whole picture. There are many other strategies teachers can use to help students develop skills in metacognition for example, teacher modeling of the behaviors involved in metacognition, generating questions that trigger reflection, labeling student behaviors, planning and choosing strategies consciously, reflecting aloud on students’ and their personal ideas, and categorizing actions based on multiple criteria (Costa 1991).
Without metacognition, thinking and the skills and strategies used in the process are likely to be flawed and unclear. Thinking about thinking helps students understand how to approach problems, decision making and other classroom tasks as well as plan, regulate, and evaluate the quality and progress of the cognitive and affective dimensions of thinking. Intimately related to metacognition is transfer. Both require conscious effort and a cycle of action and reflection.

Transfer is remembering, connecting and applying previous knowledge, skills, strategies, and dispositions to new or unfamiliar situations (Tishman 1995). Transfer is said to be the ultimate goal of education, yet it occurs less frequently than might be expected (Perkins as cited in Costa, 1991). The reasons are not fully understood. Educational researchers believe that transfer does not occur because students are not engaged in constructing meaning or are unable to relate what is learned in school to life outside school (Paul 1993). I agree that this is part of the problem but it is a truly complex issue, which cannot be addressed in the confines of this paper. Those aspects of classroom practice that may increase the occurrence of transfer will, however, be addressed.

Directing student attention to the topic of transfer through techniques such as creating analogies, questioning techniques, and tapping prior knowledge and experiences can help bring it to a conscious level. Students must be encouraged, directed and assisted in making connections and anticipating applications of skills and knowledge. Teachers and students need to continually practice looking for applications of skills, strategies, knowledge and dispositions within and across subject areas as well as in relation to life outside the classroom. Furthermore, teachers should recognize and congratulate instances of transfer when they occur. Although there are no guarantees, these techniques can increase the likelihood of transfer. At the very least, these techniques will make students cognizant that skills, knowledge and dispositions transfer to many areas of life.
Dispositions for Thinking

Dispositions refer to the affective dimension of thinking. Dispositions include the attitudes, habits, and values students bring to the thinking situation. They help in fully utilizing and supporting critical and creative thinking processes. Some argue that dispositions are essential for the ability and proclivity to think well, without them it is difficult if not impossible to develop critical and creative thinkers (Ennis 1986). Tishman (1995) ascertains that dispositions are crucial to good thinking and provides compelling reasons why. Dispositions put thinking into practice, make students aware of their thinking, help them understand what good thinking is and cultivate the habits of good thinkers.

Dispositions that support critical thinking include suspension of judgment, empathy, seeking alternate points of view, inquiry, clarification, reflection, open-mindedness, perseverance and flexibility (Paul 1993; Ruggiero 1988; and Beyer 1987). Creative thinking requires the dispositions of suspension of judgment, flexibility fluency, empathy, perspective seeking, reflection, tolerance for ambiguity, risk-taking and open-mindedness (Starkey 1995; Davis 1983; and Tishman 1995). It is through these dispositions that students come to think, analyze, synthesize, evaluate, ponder, create, and transform. These dispositions, which are explained more fully below, greatly affect how a student will approach and persist in performing tasks (Ruggiero 1988). They are the spirit in which critical and creative thinking take place.

Critical and creative thinking cannot transpire without a receptive attitude; therefore, open-mindedness is vital. If one cannot see beyond themselves, consider other points of view or understand contrasting ideas, little learning and even less thinking will take place. It is necessary for students to be open to reason, to new and different ideas, and to numerous possibilities (Swartz as cited in Boykoff, 1987). It is especially important to be open to the ideas and views of classmates because of the immediacy of student interactions such as in discussion or cooperative group work.
Suspension of judgment is also important because it provides occasion to exercise the skills necessary for carrying out certain thinking processes. It provides the opportunity to generate ideas without judging them, consider different perspectives, ask divergent questions, identify patterns and relationships, and generate ideas. It affords the learner time and freedom to explore unconditionally. When considering the factors that contributed to the Civil War, for example, students can pose questions, investigate sources of information, distinguish relevant from irrelevant information, seek clarification, build hypotheses, identify fact and opinion, detect assumptions (their own and others), detect ambiguity, biases and assumptions, and reason before coming to a conclusion, belief or action.

Tolerance for ambiguity involves problems or ideas with more than one meaning or definition. Students must learn to be patient in approaching these situations and be able to construct definitions when necessary and wait until more information is available as well as remain open to a number of possibilities and applications (Kirby and Kuykendall 1991). Ambiguous problems or situations increase student’s ability and willingness to seek solutions even when they are not readily apparent. Students must pursue the tasks they embark on; they must continue in the face of challenge. Perseverance, a disposition closely related to tolerance for ambiguity, cannot be over-emphasized. Good thinking requires time, commitment, “a willingness and consciousness of the need to pursue intellectual insights and truths despite difficulties, obstacles and frustrations” (Paul 1993, 536).

The disposition of empathy enhances critical and creative thinking by developing cognitive flexibility, aiding deferred judgment, building a tolerance for ambiguity and augmenting the ability to make new connections. Empathy is crucial in reaching fair, informed beliefs and actions based on an appreciation, understanding, and analysis of the ideas of others. This in turn strengthens students’ own thinking by forcing them to look beyond themselves and expand the realm of their own minds’ leading to more effective reasoning (Gallo 1987). It also addresses the affective dimension of learning;
attitudes, feelings and values. Who would have thought that we could become effective from being affective?

Empathy is compatible with the important disposition of seeking varying perspectives. When dealing with issues and problems it is important to explore a number of relevant positions. By examining a number of different points of view, we expand the landscape for learning. Student outlooks are broadened as well as their ability to shift focus, be flexible and reflective. It provokes possible solutions and ideas that would have otherwise gone unnoticed had they remained solely in their own frame of reference. It also amplifies students’ understanding because when they look for other ideas and opinions, they are better able to come to new beliefs and ideas that are the result of deep consideration of many aspects of the problem or issue.

“Flexibility is the ability to switch from one train of thought to another or look at something in a new and different way” (Costa 1991). It is complimentary to perspective seeking because it requires that we step out of habitual ways of viewing our environment and circumstances (Ruggiero 1988). In critical thought it is important to adapt your ideas or beliefs in the face of evidence that disqualifies previous beliefs. In creative thinking it is necessary to be able to adapt ones train of thought and see things in different ways in order to produce new, original ideas or products. Flexibility also aids imaginativeness. Closely related to imaginativeness and flexibility is fluency.

Many theorists stress fluency, the ability to generate many ideas. By generating a number of ideas, students can make distinct connections and conceive of original possibilities (Starko 1995). It is useful in critical thinking and essential to creative thinking as a way to begin and proceed on a course of creative thought. We want students to be able to generate many ideas and questions in order to be broad and seek depth in finding solutions, reaching conclusions and gaining understanding.

