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The Cultivation of Thinking Dispositions in Grades Three and Four

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THE CULTIVATION OF THINKING DISPOSITIONS
IN GRADES THREE AND FOUR

A Synthesis Project Presented

by

LINDA L. TAYLOR

Submitted to the Office of Graduate Studies, University of Massachusetts
Boston, in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

December 1997

Critical and Creative Thinking Program

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ABSTRACT

THE CULTIVATION OF THINKING DISPOSITIONS
IN GRADES THREE AND FOUR

December 1997

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Directed by
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Thinking dispositions are the internal motivation for thinking critically and creatively. Successful critical thinkers use their thinking skills without another person directing them to use the skills. Many individuals, having acquired these

In my work as an enrichment specialist, I have found support for this view. In this paper I present a case study of my work with third and fourth grade students, which focuses on developing the attitudes and dispositions needed for successful critical and creative thinking.

I begin by describing the conceptual framework of my work, reviewing the literature focusing on the contributions of Shari Tishman, David Perkins, Edward de Bono, Matthew Lipman, and Reuven Feuerstein. Following that, I describe a series of lesson plans presenting problem solving activities. These activities are samples from the enrichment program implemented during my year in a western Massachusetts school system. I conclude by offering a qualitative analysis of the responses of students, parents and teachers.

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OVERVIEW

Teachers ask, "Why should I take extra time to teach thinking skills when students don't use them?" Their experience is that students typically learn a specific skill; for example, identifying point of view, do the related worksheets and pass the test. The next day when the teacher asks why a character performed a particular action few students include the character's point of view. Why doesn't apparent learning of a thinking skill lead to applying it in other situations? Students have the knowledge, why don't they try to use it? This situation is analogous to a young auto mechanic with a magnificent set of new tools. He is able to name each tool and demonstrate how to hold each one but doesn't use them when fixing the car. Why do the cognitive tools in the form of knowledge remain inactive? Why do some individuals tend to activate their knowledge in appropriate situations while others do not? What can we do to assist in developing the tendency to use knowledge/tools?

Some thinking skills programs have achieved success in developing both thinking skills and the tendency, or disposition, to use them. Examining these programs and stand alone materials for teaching thinking skills may give us answers to some of these questions. Three programs with documented success in proximate transfer of learning are Feuerstein's Instrumental Enrichment, de Bono's CoRT Program, and Lipman's Philosophy for Children. (Perkins 1995)

These programs have several characteristics in common. They involve mediated learning experiences in which the students create and examine their own mental models of the event. They also involve extensive teacher scripts or

teacher training in use of the materials and the creation of a community of learners in which students learn and practice thinking skills. The interactions of student and teacher, student and peers, and student and the environment create this community. (Edwards 1994),(Feuerstein 1980), (Lipman 1985).

Sources for stand alone thinking skills materials fall into three major categories that I will describe in detail later in the paper. The most ubiquitous of these are the thinking skill add-ons in the teacher's guide for any text book series. Then there are the thinking skill activity books and workbooks available in every teachers' store or catalog of resource materials. The last category comes under the classification of professional reading. All three may include some experiences designed as mediated learning experiences and to help create well functioning mental models. Rarely is there any mention of the atmosphere of the classroom or its role in creating a sense of community among the students, teacher and visitors. It is this sense of community that increases the level of student involvement and potential for developing transferable thinking skills (Brown 1996). Perhaps it is time we focus less on teaching individual thinking skills and more on the classroom atmosphere and developing the attitudes or dispositions needed to use existing skills.

The Enrichment Program, at a local elementary school, provided the opportunity for me to put this idea into action. Budget cuts in 1995 caused the elimination of the Talented and Gifted program along with music classes for the lower grades. Parents, actively seeking alternatives, created the current Enrichment Program funded by an enrichment grant from the Massachusetts Department of Education.

The former TAG teacher returned to teaching fourth grade full time. The school's Enrichment Council and principal hired me as enrichment specialist because of my background in critical and creative thinking and science. In the

1996 - 1997 school year I visited three third grade and three fourth grade classes once a week for forty minutes. During that time my goal was to create, within the classroom, a community of learners working together to solve problems, conquer challenges, and examine thinking. By creating this community, I hoped to encourage, in students and teachers, tendencies or dispositions to make connections and activate knowledge. One part of my premise is that students learn not to identify connections between new knowledge and prior knowledge. I label this the disposition to maintain inactive knowledge. I believe this disposition develops as adults hurry children who are beginning to make connections. For example, one student commented that arranging sponge blocks in a pattern that satisfied specific rules was like playing soccer. When I asked her to explain, she thought for a minute before answering. She connected arranging players on the field and arranging sponges on the desk. It is not a connection I would have made, because I don't play soccer. Therefore, I might have told her the connection was not correct. It is my experience, that students who do not receive a positive response to their efforts cease creating connections between new information and past endeavors. The enrichment activities I developed focused on cultivating the disposition to activate knowledge by providing experiences encouraging students to make connections and reflect. I chose these activities from a variety of sources and disciplines and presented them as challenges that all students can master.

In implementing this work I followed some general procedures. Together we take the time to identify prior personal knowledge that might be useful in the solution. We explore various styles and formats for directions (verbal, visual, or kinesthetic), to learn which is easiest to understand. Initially, directions are either verbal or written and students are asked to identify what they do not

understand. I give additional directions in a different format. Students also take the time to identify what other assistance they need, and who (peer or adult) is the best source of that assistance. The classroom teacher usually remains in the classroom and may or may not choose to participate in the activities.