Risk-taking is probably the most important of the dispositions. Students may generate ideas, adapt their thinking, seek perspectives, and define problems but it is of
little value if they don't communicate it in some way with others. Students need to challenge themselves, their current understandings and work at the edge of their comfort zones. This means that students should be willing to pose questions, state opinions or play the role of a character whose beliefs are in opposition to their own. In this way students can grow to become independent, courageous thinkers.

A child who has these thinking dispositions will be better able to acquire the skills involved in good thinking and more easily flower into a critical and creative thinker who will use such skills in all areas of life. Literature on thinking supports the tenet that dispositions are essential in carrying thinking forward. Ennis (1987); Beyer (1987); Paul (1993); and Swartz (1994) among others, have communicated the role of dispositions and specified the dispositions. In cultivating these dispositions we are simultaneously cultivating the skills that are fundamental to critical and creative thinking.

Skills that Sustain Thinking Processes:

Experts on thinking have compiled lists of thinking skills, usually in a hierarchy or a sequence. Ennis (1985) has organized an extensive outline for a critical thinking curriculum but it is without regard to grade level or sequence. Beyer (1987) has offered suggestions for developing a thinking curriculum as well as ideas for scope and sequence based on the developmental levels of children. Still others who rally for the cause of teaching thinking have designed additional models of thinking skills. Some models focus on concept formation, others cognition, memory, knowledge or awareness (Costa 1991). Individually, the models represent only part of the cognitive and affective skills involved in the thinking process.

While some combination of these models is probably the best approach to defining and teaching thinking skills, if we are to address all phases of the thinking process in a coherent, encompassing manner a useful practical conception of thinking skills is that of Marzano (1988). His list is succinct yet inclusive, includes skills in a sequence that compliments cognitive processes, is compatible with existing school curriculum and
includes skills that apply to both critical and creative thinking. He has organized core thinking skills into eight categories which include focusing skills, information-gathering skills, remembering skills, organizing skills, analyzing skills, generating skills, integrating skills and evaluating skills. This categorization is very useful because it represents the cognitive processes involved in thinking.

Many of the skills involved in critical and creative thinking are skills already required by mandated curriculum. I have identified specific critical and creative thinking skills using an array of resources. They are shown in Figures 1 and 2. Many critical and creative thinking skills overlap due to their complimentary nature. The skills are consistent with existing school curriculum, therefore integration and implementation may require only modifications, adaptations to and organization of what is currently being done by classroom teachers. Once skills are recognized as critical and/or creative, teachers can execute them mindfully in the service of thinking, rather than as an end in themselves (Marzano 1988).
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<td>Categorize</td>
<td>Identify</td>
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<td>Clarify</td>
<td>Imagine</td>
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<td>Combine</td>
<td>Implement</td>
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<td>Compose</td>
<td>Inquire</td>
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<td>Conceive</td>
<td>Integrate</td>
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<td>Connect</td>
<td>Interpret</td>
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<td>Deduce</td>
<td>Judge</td>
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<td>Define</td>
<td>Make Decisions</td>
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<td>Detect Ambiguity</td>
<td>Metacognition</td>
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<tr>
<td>Develop Criteria</td>
<td>Observe</td>
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<td>Elaborate</td>
<td>Plan/strategize</td>
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<tr>
<td>Evaluate</td>
<td>Question</td>
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<tr>
<td>Explore (ideas)</td>
<td>Solve</td>
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<tr>
<td>Synthesize</td>
<td>Transform</td>
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Figure 1: Creative Thinking Skills (compiled by the author from various sources)
Analyze
Anticipate
Assess
Compare
Conceive
Conclude
Connect
Contrast
Deduce
Define
Detect ambiguity
Detect contradictions
Develop criteria
Discriminate fact and opinion
Evaluate
Generate (ideas)
Hypothesize
Identify (relationships, processes, structures, principles)
Induce
Infer
Inquire
Interpret
Judge
Metacognition
Observe
Order
Predict
Prioritize
Plan
Prove
Question
Reason
Sequence
Summarize
Synthesize
Solve
Transform

Figure 2 Critical Thinking Skills (compiled by the author from various sources)

Strategies for Teaching Thinking

Once defined, thinking skills must be implemented in meaningful, purposeful, contextual teaching-learning situations that require active use of the skills in inquiry, discovery, problem solving and decision-making. There are numerous strategies that foster critical and creative thinking. Many are already employed in classrooms. What is currently lacking is systematic, mindful, skillful implementation of these strategies on the part of most teachers and students. As it stands, “many teachers believe that they teach thinking skills. In most cases, however, what they actually do involves putting students in situations where they are simply made to think and expected to do it as best they can” (Cornbleth and Korth 1981, 84) in contrast to explicit training in thinking skills and
strategies. Therefore, it is the task of teachers and students to consciously learn and utilize skills and strategies that foster good critical and creative thinking.

The constraints of this paper will not allow thorough explanation of every strategy; therefore, I will elaborate on those that are least familiar and most effective in developing critical and creative thinking. The strategies touched upon include: Matthew Lipman's, *Philosophy for Children* (1980); Socratic questioning (Paul 1991); Creative Problem Solving (Torrance 1988); Synectics (Gordon 1970); Methodological Belief and Disbelief (Elbow 1986); and SCAMPER (Eberle 1971). For more elaborate discussions of other strategies refer to appendix A, which provides a list of references and resources. The strategies listed have been developed by experts in the field of education and are very useful in promoting critical and creative thinking. Trying to learn and apply all of them can be daunting. It is easier for teachers (and students) if they are introduced slowly, then practiced and applied in varied situations before progressing. Some earnest advice: think big, start small.

Strategies for teaching thinking mirror the conceptions of critical and creative thinking. For instance, Matthew Lipman defined critical thinking as, "skillful, responsible thinking that facilitates good judgment because it 1) relies upon criteria, 2) is self-correcting, and 3) is sensitive to context" (Lipman 1980, 116). In accordance with this definition he has developed a program titled, *Philosophy for Children* in which children discuss, investigate, and pursue challenging, relevant questions. Children think critically about questions that coincide with their interests and curiosities such as the concept of fairness. This type of issue requires deep thought. In the course of thinking, students must apply critical thinking skills and dispositions in order to come to conclusions or beliefs based on criteria.

Osborn's conception of creative thinking as a process likewise led to the development of Creative Problem Solving (CPS) by Torrance. This is a method in which students learn and apply steps that develop creative thinking capacities for solving problems. CPS consists of five specific steps: problem finding, data finding, idea finding, solution finding
and acceptance finding. It is especially useful because it embodies both convergent and divergent phases of thinking. It also includes tools such as “IWWMW: In What Ways Might We...?” This tool sparks divergent thinking by asking students to consider multiple possibilities in seeking solutions to problems. It can be used in any subject area at grade level; for instance, in mathematics, if trying to solve the problem of how to determine the size of the lunchroom, students will have to consult their knowledge and experience with measurement. After defining the problem, collecting information, exploring the ways in which they might determine the size, they should eventually come to the conclusion that standard measures are needed. Although the outcome is formulated, the method for arriving at it requires discovery and the construction of understanding.

SCAMPER, also conceived of by Osborn and later modified by Eberle, is a strategy for generating ideas (Starko 1991). It is an acronym for Simplify, Combine, Adapt, Modify, magnify, minimize, Put to other uses, Eliminate, and Reverse or rearrange. By asking students questions such as, “How can we simplify this problem? What other uses could this have? or Can we eliminate anything?” we assist students in breaking habitual ways of thinking when working toward solutions. Teachers and students can use this tool when generating ideas for problem solutions. It helps instill dispositions of critical and creative thinking such as flexibility, fluency, suspension of judgment, and perseverance.

Methodological belief and disbelief, conceived of by Peter Elbow (1986), is another effective strategy for developing good thinking and dispositions. Elbow defines methodological belief and doubt as “the disciplined procedure of not just listening but actually trying to believe any view or hypothesis” (Elbow 1986, 260) or doubt any view or hypothesis. This strategy requires students to genuinely listen without criticism and try to believe or doubt the position being presented. The teacher can facilitate the procedure by asking questions such as, When might this conjecture be true? or Under what conditions would that claim be incorrect? The believing and doubting games offer students new ways of comprehending issues, problems, the interpretations and opinions of others as well as deeper understanding of their own
beliefs. Embedded in this strategy are divergent and convergent thinking. Believing is speculative which is associated with broad thinking and numerous possibilities. Believing also helps engage students with alternate perspectives. Doubting is aimed at converging on a belief or conclusion only after contemplation of other viewpoints. This strategy promotes the dispositions of empathy, suspension of judgment, and seeking varying perspectives.

Socratic questioning, used as a strategy for inducing and improving critical thinking, comes in three forms: exploratory, issue specific, and spontaneous (Paul 1993). Exploratory Socratic questioning is used to find out what students know about a topic or issue, what their impressions are, what misconceptions they may have and their ability to discuss the issue. Issue specific questioning is used when you have specific areas to cover but want to probe the issue for thoughts, perspectives, known and unknown information. With this information, it is easier to help students clarify thoughts, identify assumptions and biases and arrive at a reasoned judgment. Spontaneous questioning occurs at teachable moments when it is necessary and appropriate to explore student beliefs and listen critically, which is a way to model and reinforce behaviors associated with critical thinking.

Synectics (Starko 1991) is a teaching strategy that can be used to augment analogical and metaphorical thinking. These types of thinking enhance our critical and creative thinking abilities by helping make connections and associations and bring together normally unrelated elements. They guide us toward uninhibited thinking. Synectic methods were originated by William J.J. Gordon. There are four forms of this method: direct analogy, personal analogy, fantasy analogy and symbolic analogy. Virtually any type of problem can be approached using the analogy method (Davis 1983). This method helps shape syntheses, stimulates different perspectives and discover or create idea combinations that under normal circumstances would unlikely be conceived. Skill at this technique, as with the others, requires considerable practice but offers promise for the development of good thinking and transfer to many situations.
Direct analogy asks students to search their memories for other problems that have been solved in a similar manner, usually using examples from nature. We might ask ourselves for example, how animals carry their young in order to find new ways parents can be more mobile if they have young children. Perhaps this is how “Snuggly” baby carriers were conceived.

Personal analogy involves placing yourself in an imaginary position as part of the problem. It requires taking on a new perspective as in the case of imagining yourself as a yo-yo and how it feels to go up and down, be dropped and stuffed in pockets. Fantasy analogy is synonymous with farfetched. In this case students look for outlandish ideas to solve a problem. Often students must work backwards, as in the case of imagining a bedroom that picks itself up, and then take steps to realize such a commodity. Lastly, symbolic analogy is the bringing together of two self-contradictory ideas in the search for a solution to a particular problem. It is similar to what is known as an oxymoron, such as painful pleasure, bitter sweet or wicked good. This particular form is a bit sophisticated and may best be used with older students. A large vocabulary is useful in putting together self-contradictory words.

These strategies can be used to promote critical and creative thinking in the context of current curriculum. Using them to teach for thinking does “not require a profound reconstruction of the curriculum” (Raths 1986, 205). What is important in choosing and utilizing these strategies is that individual teachers apply them frequently and skillfully in their classes with freedom to choose which are most useful for each situation. There is a sense of artistry involved on the part of the teacher who uses knowledge, experience and intuition in daily classroom activities and instruction.

Environmental Conditions that Promote Critical and Creative Thinking

In order for critical and creative thinking to flourish in the classroom, it must first be invited. It is the role of the teacher to create the conditions that will encourage such thinking. Three central factors that help nurture the attitudes, habits and skills essential
to thinking critically and creatively are atmosphere, behavior and opportunity (Kirby, 1991).

Atmosphere refers to the feeling students get when they walk into the room, when they share ideas or when they raise questions. If students are to become courageous, autonomous thinkers, they must feel safe to “negotiate the world of wonder and possibility” (Erickson 1991, 184). In this type of atmosphere students feel safe, accepted, respected, valued and part of a community. Together the classroom community questions, investigates, discovers, and shares ideas, successes and failures on a path to understanding. It is a celebration of curiosity and the pursuit of answers. This atmosphere also encourages the dispositions, use of skills, and application of strategies that are central to the development of critical and creative thinking.

Behavior refers primarily to that of the teacher. Teachers must model the behaviors they ultimately want to manifest in their students. It is important to think aloud, ask questions, clarify questions and answers, show curiosity, hypothesize and so on. In essence, teachers themselves must be critical and creative thinkers and risk takers. In this way students will learn how to think well by example and learn that this type of thinking is valued.

Lastly, teachers need to provide opportunities for students to think critically and creatively. Literature on classroom practices reveals that it is often the teacher who does the talking, questioning, and thinking (Ornstein 1995). Students are provided little opportunity to discover for themselves, question and discuss concepts, findings, and plans. In the spirit of constructivism, students must be allowed to pose questions, explore answers, discuss ideas and construct meaning, understanding and knowledge (Erickson 1995). It is through these types of activities and engagement that students’ ability to think critically and creatively are nourished.

These conditions will help foster critical and creative thinking among students. It takes time, practice and patience, but it is well worth the effort for all involved. Once
the atmosphere is established, students will be inclined to pursue their curiosities, propose and support ideas of their own, and share and analyze beliefs (Marlowe and Page 1991).
CHAPTER 3
GUIDING PRINCIPLES FOR INVITING CRITICAL AND CREATIVE THINKING INTO THE CLASSROOM

One of the most salient questions teachers are facing is: how do we help students become good critical and creative thinkers in the context of mandated curriculum? There are many ways teachers can help their students. "Teachers are the architects for learning. They design the environment for developing minds" (Erickson 1995, 181) therefore, teachers need to create mindful classrooms where students are aware that thinking is the objective and that they are supported in their journey to becoming autonomous thinkers.