In this paper, the first section of Chapter I offers a review of the critical and creative thinking literature that has informed and supported the development of the beliefs leading to this enrichment program. The second section of Chapter I describes additional support for the need to improve thinking skills in today's students from the Massachusetts Common Core of Learning and the U.S. Department of Labor Secretary's Commission On Achieving Necessary Skills (in future I will refer to this as the SCANS report) report. Chapter II contains a description of the enrichment program, some of the activities used, and their presentation to the students. Chapter III is a qualitative evaluation of the program for last year and plans for the upcoming year.

CHAPTER 1

REVIEW OF THE CRITICAL AND CREATIVE THINKING LITERATURE

Thinking skills programs abound on the educational scene. Tips for teaching critical and creative thinking are part of most of the teacher materials published in the last three or four years. So many definitions exist for those two terms, that it is difficult to know what is valuable and what is not. The definitions I use for critical thinking come from the National Council for Excellence in Critical Thinking Instruction articulated by Richard Paul and Connie Missmer. The National Council's definition states,

“Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, or evaluating information gathered from, or generated by observation, experience, reflection, reasoning, or communication, as a guide to belief and action.” (Paul 1993, 95).

Connie Missmer states that “critical thinking entails alternative argument, evidence, and sensitivity to the feelings and level of knowledge of others.” (Missmer 1995,). I contend that it is important to include the affective aspects of critical thinking in my working definition.

For a definition of creative thinking I turn to Davis' Creativity is Forever. Davis cites Torrance's well known definition which states:

“the process of (1) sensing difficulties, problems, gaps in information, missing elements, something askew; (2) making guesses and formulating hypotheses about these deficiencies; (3) evaluating and testing these guesses and hypotheses; (4) possibly revising and retesting them; and finally (5) communicating the results” (Davis 1992, 43).

All of these definitions describe active thinking as a process in which the thinker is doing something with the information available. Why then, Tishman asks, if critical and creative thinking skills are being included in many lessons, are learners "plagued by the problem of 'inert' knowledge and skill-learning stored up in memory that does not get activated in useful circumstances."...? (Tishman 1995, 160) Students often have an impressive repertoire of strategies and skills that they can define and apply when requested. However, like the young auto mechanic, they are unable or unwilling to use these as tools unless guided. One solution, popular in educational literature, is to teach for transfer.

Aspects of Teaching for Transfer

"Transfer means learning something in one context and applying it in another." (Fogarty 1992, ix) Additional meanings are:

- "Applying thinking strategies and dispositions in many different contexts.
- Connecting seemingly different areas of knowledge, seeing how they inform one another." (Tishman 1995, 155)

These ideas sound good, but what does teaching for transfer actually mean? David Perkins divides transfer into different categories. There is "low road transfer" which depends on practice and pattern recognition, and "high road transfer" which depends on the development of a principle applicable under varied circumstances. These occur either in situations similar to the learning situation, "near transfer" or in situations very different from the learning situation "far transfer". (Perkins 1995)

Most easily taught is low road, near transfer. This occurs where similar situations cause the student to recognize a common pattern and use an already successful technique instead of learning a new technique. For example, the student learned several techniques for solving addition word problems uses the same techniques in solving multiplication word problems in another

arithmetic unit. The two situations are only slightly different and word patterns in the two problem sets are often deliberately similar. An example of low road, far transfer would be solving subtraction word problems. There are similar strategies, but the word patterns in the subtraction problems are different and require modification of some techniques.

More difficult to promote is high road transfer because it depends on the understanding or reflective development of a principle and then identifying new situations in which it applies. For example, the student, having learned about levers in science class, goes home and uses a stick with a log under it to pry loose a large rock he wants to move. Some students seem to see these connections naturally; most need extra time and guidance in identifying them.

Often we discourage students from spending time reflecting on what they have learned or examining their thinking because we need to accomplish a given task within a limited time frame. We are constantly hurrying students along. It is a challenge to provide thirty seconds of thinking time when asking direct questions, much less the time required for students to reflect on the thinking process. This is, in part, because our culture is not in the habit of rewarding reflection. We then wonder why students don't take the time to answer questions thoughtfully and to reflect, making connections to activate their knowledge. Much of my work focuses on developing the regular practice of reflection, often called metacognition. I use Shari Tishman's definition of metacognition. She states that it is "the art of reflecting on and guiding one's own thinking processes." (Tishman 1995,)

Dispositions that Support Critical and Creative Thinking

The emotional/affective reason for acting one way or another is an essential piece of the puzzle. We all need a reason for exerting ourselves as active learners. Disposition is a term used to describe this affective impetus.

Tishman cites David Perkins' definition of thinking dispositions "as inclinations and habits of mind that benefit productive thinking. These ongoing, abiding tendencies in thinking behavior are exhibited over time across diverse thinking situations" (Tishman 1995, 37). Bryce Hudgins words it slightly differently. "In the case of self-directed critical thinking, disposition refers to the tendency of the thinker to apply the intellectual skills of critical thinking to a new occasion for such thinking and to do so under ones own volition, that is, without requiring external assistance, and to make such application correctly or appropriately" (Hudgins 1994, 4). These dispositions distinguish the person skilled in defining critical thinking techniques and applying them when directed from the person who is a skillful, critical thinker. It is the difference between the auto mechanic with a magnificent tool chest of rarely used tools and the skilled auto mechanic. The first owns all the tools, but doesn't use them and the second owns them and uses them to accomplish the job quickly and well.