A mindful classroom is one where teacher and students understand that critical and creative thinking are important goals of education. Instruction in thinking is explicit and all are encouraged and expected to exercise thinking skills, strategies, and dispositions. The teacher uses the language of thinking, employs activities that foster critical and creative thinking among students, models the behaviors of a good thinker and creates an environment that supports thinking. Thinking activity is purposeful, skillful and thoughtful. In order to design this archetype, teachers must first realize the virtues of critical and creative thinking, understand the essential elements that sustain and propel critical and creative thinking and become committed to developing such skills in their students.

In this chapter, eight guiding principles are presented which teachers can apply to classroom practice to develop students’ critical and creative thinking capacities. The principles are based on the theory of constructivism, which concurs with critical and creative thinking processes, the elements that contribute to their development, reform efforts and many of the consequent curriculum frameworks. New curriculum frameworks generally include many aspects of constructivist theory as Starko points out in her book Creativity in the Classroom (1990). They include: significant outcomes; authentic assessment; inquiry based instruction; active learning; higher order thinking...
skills; metacognition; use of relevant technology; development of habits of mind; key concept orientation; and interdisciplinary instruction. These aspects are compatible with attributes of critical and creative thinking and make implementation of such thinking and skills a practical endeavor.

In the midst of educational reform, teachers can take the opportunity to adopt the theory and implement practices that will develop good thinking skills in all students. Though thinking is innate, good thinking can be nurtured and taught in every classroom. The new curricula frameworks have laid the groundwork. They have mandated curricula that requires students to think, inquire, explore, investigate, discover, collaborate, solve problems and make decisions, which is based on the constructivist theory of learning. It is time to adopt practices that will help students become good thinkers and therefore, become productive individuals and citizens. By following these guidelines in action and reflection, teachers can develop students’ critical and creative thinking capacities.

Applying these principles to classroom practice does not require profound changes to the curriculum. It does however require a profound change in perception regarding student and teacher roles in the learning process. In adopting these guidelines teachers and students shed the semblance of traditional classrooms in which teachers are dispensers of information and students take in already formulated knowledge. Students become active in the construction of knowledge and understanding. Teachers become facilitators of thinking and learning. As facilitators, teachers direct student learning by observing and guiding their learning process. Teachers challenge students by basing instruction on problems and issues that stimulate curiosity and inspire attitudes that carry thinking forward.
Eight Guiding Principles for Inviting Critical and Creative Thinking into the Classroom

Do more than exist ~ live.
Do more than touch ~ feel.
Do more than look ~ observe.
Do more than read ~ absorb.
Do more than hear ~ listen.
Do more than listen ~ understand.

-John H. Rhoades
Principle 1: Create an environment that promotes good thinking by making it an explicit goal of instruction and showing that it is valued and expected.

Key points of rationale: * Creates a safe environment for the risks involved in thinking.
* Nurtures positive attitudes toward thinking.
* Establishes explicit expectations for thinking.

Massachusetts Mathematics Curriculum Framework, 1997
The teacher sets the tone for learning therefore, it is vital that she give strong, positive messages, implicitly and explicitly, that student thinking is valued and welcome. The types of interactions between students and teachers, the feeling students get when they walk into the classroom as well as spoken and unspoken expectations all contribute to the classroom environment. That environment can promote or inhibit thinking. Everything from the desk arrangement to the questions teachers ask and responses to student questions and ideas sends a message about what is valued in the classroom. Consequently, the classroom should be arranged for maximum interaction and exchange among students and the teacher. Groups of desks or tables are preferable arrangements that invite intercommunication rather than one-way communication between the teacher and selected students. This kind of arrangement also lets students know that communicating their ideas and questions is celebrated and contributes to students' sense of safety in asking and answering questions.

In order to be conducive to critical and creative thinking, the classroom environment must also invite and provide opportunities for students to initiate and ponder complex questions. Students must be able to share their ideas, questions and curiosities through activities such as discussion and collaborative projects in an environment where they are accepted, valued, and expected. Students should feel part of a classroom community that inquires, explores and discovers (Caine and Caine 1991). It is equally important that students' ideas and questions, whether correct or incorrect, are received with encouragement and enthusiasm so they know and feel that their classroom is a safe place to learn, grow and take risks.

Another important environmental factor is being explicit in communicating instructional goals. Research shows that when teachers clearly and directly state the objectives and strategies for instruction, student performance is enhanced (Rosenshine and Furst as cited in Costa 1991). For instance, when beginning a lesson state to the class: "Today we will look for patterns in the weather system and predict the causes of those patterns." This allows students to better understand what is expected and therefore carry out activities and tasks more efficiently. They can spend more time on task and less time
trying to figure out what the teacher is trying to communicate. Stating objectives and strategies clearly and explicitly also helps students understand the language, which will be discussed in detail later, and goals of thinking. Eventually they will be able to state which skills and strategies to employ in approaching assignments. They will become equipped to be autonomous thinkers and doers who take initiative in learning (Erickson 1991).
Principle 2: Model the behaviors you want to manifest in your students.

Key points of rationale: * Teachers teach by example.
  * Modeling reinforces the habits of good thinking.
  * Modeling behaviors helps create a thinking environment.

(Sarko 1995, 79)
It has often been said that children learn what they live. If there is truth to this statement - and I think there is - then students need to live with a teacher who teaches by example. The teacher should model critical and creative thinking by exhibiting the dispositions, applying skills and strategies, and practicing metacognitive techniques. Everything the teacher says and does sends a message, positive or negative, intended or unintended, about what is valued; therefore, it is imperative that students witness good thinking. Teacher behaviors should “inspire attitudes congenial to thinking and reinforce” the skills and strategies that support critical and creative thinking (Ruggiero 1988, 103).

Living in a classroom with a teacher who shows curiosity, flexibility, openness, perseverance, resourcefulness, clarity, and empathy, will help to develop these dispositions in students (Kirby 1990). For example, if the teacher shares with the class the solution to a problem she’s been working on for a period of time, the students will know she is persevering. Teachers must also display critical and creative thinking skills such as distinguishing fact from opinion, create analogies and use evidence to support claims. In essence the teacher must be a critical and creative thinker. Students will learn two things: 1) that thinking is valued; and 2) what good thinking looks like.
Principle 3: Cultivate the dispositions for critical and creative thinking.

Key Points of Rationale: * Personal dispositions support and propel thinking.
  * Values influence thinking.
  * Contribute to good habits of mind.
“The values and attitudes that support critical and creative thinking should be explicit goals of instruction, for such dispositions as much as skill with cognitive operations and critical knowledge, carry thinking forward” (Beyer 1987, 75). Effective thinking is supported by dispositions. The attitudes and values that students bring to the learning situation greatly affect how students approach tasks; therefore, dispositions are an important aspect of critical and creative thinking. Nurturing the dispositions to suspend judgment, be empathetic, flexible, fluent, open-minded, to seek multiple perspectives, persevere, reflect, take risks and tolerate ambiguity, is crucial if students are to develop and apply the skills and strategies for thinking.

Activities must promote these thinking dispositions. A child who has these dispositions is likely to:

... pose questions and investigate sources of information;
... enter into empathetic situations and dialogues;
... seek varying perspectives;
... take time to observe and postpone action;
... have the inclination to consider other points of view, other ways of doing or being;
... draw upon her memory to make connections and generate ideas;
... pursue problems that have multiple interpretations or no clear paths to solutions; and
... work on the edge of possibility and communicate her ideas with others.

There are many ways teachers can cultivate thinking dispositions in students. First, teachers should engage students in activities that build and require thinking dispositions. A shy student, for example, who may not like to speak in front of the class may speak in cooperative groups before moving on to bigger audiences. This can help build his ability and willingness to take risks. Second, teachers should reinforce thinking behaviors whenever students display them. The teacher should make comments such as: “Tommy,
you did a great job explaining your opinion”, or “Sally, it’s wonderful to see how many ideas you have for solving the problem.”

Third, teachers should model the behaviors associated with good thinking; e.g., seeking information, providing reasons for statements, being open-minded and flexible. By modeling and encouraging the dispositions, students will see the value and in time exercise the dispositions themselves. Lastly, teachers should create a safe, orderly classroom environment where students feel comfortable and accepted. This can be accomplished by establishing expectations for behavior and performance together, setting clear goals, inviting student inquiries and ideas through questioning techniques and instructional activities and acknowledging mistakes (yours and theirs) as a natural part of learning.
Principle 4: Use the language of thinking in your classroom.

**Key Points of Rationale:**
* Builds language and understanding of specific thinking skills.
* Clarifies procedures used in thinking.
* Facilitates transfer of skills.
Claim, opinion, judge, and investigate are just a few examples of language that can be used in classroom interactions, discussions, instruction and reflection to mirror the kind of thinking that is being developed, defined and applied. Language should be used to *evolve* thinking, *clarify* thinking and *direct* the mental activity and products being generated in the classroom (Tishman 1995). Teachers need to articulate and explain thinking as it occurs spontaneously or intended. If you recognize a student using the language of thinking, direct attention to it as in the following example:

Student: My guess is that Charlotte feels sad because Wilbur is leaving.

Teacher: I like how you stated your opinion and provided a reason for it. This helps students take command of thinking and apply it more skillfully and appropriately and provides students with a broad, vivid thinking vocabulary.

Together teacher and students generate a thinking vocabulary that is used in the classroom on a regular basis. During lessons and activities, it is important to talk about and use the language of thinking. If the class is working on hypotheses or validating claims, it is important to use those terms. As an illustration, the teacher may say to the class: “John’s hypothesis was that porous rocks will float in water. Does anybody agree or disagree with that hypothesis?” or “How could we validate the claim that our school lunches are the best in Massachusetts?”

To make the language more salient, lists can be created from all subject areas during the course of the school year, displayed on charts, and referred to and discussed at appropriate times; for example, when students recognize thinking words, discover new ones or use them to express what kind of thinking is occurring during lessons. Use of thinking vocabulary within and across disciplines may aid transfer. Students will begin to see, hear and use the same words and skills connected to a variety of situations. Application of the language and skills used in different situations should be pointed out to students since transfer is not automatic (Beyer 1987). The teacher may say, for example, “Yesterday in science we predicted how much water is wasted from leaking faucets in our houses. Today we will use predicting skills in reading to think about what might happen in the story.” This technique may increase the likelihood of transfer. Examples of thinking
words that cut across disciplines include: investigate, conclude, guess, hypothesize, believe, claim, justify, opinion, reflect and many more. Look and plan for them in stories, texts, activities, and discussions. They are everywhere!
Principle 5: Actively engage students in meaningful, relevant, and purposeful activities that include problem solving and decision making.

Key points of rationale: * Thinking is active.
  * Active problem solving and decision making are real and relevant.
  * May promote transfer.
There is a Chinese proverb that says, "I hear and I forget, I see and I remember, I do and I understand." In order for students to become good critical and creative thinkers, they have to engage in thinking. Children must be encouraged to pose questions, investigate answers, form hypothesis, discuss findings, work collaboratively, and reflect. They must have the opportunity to practice the skills and strategies essential to good thinking. "When students are given opportunities to deal with life-relevant problems and issues, they feel a need to know. They develop analytical and critical thinking skills as they research, probe, dialogue and defend" (Erickson 1991, 181).

An environment that invites critical and creative thinking provides opportunities to do so. The classroom should hum with activity from students who are deeply engaged in what they are doing. Through problem solving activities, decision making, and conceptualizing in contexts that are meaningful, relevant and purposeful, students can construct knowledge and understanding, take ownership of learning and develop habits that last a lifetime.

Research in cognitive psychology has given valuable insight into how the brain works and how we learn (Caine and Caine 1991). A word that comes up in the literature again and again is "active". This means that our students are not passive recipients of 'knowledge'. They process new information and experiences actively in order to construct meaning and understanding rather than passively receiving information for use at some later date. Therefore, students should be actively engaged in the learning process and classroom activities. One such activity may involve students working together in "corporate" groups to design a product for consumers, name the company and product, and create an advertisement to market the product. An added benefit of this type of activity is that it allows for the integration of subject matter.

Research has also provided evidence that thinking processes are enhanced by context, which allows students to connect previous knowledge to new knowledge and concepts. It aids interpretation and organization of stimuli (Matlin 1998). In mathematics it is much easier to appreciate and understand the value of multiplication when there is a need to multiply. Students may be involved in calculating the amount of garbage produced in their
city each month as a result of their concern with the issue of recycling. Students may then consider options for reducing and recycling garbage. Students can thus create meaningful associations and more easily synthesize knowledge. These are important outcomes of critical and creative thinking.

Teachers must consider students’ previous experiences, interests, and knowledge when planning lessons in order to relate curriculum and thinking skills to students’ lives (Matlin 1998). Problem solving and decision making are effective tools in making content and skills relevant and in teaching thinking. They call on students to use skills and knowledge through action that is purposeful. This provides a need and motivation to learn and it facilitates deep understanding on many levels. One way to use these methods is to decide classroom expectations - also known as rules - together. This gives students an active role and responsibility in considering what behaviors they expect and do not expect from each other. It is an issue worthy of deep consideration.

Problem solving and decision making compliment and challenge the human mind. They are activities we engage in naturally everyday. Instruction that employs these processes can make them more efficient. Moreover, problem solving and decision making can be taught and nurtured in every classroom, in every discipline at every grade level whether in a single lesson, a unit or a long-term project.
Principle 6: Practice metacognitive techniques.

Key points of rationale: * Makes students aware of thinking skills and strategies used.
* Gives students control over planning, monitoring and assessing.
* Gives students responsibility for their thinking.