Many people seem to be in the first category of possessing the skills, but not the inclination. David Perkins' study of how people reason about public issues illustrates this tendency. He found that most people gave few arguments to support their position and those showed a strong "my-side bias". When he explicitly asked people to think of additional factors supporting the opposing point of view, they did. When he challenged them to respond to these factors, they generated additional arguments in support of their position. This was true for a cross section of the general population from high school students through graduate students, as well as adults ten years or more out of school. (Perkins 1995). Individuals with the disposition to think critically tend to employ and develop thinking skills (Facione 1995). Individuals not already disposed towards thinking critically generally do not value the effort and therefore, are unlikely to exert the effort required to activate their skills unless directed.

Comparing Thinking Skills and Thinking Dispositions

Descriptions of thinking skills and thinking dispositions provide evidence that both components are crucial for the development of a successful critical thinker. The table in Appendix A, derived from work by Richard Paul and Shari Tishman, illustrates the relationship between thinking skills and thinking dispositions and provides the rationale behind my curriculum objectives. The thinking skills describe actions while the dispositions describe the motivation for the action. For example, what is involved in mastery of this thinking skill - "uncovering significant similarities and differences, making interdisciplinary connections, transferring insights to new contexts?" First comes recognition that there are similarities and differences, enhanced by the disposition to devote time and effort to thinking. Then the disposition to make connections between different areas leads to transferring insights to new contexts. Thinking skills and thinking dispositions are complementary, one is the action, the other is the motivation.

Both skills and dispositions are necessary for success as a critical thinker, which do we develop first? John Dewey, in How We Think, expresses his opinion of the importance of these dispositions:

"If we were compelled to make a choice between these personal attributes and knowledge about the principles of logical reasoning together with some degree of technical skill in manipulating special logical processes, we should decide for the former."
(Dewey 1933, 34)

It certainly seems apparent that teaching the thinking skills alone does not work. In my experience students learn the skill long enough to pass the test and then discard it. However, since no one has suggested that teaching dispositions alone would be possible, the logical alternative is to develop them together.

Looking at the question from “a developmental perspective would suggest that skills and dispositions are mutually reinforced and, hence, should be explicitly taught and modeled together.” (Facione 1995, 4)

All of this sounds good, but how do we actually do this in a classroom? What about all of the thinking skill activities already being used? Teachers are not going to abandon what they are already using. They can't afford to purchase all new material. How do we modify the existing thinking skills material to include development of thinking dispositions? One method is to examine programs with documented success in developing both thinking skills and the tendency to use them in varied situations. Comparing the elements of successful programs and those of stand alone thinking skill activities we can identify key elements crucial for success. We can then add these elements to the stand alone thinking skill activities to improve their success.

Description of Thinking Skill Programs

Three programs designed to enhance thinking skills are Feuerstein's Instrumental Enrichment, de Bono's CoRT Program, and Lipman's Philosophy for Children. The first, Instrumental Enrichment, is a series of brief activities designed to provide mediated learning experiences using a variety of problem solving situations. Guiding these experiences is the thoroughly trained teacher/mediator. This training includes questioning strategies that support the students' progress in problem solving and techniques for identifying bridging activities.

Studies demonstrating the success of Instrumental Enrichment were conducted in Israel with a variety of populations. It appears to be especially effective with the educable retarded and those deprived by circumstances of mediated learning experiences (such as children in an orphanage). The length of time spent with the program also affects the results. Gains from the program persist

even after completion. Two years after the end of the program Instrumental Enrichment students entering the Israeli army took the standard Army intelligence test and scored higher than students from the control group. (Feuerstein, 1980)

Second, the CoRT program provides training in a variety of thinking strategies that encourage examining many aspects of a situation. Embedded in a variety of scripted half hour exercises these strategies serve a dual purpose. They improve thinking skill and encourage people to perceive themselves as active thinkers.

Studies in Venezuela and in Australia document the success of the CoRT program. In both countries, students involved in the CoRT program demonstrated increased fluency, and originality of ideas. (Perkins, 1995) In Australia, the program participants scored slightly higher in standard IQ tests along with increased originality and fluency. (Edwards, 1994)

The third program, Philosophy for Children, uses specially written literature as the basis for discussions. These use an analysis of the main character's thinking as a starting point for students to analyze their own thinking. Before implementing the program teachers receive extensive training. Their role is to facilitate the discussion by asking scripted questions as discussion starters and managing group dialogue.

Several studies conducted in the United States, between 1970 and 1981, document the success of Philosophy for Children. In these studies researchers found increases in students standardized test scores along with informal results. "Teachers' appraisals of the impact of the program upon their pupils were extremely favorable. Students appeared to be significantly more curious, more attentive to learning tasks, more considerate of one another, and better able to reason." (Lipman, 1985, 104)

Description of Stand Alone Materials

There are three main types of stand alone materials. The most common is the thinking skill add-on to the regular teacher's guide for any text book series. These are the sentences printed in bold or a bright color that proclaim a given exercise in the text or workbook promotes a specific thinking skill. Some also contain suggestions for additional thinking skill activities.

Second, there are thinking skill activity books and workbooks available in every teachers' store and publishers catalog of resource materials. The best of these provide an introductory chapter on cognitive theory and thinking skill development. Many just jump right into cookbook style activities for teachers to use with their classroom. Others consist in a series of work sheets that the teacher distributes as seat work. An example of these is Susan Petreshene's book Brain Teasers. The only instructions are those written at the top of the page. There is no additional guidance for the teacher.