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Metacognition, “the art of reflecting on and guiding one’s own thinking processes”, (Tishman 1995, 65) leads to improved thinking on many levels. It helps students plan, monitor, assess and refine thinking processes. Educational and cognitive research support this notion (Costa 1991). When students are aware of their thinking processes, they come to understand the when, where, how, why, and what of their thinking. They are better able to develop and apply skills and strategies mindfully and skillfully. Furthermore, it gives them insight and awareness of which strategies work and which do not work in a certain situations. Practice in metacognitive techniques also helps build an appreciation of necessary changes in thinking patterns and strategies. For instance, if a goal is not met, students can ask themselves why or why not, at what point in the process did understanding break down, and what should be done differently next time.

Before instruction, during instruction and after, it is important to guide students in metacognitive behaviors. Before direct instruction, the introduction of new concepts elicits students’ intuitive understanding of the phenomena. During instruction questions, directions and activities should direct students to consider what plans and strategies will be or were used in order to evaluate which ones helped achieve the goal and which did not and then plan new ways to approach the task if necessary. After instruction students write journal entries about main concepts and applications. To further augment metacognition, it is helpful to label student behaviors, clarify student questions and responses, keep journals, use observation sheets for work and activities, generate questions and plan strategies together. It provides an opportunity for students to explore their thinking.
Principle 7: Focus on questioning that evokes multiple appropriate responses.

**Key Points of Rationale:** *Elicits novel responses and student generated questions.*

* Supports thinking dispositions of open-mindedness, flexibility and originality.
* Enhances divergent thinking.

"I have a riddle for you. Which came first, Microsoft or Bill Gates?"

(Better Homes and Gardens, April 1999, 260)
Questioning is perhaps one of the best tools teachers can use to develop students' critical and creative thinking predilection. Socrates demonstrated the power of questioning to stimulate thinking more than 2000 years ago (McTighe cited in Costa 1991). Questions, when worded thoughtfully and applied skillfully, help provoke and probe student thinking. Questioning prompts students to share, investigate, ponder, explain, and elaborate their thoughts and the ideas of others. For this reason, divergent, open-ended questions that evoke multiple appropriate answers should comprise a generous portion of questions generated in the classroom by teachers and students. Divergent, open-ended questions that require multiple appropriate responses are more likely to create an environment that invites thinking. For example, teachers can ask, What possible explanation could you give for...? Why did you assert that ______ is the best? or That's a very good conjecture. How did you arrive at it? When teachers probe students' responses and ask follow-up questions, they help students develop reasons and assist them in understanding their assumptions and the bases for their beliefs.

The kinds of questions asked and generated contribute to a thinking atmosphere. If questions are consistently convergent, such as who, when, where, which require only one correct answer, it is unlikely that students will perceive thinking as a goal. Divergent questions such as, What if? Why? and How? are much more interesting and thought provoking and focus on contemplation and imagination, which lead to discovery, insight, and understanding. Divergent questions cause students to speculate possibilities and scrutinize ideas. They invite critical and creative thinking. A case in point is when elementary students study U.S. History. They often learn that “Columbus sailed the ocean blue in 1492.” While this knowledge is useful, it does not elicit active thinking and learning nor critical or creative thinking. We want students to know why and how it was possible to sail the ocean at that time. What fueled exploration and colonizaion? These types of questions promote student construction of understanding rather than dispensing information in a ‘hand-me-down’ manner.

Using questions designed to elicit multiple responses should be done in an environment that allows students time and opportunity to answer them. It is important to
use silence and \textit{wait time} so that students have time to think and know that it is expected, that you will not simply jump to the next person. It helps students recognize that you value and expect thinking. Likewise, teachers must accept and value a wider spectrum of responses and products from students (Crepley 1992). Divergent questioning generates divergent answers that may at first appear irrelevant or bizarre. Teachers must learn to recognize when students' think broadly, expand their perceptions and elaborate their ideas. In addition to answering divergent questions, students should generate their own questions such as, Why? What if...? and How might we...?

Many questioning techniques have been developed or advanced by outstanding educators to induce and direct critical and creative thinking. Synectics (Gordon as cited in Starko 1990) is a particularly wonderful method for sparking divergent thinking. This technique develops analogical and metaphorical thinking which enhance our critical and creative thinking abilities by helping us make connections, associations, and bring together normally unrelated elements. There are four types of analogy: direct, personal, fantasy and symbolic.

Direct analogies ask students to find solutions to problems by asking, “How have similar problems been solved?” usually using examples from nature. For example, if students are trying to find clothing that will grow as they grow, they may look to the way human skin grows with the body to find a solution. Personal analogy involves imagining yourself as part of the problem. Students may, for example, pretend that they are the “White House Turkey” for Thanksgiving this year. Imagine how you feel about it, what thoughts are running through your head and what your future may or may not be. Imagining that you are part of the problem “should stimulate an inside view of the situation and some new ideas while you are there” (Davis 1983, 146). Fantasy analogies are equated with preposterous ideas. Often, students work backwards to find a solution. Students may picture a kitchen cabinet that automatically adjusts to their height so they can more easily reach the Oreos. Starting with an outlandish solution can often provide very practical ideas. Lastly, symbolic analogy is used to generate solution ideas by forcing unlike
concepts together. This type of analogy is commonly referred to as an oxymoron, such as in hurried patience or lazy ambition.
Principle 8: Structure activities so that students see problems and issues from multiple perspectives.

Key Points of Rationale: * Fosters a tolerance for complexity and ambiguity.
* Builds elaborated mental models for the basis of beliefs, conclusions and actions.
* Support the dispositions of open-mindedness, empathy and intellectual humility and perseverance.

(Starko 1995, 329)
Multiple perspectives, point of view and frame of reference all refer to the lens through which we view problems and issues. Critical and creative thinking require moving out of one’s own perspective in order to see further and more broadly. If you always live on top of Mt. Me, for example, and never see the view from Mt. X or Mt. Y, it is not likely that you will have a broad understanding on which to base personal opinions. Seeking and engaging in multiple perspectives expands the picture of problems and issues for students. “Presenting content from a single perspective is unlikely to reflect the complexity inherent in many concepts. In contrast, repeated exposure to information from varying perspectives helps learners to establish the interrelationships necessary to mediate deep processing and effective retrieval of lesson concepts” (Erickson 1991, 96).

The strategies used to promote perspective seeking are important. Teachers cannot merely say, “What does John think about recycling?”, but must engage students in activities such as role-playing, methodological belief and disbelief and Synectics. Each of these methods, which will be explained shortly, heightens student involvement with alternative perspectives, revealing the many ways in which the world may be perceived. Not only are students exposed to alternative points of view, but they also interact with them in meaningful contexts.

Role-playing is used to help students take on points of view other than their own. During this activity, students are generally required to enter the discussion from two or three other perspectives (Gallo 1987). If the issue is use of reservation land, students may have to take the role of a Native American, a government official or a conservationist. This takes the issue beyond initial reactions to the problem to deeper understanding of the factors involved. “With each successive perspective we take, however, the issues become more complex and the ‘right’ answer less clear” (Costa 1991, 13). This increases students’ ability to tolerate ambiguity and to be persistent in reaching conclusions or beliefs based on the enlarged picture of the issue.

Another activity that requires engagement in varying perspectives is Peter Elbow’s (1986) methodological belief and disbelief. This technique requires that students either
believe or doubt a hypothesis or view other than their own. Believing obligates students to look for strengths of the position or hypothesis proposed even if it is farfetched or in direct opposition to their own beliefs. Doubting requires students to find flaws in the argument or position proposed whether they agree or disagree with it. It is best to try this method in literature since it is inherently open to interpretation (Elbow, 1986). This makes it easier for students to learn and participate in this type of activity. After reading SHILOH you may, for example, solicit student opinions about Jake’s actions in hiding the dog from its owner, then engage them in systematically believing and doubting a partner’s view on the issue.

Activities that cause students to solicit and consider multiple perspectives have several advantages for critical and creative thinking. First of all, they provide an extended background on which to base beliefs, actions and conclusions. Imagine a group of students engaged in role-play on the issue of colonizing space. After discussion, reflection, and consideration of many aspects of the issue, students are better able to reach a conclusion that is conscientious and informed.

Second, activities structured to include varying perspectives help students reach beyond their own limits. They can expand the landscape for learning and for understanding problems and issues as well as help students reach fair, emphatic decisions and beliefs. Seeking multiple perspectives also moves students beyond “either/or” thinking, which humans are prone to (Dewey 1938). They understand that every issue and problem has many sides and they begin to see the intermediate possibilities of interpretations, explanations and resolutions. Lastly, exposure to and engagement with multiple perspectives help foster many of the dispositions necessary for good thinking such as empathy, suspension of judgment, tolerance for ambiguity and perseverance.
Implications of Implementation

Critical and creative thinking must be made the norm in every classroom. These principles are offered as an illustration and guide to help teachers “assimilate practices and strategies that foster thinking” (Caine and Caine 1991, 46). They address the needs of individual teachers in the context of the regular, mandated curriculum by offering practices that cultivate critical and creative thinking in the classroom environment, teacher behaviors and instructional strategies. It is hoped that by utilizing the principles, teachers will become committed to teaching and developing critical and creative thinking in their students. Teachers and students will find satisfaction from employing thought processes in a meaningful, purposeful context that encourages and develops our capacities for critical and creative thinking.

As teachers attempt to integrate these principles into classroom practice, it is important to reflect on progress, strengths and weakness, and the successes and failures that are a natural part of the journey toward creating a critical and creative thinking classroom. In the final chapter, an evaluation instrument is provided to allow teachers to reflect on the actions taken and progress made in inviting and implementing critical and creative thinking practices.
Undertaking instructional changes, such as those proposed in this paper, requires time, commitment, practice, and reflection on the process. As teachers strive to implement these principles and develop good thinking skills, habits, and strategies in their students, it is important that they reflect on present classroom practices to determine what changes, modifications, and adaptations are necessary. For this reason, a corresponding assessment instrument has been designed which can assist teachers on their journey to becoming facilitators of critical and creative thinking.

The goal of the assessment tool is to allow teachers to reflect on their strengths and inclinations in light of present classroom practices and to continually monitor progress toward creating a thinking classroom using the eight guiding principles. The assessment should be used before, during, and after employment of the principles; therefore, the assessment is meant for use by teachers who will most likely be the initiators of change and the evaluators of that change. The instrument does, however, lend itself to use for observation by colleagues or supervisors if the opportunity arises.

For each principle, criteria are provided to help determine the extent to which the principle is present in the current classroom environment, teacher behaviors, and specific instructional strategies. These three elements were chosen because they are of primary importance in promoting critical and creative thinking among students. Reflection on current practices will provide teachers with a reference point from which to begin implementation of the eight guiding principles. The unique situations of individual teachers will determine the path taken toward putting the principles into practice. Principles for teaching critical and creative thinking should be implemented slowly. The teacher and students need time to adapt, experiment, and to explore this new territory.
Using the EBS Assessment

Initiating educational change requires assessment of teaching practices at every phase of implementation. Teachers need to have a picture of practice before implementing the eight guiding principles and to continually monitor changes and progress. The EBS Assessment instrument, provided below, will aid teachers in initiating and sustaining change. The EBS assessment is named after the three elements that are crucial to implementation of each principle – environment, behavior and strategies. It should be used at each phase of implementation: before, during and after employing the principles. Initially, as well as over time, use of the assessment instrument will allow teachers to recognize areas that need to be developed, their progress in implementing the principles and growth toward creating a thinking classroom.

Implementation of the principles should be preceded by an assessment of what is currently taking place in terms of the classroom environment, teacher behaviors and instructional strategies. This provides a reference point for gauging progress toward inviting critical and creative thinking in the classroom. Before implementing any of the principles, teachers should take stock of what is and is not present in classroom practices in regard to the principles through an overall evaluation of the environment, behavior and strategies using the assessment tool. Afterward, teachers can use the information to begin implementation of the principles. The realization of a thinking classroom is not a hurried event but a process that occurs over time therefore, the principles should be implemented one at a time. Employing the principles one at a time makes it systematic and manageable. Teachers should not feel overwhelmed nor should students.

Initially, teachers should do an overall assessment of their classroom practices using the EBS assessment. Once teachers have a picture of their classroom practices and are aware of what changes and modifications are necessary, implementation may begin. For instance, teachers may begin taking discrete steps toward creating a classroom environment that promotes thinking by encouraging students’ questions and ideas.
During implementation, teachers should continually assess their progress in employing the principles. Depending on the situation, teachers may assess as often once a week or just once or twice a month. Eventually it will become a habit to check for critical and creative thinking elements in classroom practices. After implementation of the principles, teachers may review the changes that have occurred during the semester or school year in order to assess and plan steps and strategies for continued progress.

The principles have been presented in an order consistent with adoption into classroom practices. Starting with the environment and teacher modeling are good entry points because they are centered around the actions of the teacher, allow teachers to focus on taking definitive steps toward implementation, and allow time to acclimate students to the changes taking place and monitor their responses to the changes. The unique situation of the teacher will determine the precise strategies used to employ the principles. If, for example, many elements of a critical and creative thinking environment are already present in classroom practices, beginning with specific strategies that foster critical and creative thinking may be more appropriate. Regardless of the sequence in which the principles are implemented, teaching explicitly for thinking is a challenge but ultimately worthwhile for all involved. Critical and creative thinking bring an added sense of purpose, energy and excitement to teaching and learning.
Inviting and Implementing Critical and Creative Thinking in the Classroom
Self-assessment for getting started and continued progress

Name: ___________________  Subject: ___________
Date: ___________________  Grade: _____________

Principal and/or elements assessed: _______________________

For each of the following principle(s) please write comments in the box regarding the absence or presence of the essential elements for inviting critical and creative thinking into the classroom: environment, behavior, and strategies. Include comments on specific strengths and weaknesses.
**Principle 1:** Create an environment that promotes good thinking by making it an explicit goal of instruction and showing that it is valued and expected.