The third type falls within the category of professional reading for example The Thinking Classroom by Shari Tishman, David Perkins, and Eileen Jay. These books assume that the teacher has an interest in thinking skill development, the disposition to explore further, and the initiative to implement new ideas in the classroom. They usually combine chapters on cognitive theory with strategy implementation examples.

Common Elements in Successful Programs

Instrumental Enrichment, the CoRT Program, and Philosophy for Children have several characteristics in common. All involve mediated learning experiences. Mediated learning experiences (in future I will refer to this as MLE) occur when one person (teacher, parent, sibling) structures a lesson or experience, focuses on limited aspects, and organizes activities to achieve a specific effect. For example, before the first day, parents often visit a new school

with their child, locating the new classroom, where to get on and off the bus, and possibly even meeting the teacher. This in turn affects the students' response when exposed to the broader experience; the first day in the new school with all the other students.

Defining mediated learning Feuerstein states that,

"MLE produces in the organism a propensity to learn how to learn, by equipping the organism with the tools necessary for this facility. The fact that an individual becomes party to information not directly available from his immediate sensorial and experiential field affects more than his reservoir of knowledge. It produces a readiness to explore, or an orientation of curiosity toward the more remote realms of knowledge."(Feuerstein 1980, 25)

These experiences actively involve the student in creating and examining his/her own mental models. People create mental models as they try to make sense of the world around them. They are dynamic structures created on the spot to meet the demands of specific problem-solving situations. (Johnson-Laird 1983) People manipulate them mentally and they provide explanations of physical phenomena. (Vosniadou 1994)

Each of these three programs also includes extensive teacher training or scripting in the use of the individual materials. Matthew Lipman states "trainers should be taught the methods and material in the same manner they are expected to convey it to teachers. If the training workshops are arenas for open and lively discussions, then the teachers will be likely to conduct their own classes in the same fashion." (Lipman 1985, 95) In addition there is a focus on developing a community of inquiry created by the interactions between student and teacher, student and peers, and student and the environment. ((Feuerstein 1980), (Edwards 1994), (Lipman 1985)) "A community of inquiry is a teaching and learning environment which 'practices what it preaches'. It is both student-centered and highly-structured, with a focus on improving critical thinking and

reasoning, inquiry-based questioning, collaborative dialogue and communication, imagination, and building self-esteem through active participation." (Splitter 1997, 6) The learning community provides a setting in which dispositions develop naturally, as a result of social interaction in tandem with focused intellectual activity. (Lipman 1985)

Elements in Stand Alone Materials

Are mediated learning experiences, mental models, and a community of inquiry, among the strategies used in stand alone materials? Even when the teachers guide and the thinking skills workbook have a brief chapter outlining cognitive theory, there is rarely any mention of mediated learning experiences, mental models or a community of inquiry. That is not to imply that the authors didn't use some of these concepts in creating the activities. The authors assume that a teacher is going to follow the designed activities exactly. Therefore, it probably is not necessary to understand how to construct a mediated learning experience, or how it helps the learner create a working mental model. However, one characteristic of mediated learning experiences is the intention of the mediator/teacher to influence the cognitive/ affective/motivational functioning of the student. (Gordon 1996) It seems to me that without understanding the concept behind the activity, it is difficult to effectively mediate the experience. This may be why the teacher's guide and workbook activities always seem somewhat forced and artificial, focusing on drill and practice in thinking skills. As Matthew Lipman says "... there is an enormous difference between drilling children until they improve their performances on specific skills such improvement being merely superficial and transient, and involving children in an educational process in which a wide spectrum of thinking skills is sharpened." (Lipman 1985, 96)

In the third type of stand alone material, professional reading, we see the terms mediated learning experiences, and mental models explained and examples given. Even these resources rarely mention the community of inquiry directly, though it is implicit in the examples. The literature encourages teachers to apply the theory to his/her teaching using the models given. In my opinion, of these three, professional reading provides the greatest likelihood of providing teachers with the tools for improving student thinking skills. The teacher engaging in professional reading already displays the disposition to think critically and creatively. They actively analyze their thinking, and try to learn methods for cultivating thinking skills in students.

The Difference a Community of Learning Makes

Why do the three thinking skill programs mentioned produce measurable changes in students' abilities, when the stand alone activities don't seem to cause much change? The difference appears to be the teacher training provided prior to implementing the thinking skills program. (See Appendix B for a summary of the differences) However, the type of teacher training varies from program to program. Instrumental Enrichment and Philosophy for Children require attendance at workshops where the teacher experiences all aspects of the program. In contrast, the CoRT program provides extensive scripts describing the techniques to be used and the supportive, everyone is learning together atmosphere of the classroom. I suggest this emotional component is the crucial element.

The "Freshman Thinking Project," described by Howard Brown and Sandra Salish provides an illustration supporting my belief that the emotional component is significant. In this community college program, sections of freshman classes in English, Speech, and Philosophy adopted a common critical thinking text along with subject specific texts. They also adopted

common themes and insisted on cross-disciplinary reinforcement of skills. After running the program for several years, they found students completing the project were more likely to graduate than those not participating in the Thinking Project. In their evaluation of the program, students mentioned two factors they considered crucial. The development of a common language across subjects and an increased sense of connectedness among the students and between students and faculty (Brown 1996) were cited as central to the success of the program. These features of common language and student connectedness are two characteristics of a community of inquiry. Additional characteristics of a classroom community of inquiry are:

- students working cooperatively when confronting a problem or puzzle
 - a sense of common purpose
 - mutual trust and respect
 - building and growing together
 - taking chances: a “safe” place
 - building self-esteem
 - learning to think for oneself by thinking with others
 - developing care for the procedures as well as the subject matter of inquiry
- (Splitter 1997, 7)

Applying Successful Elements

How does this apply at the elementary level? Classes are self-contained: one teacher is responsible for teaching reading, writing, arithmetic, language arts, science and social studies. This should provide plenty of opportunities for the development of both a common language and a community of inquiry. Indeed, most of the classes I am familiar with include one or more of these characteristics. Teachers design many activities so that students can work cooperatively on problems and puzzles. They are aware of their role in building

children's self esteem. Some successfully apply the vocabulary of thinking. Yet there are few that I would classify as a community of inquiry. Still missing in many classrooms are the elements that are the most challenging to develop: mutual trust and respect, skill in dialogue and the ability to acknowledge other points of view. These take time and practice to develop. Teachers are under pressure to cover a certain amount of material during the year to prepare students for the following year. They hesitate to take time away from teaching the familiar, measurable skills. In addition, parents expect their children to learn these skills, often by the same methods they did. This makes it even more difficult for teachers to justify taking the time to develop the habit of reflecting on classroom thinking. Students gain a great deal when taught to reflect on their thinking, it becomes self-correcting and they learn to think for themselves. For example, one fourth grade teacher I work with does create a sense of community in her classroom. On one occasion there was a change in the planned meeting spot that occurred during recess. The students expressed concern about informing their teacher. I watched as they discussed possible solutions. Their final solution was to delegate one child to approach the teacher in charge during recess. This child explained the situation to the teacher and asked permission to locate their teacher and inform her of the change in plans. The teacher granted permission. The whole incident took no more than a couple of minutes instead of the usual scenario where the teacher in charge is approached by several different students during the remaining recess time.

NEEDS OF BUSINESS

During the time parents and teachers were growing up, seventy-three percent of United States employees worked in production or manufacturing. (Pritchett 1994) In most manufacturing workplaces, work is routine, repetitive, and organized along hierarchical lines. Perhaps its most prominent feature is

that it emphasizes mass production by workers who do not think about what they are doing. Supervisors inspect the product after production through a separate quality control process. (SCANS 1991) Using drill and practice worksheets to memorize facts and testing them later, mirrors this workplace scenario. Unfortunately, less than fifteen percent of the work force now holds a manufacturing job supported by this style of teaching. The shift in jobs has been towards the service sector. Two thirds of U.S. employees now work in the service sector, and knowledge is this sector's most important product. (Pritchett 1994).

Business and government have been studying how best to prepare students for future employment because of changing workplace needs. The results of their studies support concurrent development of thinking skills and thinking dispositions. (SCANS 1991), (Education 1994) The SCANS report proposes a three part foundation as the basis for learning competencies identified as necessary for workers to be effective. This foundation consists of:

- Basic Skills - reading, writing, arithmetic, speaking and listening
- Thinking Skills - thinking creatively, making decisions, solving problems, seeing things in the mind's eye, knowing how to learn, and reasoning
- Personal Qualities - individual responsibility, self-esteem, sociability, self-management, and integrity (SCANS 1991)

Closer to home the Massachusetts Board of Education conducted focus groups throughout the Commonwealth to identify "what citizens highly value and see as essential for success in our democratic society." (Education 1994) They identified three general areas where students should be competent.

- Thinking and communicating - being able to read, write and communicate effectively. Use mathematics, the arts, computers and

other technologies effectively. Define, analyze and solve complex problems.

- Gaining and Applying Knowledge - Acquire, integrate and apply essential knowledge in all major subject areas, the arts and health
- Working and contributing - Study and work effectively both independently and in groups and demonstrate personal, social and civic responsibility. (Education 1994)

“A well developed mind, a passion to learn and the ability to put knowledge to work are the new keys to the future of our young people, the success of our businesses, and the economic well-being of the nation.” (SCANS 1991)

SUMMARY

Critical and creative thinking are active processes. Successful thinkers have mastered the skills and cultivated the dispositions necessary for implementation of the skills. Unfortunately, research contains many examples of individuals who appear to have mastered the skills, but do not use them to their advantage (Perkins, 1995). This lack of transfer frustrates teachers and discourages them from teaching thinking skills. Comparing successful thinking skill programs with the commonly available stand alone thinking skill materials uncovers several differences. The two types of materials have some common characteristics:

- activities designed to provide mediated learning experiences
- activities designed to help students create mental models
- activities are designed to promote transfer.

Their differences provide the key to understanding why Instrumental Enrichment, CoRT, and Philosophy for Children are successful while stand alone activities cause little change. The training and guidance given to the teacher who implements these thinking skill materials makes the difference.

This training guides the teacher in

- mediating the learning experiences
- helping students identify connections with daily experiences (transfer)
- creating a community of inquiry within the class

It is the last, creating a community of inquiry, that seems to be crucial in fostering the development of thinking dispositions along with thinking skills.

In the enrichment program described in the next chapter, I will be applying my training in critical and creative thinking to adapt stand alone thinking skills activities to foster a sense of community. My expectation, based on twenty years of teaching experience, is that this sense of community will carry over into some classroom activities. To encourage this I am sharing with the classroom teachers my goals, techniques and rationale for the activities.