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<th>Provide comments for each...</th>
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| **Environment:** Encourages interaction among students through classroom arrangement. 
  *e.g.* work tables, groups of desks |           |                   |
| **Behavior:** Shows an attitude of acceptance toward and encouragement of student inquiries, questions and ideas.  
  *e.g.* “I’m glad you asked that.” “Interesting idea.” |           |                   |
| **Strategies:** Clearly communicates thinking objectives to students. 
  *e.g.* Today we will..., Our goal is to... |           |                   |

**Principle 2:** Model the behaviors you want to manifest in your students.

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| **Environment:** Shares an awareness of thinking processes and strategies with students.  
  *e.g.* posts strategies and steps |           |                   |
| **Behavior:** Exhibits dispositions of a good thinker in word and action.  
  *e.g.* I’m still working on..., Another way to look at it is... |           |                   |
| **Strategies:** Openly uses and articulates skills and strategies of a good thinker.  
  *e.g.* “Where am I now?” or “Am I making progress?” |           |                   |
### Principle 3: Cultivate the dispositions for critical and creative thinking.

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| **Environment:** Communicates expectations for applying thinking dispositions.  
  *e.g.* Displays posters that promote dispositions. |           |                   |
| **Behavior:** Encourages and rewards displays of dispositions.  
  *e.g.* That’s very open-minded.,  
  I like the way you’re seeking other opinions. |           |                   |
| **Strategies:** Uses activities that Call for the dispositions.  
  *e.g.* role play, what’s another way to approach this problem? |           |                   |

### Principle 4: Use the language of thinking in your classroom.

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| **Environment:** Conspicuously displays thinking words in classroom.  
  *e.g.* posters, charts, webs |           |                   |
| **Behavior:** congratulates use And identification of thinking words.  
  *e.g.* You used/noticed the word claim, investigate, conclude. |           |                   |
| **Strategies:** Uses thinking language in lessons, activities and discussions.  
  *e.g.* Can you justify... How would you interpret...? |           |                   |
**Principle 5:** Actively engage students in meaningful, relevant, and purposeful activities that include problem solving and decision making.

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<th>Provide comments for each...</th>
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<tbody>
<tr>
<td>Environment: Allows students to be active in the construction of meaning and understanding. e.g. resources, manipulatives, computers, problem solving tools.</td>
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<tr>
<td>Behavior: Provides opportunities for students to question, discuss and investigate. e.g. How can we find out... Talk with a partner about...</td>
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<tr>
<td>Strategies: Activities require students to solve problems and make decisions about pertinent issues in many areas of curriculum. e.g. think of explanations, alternatives, possibilities</td>
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**Principle 6:** Practice metacognitive techniques.

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<tr>
<td>Environment: Students are given time to reflect on their thinking processes. e.g. posters, deliberate assess</td>
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<td>Behavior: Models metacognitive strategies and processes. e.g. “Why did that work?, I think I need to change...”</td>
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<tr>
<td>Strategies: Guides students in using metacognitive strategies to reflect, assess and redesign. e.g. plan-successes-difficulties?</td>
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Principle 7: **Focus on questioning that evokes multiple appropriate responses.**

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| **Environment:** Accepts and encourages divergent questions and responses from students.  
  *e.g.* What an interesting question. Who can think of a question that isn’t ‘yes/no’? |           |                   |
| **Behavior:** Uses wait time when directing questions to students.  
  *e.g.* pause, “Take your time.” |           |                   |
| **Strategies:** Question style and activities encourage broad thinking and many equitable answers.  
  *e.g.* asks what if, how, why and In what ways can we...? |           |                   |

Principle 8: **Structure activities so that students see problems and issues from multiple perspectives.**

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| **Environment:** Creates a community that thinks broadly about issues and problems.  
  *e.g.* resources, exhibits |           |                   |
| **Behavior:** Presents content from different viewpoints.  
  *e.g.* How did... view the situation? |           |                   |
| **Strategies:** Activities cause students to step away from their own perspective and consider alternatives.  
  *e.g.* role play, problem based units |           |                   |
CONCLUSION

It is my belief that developing the critical and creative thinking capacities of students will procure enormous benefits for individuals and society. Our mind is our greatest asset, and developing it to its full capacity can tremendously enrich our lives. In thinking critically and creatively the limits are few and the possibilities endless. When people use their minds fully, they become more productive to themselves and others. They are able to move toward developing their full potential.

Critical and creative thinking have, throughout history, provided ideas and innovations that have contributed to humankind. The wheel, music, electricity, political systems, medicine, mass communication and architecture are but a few examples of what critical and creative thought can produce. Although these examples are of great magnitude and we equate them with great minds, each and every one of us has an innate capacity to think critically and creatively in order to better our lives and the world. “Thinking is at the heart of what it means to be human; to fail to develop one’s potential in this regard is to preclude the full expression of one’s humanity” (Nickerson 1985, 32). To fail to develop good thinking in our students, that is, critical and creative thinking, is to fail our students and ourselves.

This paper was developed around the tenets that: 1) the thinking skills of all students can be developed through instruction; 2) the improvement of thinking should be addressed throughout the grades beginning in elementary school; 3) thinking is fundamental to all subject areas; and 4) teaching for thinking promotes deeper understanding of concepts and content material (Costa 1991). It is hoped that the eight principles proposed in this paper will help teachers understand these tenets and the importance of critical and creative thinking, as well as become committed to and engaged in teaching thinking to their students. The dispositions, skills and strategies that are developed in learning to think critically and creatively will equip students with essential tools for success in a world where change is constant and guaranteed.
The principles proposed in this paper, though potent, only begin addressing the need to teach thinking in our schools. A collaborated effort is needed at all levels of the education system if permanent, necessary, fundamental changes are to be made in regard to teaching students to think well. Although new state frameworks have begun to recognize thinking as an essential skill, curriculum is not yet aligned to systematically include thinking skills across disciplines and grade levels. Critical and creative thinking must be explicitly incorporated into the curriculum. In addition, schools can encourage and train teachers to use methods and strategies that develop the critical and creative thinking abilities of students. Lastly, teacher training programs can make prospective teachers aware of the importance of teaching good thinking and the instructional practices that promote its development.

As a student in the Critical and Creative Thinking Program, I have learned the importance, value and need to teach students to think critically and creatively. This paper was conceived for the purpose of informing other educators about the need to teach thinking in their classrooms and as a guide in undertaking such an endeavor. I hope that the eight guiding principles presented in this paper help promote the development of classrooms where critical and creative thinking are the definitive goals of teaching and learning.
APPENDIX A

BIBLIOGRAPHY OF RESOURCES ON STRATEGIES FOR TEACHING CRITICAL AND CREATIVE THINKING


Creative Teaching Press, 5305 Production Drive, Huntington Beach, CA 92649.


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