CHAPTER 2

PROGRAM BACKGROUND

This enrichment program is being implemented in an elementary school, located in a rural town in Western Massachusetts. The elementary school population is around three hundred students in pre-kindergarten through fourth grade. In the 1995-1996 school year budget cuts eliminated the Talented and Gifted and the elementary music program. Concerned parents and teachers wrote a grant to replace a portion of the enrichment program. Their focus was enrichment for all students instead of focusing on the academically talented. To accomplish this they hired me to develop a program around thinking skills for third and fourth grade. Each grade consists of three self-contained classes of approximately 20 students each. Experienced teachers (from 10-30 years teaching) have been teaching at their present grade level for three or more years. The students are eight to nine years old in third grade and nine to ten years old in fourth grade. Approximately fifteen percent receive Chapter 1 math and/or reading assistance and about five percent receive resource room support.

Program Structure

The program has two components: the classroom based student activities and the teacher support/training component. During the classroom portion, I visit each class for forty minutes once a week. Adaptations for grade level and presentation maximize the effect of the activities. Given the time I spend in the classroom, even these altered stand alone activities have limited potential for cultivating dispositions. The classroom teacher is crucial to the success of the program. There are brief monthly teacher meetings, with weekly teacher observation of, and participation in, the enrichment class. Informal conversations before and after the class provide time for discussing the

activities' strengths and weaknesses, clarifying the purpose of the activity, and identifying connections to other lessons planned for the week. My goal for this program is to create a community of inquiry within each classroom. The key to developing a continuing community is the classroom teacher. It is this continuing community that provides the environment that develops and maintains thinking skills and thinking dispositions.

The Activities

The activities come from several different sources including thinking skill activity books, classroom activity and craft guides, and some I developed. There were several criteria used in choosing activities. The activity materials had to present a problem that challenged the students. Also, they needed to be enjoyable for most of the students. Finally, they had to be easily portable as I travel from class to class with a cart providing storage. The sources I used are: The Five Day Thinking Course by Edward de Bono, Brain Teasers by Susan S. Petreshene, Origami and Papercraft by Paul Jackson and Vivien Frank and WonderScience from the American Chemical Society.

Since many of the students appear to be predominantly kinesthetic learners I chose to start with Edward de Bono's strategic thinking challenge from his book The Five Day Thinking Challenge. Other activities resulted from teachers' requests for reading or curriculum connections. For example, when the third grade read "The Origami Truce" from Lucky Charms and Birthday Wishes by Christine McDonnell, enrichment class made folded paper chatterboxes. Additional activities evolved as a direct result of teacher frustration concerning difficulties many students had following written directions and recording observations. All of the activities required some changes, since many of them were designed for adults. I substituted sponge rectangles for boxes in the de Bono challenge to make the activity easier to do in the

classroom as well as quieter and more portable. Making sense of the origami directions was approached as a separate challenge before trying to make the chatterboxes.

Creating a Community of Inquiry

I began the first class with a discussion of the words “challenge” and “problem”. I asked each student to share their feelings and opinions about the two words. During the discussion, some students felt that challenges were fun; some felt that problems were fun. No one thought of both as negative. I encouraged them to use the word with a positive meaning any time we discussed the activities. Then I asked what their expectations of enrichment class were. The consensus was that enrichment class should be fun and consist of activities that were different from regular classroom activities. Next I shared my expectations which were more specific:

- that each individual would do their best at all times – even if they didn’t like an activity.
- that each student was capable of mastering every activity given adequate directions and assistance.
- that I expected each student to examine their thinking and write about it in their journals using complete sentences.
- their “job” in enrichment class is to identify what help they needed and request that help from a person able to provide it.

Other topics discussed were the difference between sharing information and cheating or stealing answers. Many students seem to feel that any sharing of information is wrong. These third and fourth grade students are competitive and very possessive of their problem solutions. It was difficult for many of them to understand that there was no reward for being the first one finished and that I wanted them to *share* how they arrived at a solution. We discussed different

techniques for working with a partner. Emphasizing listening to what each person has to say and taking turns testing solutions to the challenge were emphasized. Some students also had difficulty understanding that there could be more than one correct answer or solution. This ambiguity of result pleased others.

Introduction of each activity included questions about the students' experiences with the challenge or similar activities. Questions, such as: "What do you know about...., Where have you seen ...?, and Have you ever watched someone else ...?", served as triggers for them to identify and share their own personal knowledge. These discussions needed careful management to ensure each student had a chance to think and share their thoughts. Many of the students as well as teachers were uncomfortable at first when I did not immediately call on someone for an answer. The use of "think time", the technique of waiting while everyone organizes their thoughts is unfamiliar and difficult for most students. Those who are quick to answer became frustrated waiting, while those who require more thinking time are in the habit of letting someone else answer. Even the classroom teachers participated in these discussions adding examples from other lessons as well as their experiences outside school.

The following section presents seven sample lessons from the enrichment program. In each lesson I identify the source of the activity, describe my objectives, and explain changes in the procedure that help foster a sense of community. At the end of each sample lesson I outline the guidelines for student reflection on the activity and comment briefly on the content of their journal entries.

LESSON PLANS

Sponge Challenge I - adapted from de Bono's Five Day Thinking Course

critical thinking objective: To introduce sequencing in game format
To introduce and define the word "variation".

creative thinking objective: To practice working with an open-ended task

disposition objective: To encourage exploration of alternative solutions.

Materials: 1"x2" pieces of sponge, chart paper and markers, overhead projector

Procedure:

1. **Creating a Community:** Ask the students questions about their problem solving abilities such as - How do you solve puzzles? Give each student a chance to share their method. How would this method change if you were working with another person on the puzzle? Highlight answers like taking turns, sharing ideas, and thinking of different ways to do it. Explain that there are at least two different solutions to the challenge and that each solution has several variations. Define variation and provide an example, as well as an example of something different. (I use ice cream flavors for variation and sherbet as an example of different.) Ask for other examples.
2. Give each pair of students 6 sponge rectangles.
3. Their challenge is to arrange the sponges with two sides of each sponge touching the sides of two other sponges and only two other sponges.
4. Sponges touching at corners do not count.

After the challenge:

Discussion:

1. Compare student solutions. (The standard solutions are in Appendix B.) Do this orally or visually. They especially enjoy presenting their solutions on an overhead projector.

Journal process writing:

1. What did you do to arrive at the solution? Students have the hardest time with this question. They rarely stop to think about how they do something.
2. What was easy about solving the challenge? What was difficult?
3. What did you like about working with a partner? What didn't you like about working with a partner?

Sponge Challenge II - adapted from de Bono's Five Day Thinking Course

critical thinking objective: To introduce sequencing in game format
To reinforce the meaning of variation vs. different.

creative thinking objective: To practice working with an open-ended task
To practice examining an experience and describing that experience (reflection).

disposition objective: To encourage exploration of alternative solutions.

Materials: 1"x2" pieces of sponge, chart paper and markers, projector

Procedure:

1. Creating a community: Review the techniques for working with a partner.
Why do you choose a particular partner? What worked well last time? What didn't work well? What can you do differently this time?
Remind students that there are at least two different solutions to the challenge and that each solution has several variations. Define variation and provide an example, as well as an example of something different.
2. Each pair of students receives 6 sponge rectangles
3. The challenge is to arrange the sponges so that three sides of each sponge are touching the sides of three other sponges and only three sides.
4. Sponges touching at corners do not count.

After the challenge:

Discussion:

1. Compare student solutions. (See Appendix B) Do this orally or visually. They especially like presenting their solutions on an overhead projector.

Journal process writing:

1. Draw the solutions. What did you do to arrive at the solution?
2. What was easy about solving the challenge? What was difficult?
3. What did you like about working with a partner? What didn't you like about it?

Although some students when answering question 1 say, "I just did it." . Others are starting to realize that they moved the pieces around and tried different combinations. They are better about identifying the pro's and con's of working with a partner. Though some still answer, "He/She is my friend." , without adding any details.

Sponge Challenge III - adapted from de Bono's Five Day Thinking Course

critical thinking objective: To introduce sequencing in game format
To reinforce the meaning of variation vs. different.

creative thinking objective: To practice working with an open-ended task
To practice examining an experience and describing that experience (reflection).

disposition objective: To develop the desire to explore alternative solutions.

Materials: 1"x2" pieces of sponge, chart paper and markers, projector

Procedure:

1. Creating a community: Review the techniques for working with a partner. Would you like to change partners? Why or why not? What is working well in your joint problem solving? What is difficult about working with a partner.
2. Remind students that there are at least two different solutions to the challenge and that each solution has several variations. Define variation and provide an example, as well as an example of something different.
3. Each pair of students uses 6 sponge rectangles
4. Arrange the sponges so that four sides of each sponge are touching the sides of four other sponges and only four other sponges. No corners.
5. Where in the room can you find one answer to the four side challenge?

After the challenge:

Discussion:

1. Compare student solutions. (See Appendix B) Do this orally or visually. They especially like presenting their solutions on an overhead projector.

Journal process writing:

1. Draw the solutions. What did you do to arrive at the solution?
3. What was easy about solving the challenge? What was difficult?
4. What did you like about working with a partner? What didn't you like about it?

More students are able to write that they moved the pieces around to look at different solutions, or that they looked at the sponges and thought about the shapes. They still have trouble describing what was easy and what was difficult. The most difficult part about working with a partner is taking turns. They like sharing the thinking and talking about the problems.

Making notebooks

critical thinking objective: To provide additional sequencing experiences.
To introduce the idea of developing criteria for identifying an object

creative thinking objective: To have students create their own journals.
To practice examining an experience and describing that experience (reflection).

disposition objective: To reinforce the tendency to be orderly and methodical

Materials: directions, colored construction paper, lined writing paper, yarn, tape staplers, hole punches

Procedure:

1. Creating a community: Read the directions silently as a class. Ask the class if there are any words they do not understand? Have them raise their hands if they know what they are going to make? Call on several to check the answers. Discuss what parts of their notebook will be the same for each person and what part will be different. Have them name the materials they will need.
2. Have them collect the materials and construct their notebooks.
3. Have them decorate the notebooks with yarn, markers or crayons. Have them write their initials on the notebook.
4. On another piece of paper describe how you made your notebook. Include the color of paper for the cover, method of fastening, and any decorations in your description. Students from another class will try to match the description with the notebook. Write your locker number on the description.

After the challenge

Journal process writing:

1. What was easy about following the directions? What was difficult?
2. What was easy about writing the description of your notebook?
3. What was difficult about writing the description?

Students didn't have any trouble following the directions. If they had I would have asked them to think about ways they could help themselves next time. Many of them wrote very short descriptions and mentioned having trouble identifying characteristics to write about.

Matching notebooks with descriptions

critical thinking objective: To provide an opportunity to identify similarities and differences

creative thinking objective: To brainstorm possible identifying characteristics
To practice working with an open ended task

disposition objective: to encourage the tendency to devote time and effort to thinking

Materials: descriptions of notebooks, notebooks, additional paper

Procedure:

1. Creating a community: Discuss how students feel about creating a notebook from another students directions. Talk about being careful to understand what the words in the description mean. Talk about feeling confused by the description and what to do when that happens
2. Hand students the notebook descriptions from another class.
3. Read the descriptions silently identifying any words that are illegible, misspelled or where the meaning is unclear.
4. Have them make a new notebook using the original directions and the description.
5. Arrange the first set of notebooks around the classroom and have students line up with the descriptions and the new notebooks.
6. Have students walk around the room to find the notebook that matches the description.

After the Challenge:

Journal process writing:

1. What was easy about making the new notebook? What was hard?
2. What was easy about finding the matching notebook? Why?
3. What was difficult about finding the matching notebook? Why?
4. What characteristics were most important in identifying the notebook?
This activity was difficult. Most students found matching notebook and description difficult. The descriptions were too general. They had trouble identifying key characteristics. They focused on the color of the cover or the method used to assemble them. There was little mention of cover art work in the descriptions or as key characteristics.

Tile Patterns

- critical thinking objective:* To develop skill in sequencing activities
To define and use a scale model in planning
- creative thinking objective:* To practice working with an open ended task
To brainstorm about the consequences of inaccuracy
- disposition objective:* To provide an experience where approaching things
in a methodical fashion is rewarded.
To encourage students to connect different areas of
knowledge. (transfer)

Materials: pattern blocks, paper with tile patterns, pencils and crayons, rulers

Procedure:

1. Creating a community: Explain the role students will be playing - They are apprentice floor layers, hired to lay a tile floor. Discuss their experiences with watching others laying tile floors and the materials needed. (Tiles, grout, cement, trowels, tile cutters, straight edge, carpenter's square, chalk)
Ask: What type of planning does the tile layer have to do? What happens if the tile layer doesn't do the planning?
2. As tile layer helpers their task is to figure out how many of each type of tile their employer needs to purchase to complete the job. Brainstorm ways they could figure this out.
3. Each pair of students receives a pattern sheet with one repetition of the pattern already drawn to scale and one block of each shape in the pattern. Using these tools plus pencil and ruler they are to determine the total number of whole tiles of each shape needed to cover the floor completely, from one edge to the other in all directions.

After the challenge:

Discussion:

1. Did everyone come up with the same number of tiles?
2. What could have caused the differences?
3. What is the consequence of getting different numbers?

Journal process writing:

1. What was difficult about this activity? What was easy about this activity?
2. Would this activity have been easier without a partner? Why or why not?
3. What did you like about this activity? Why? What didn't you like? Why?

Tile Patterns

critical thinking objective: To develop criteria for evaluating their product

creative thinking objective: To practice working with an open ended task

disposition objective: To encourage awareness of personal preferences and styles in completing activities
To encourage the impulse to be playful.
To encourage thinking about their thinking

Materials: sheets of paper, pattern blocks, pencils and crayons, rulers

Procedure:

1. Creating a community: Discuss their journal entries from last week and their feelings about the activity. Identify where problems occurred and how students solved them. Explain that this week it is their turn to design the tile pattern for a floor and determine the number of tiles they would need to complete the design. Talk about the advantages of laying the pattern out on paper (create a scale model) before laying a tile floor of their design?
2. Brainstorm to identify criteria to use for evaluating the floors.
3. Give each student a piece of paper and have them choose up to five shapes to use in their design.

After the challenge:

Discussion:

1. After they have drawn the design and colored it have them share the design with the class and apply the evaluation criteria developed earlier.

Journal process writing:

1. Ask them to write about the tiling activity they enjoyed more. What they enjoyed about it and what they didn't enjoy about it.
2. Ask them to write about the tiling activity they enjoyed less. What they didn't enjoy about it and any parts they did enjoy.
3. Ask them to write about using scale models - where else do they think scale models might be useful.

Students enjoyed both tiling activities. A few identified the need for accuracy and were able to follow through. Many students had trouble being precise and their tile counts were off by three to five tiles. Allowing for partial tiles was especially challenging. For the third grade this is their first experience with determining area. A topic that is introduced either at the end of third grade or during fourth grade.

The previous seven lessons are a selection from twenty-eight lessons done during the year. They are representative in that each one began with a discussion to develop the attitudes and skills that characterize a community of inquiry. They all involved open-ended tasks that involved working with a partner to develop a solution and test it. This requires them to improve their interpersonal communication skills. Each activity ends with metacognitive questions answered in process journals. These responses are often shared in class and discussed before going on to the next activity. In the next chapter I will provide the results of these lessons captured in parent questionnaires, student journal entries, and classroom teacher comments.

CHAPTER 3

EVALUATION

Evaluation of a project of this nature is always difficult. The changes are subtle and difficult to separate from changes due to growth without comparing the enrichment classes to a control group. Having been hired to work with all the students in the two grades, I was not comfortable using one class in each grade as a control. Instead, I used three different qualitative methods of evaluation: parent questionnaires designed to collect information about student's demonstrated dispositions outside of the classroom, student journal entries, and teacher comments on the impact of the lessons.

The Questionnaires

The first questionnaire consisted of two parts (see Appendix D). The first half describes three general situations along with three possible reactions for each. The parents indicated how often each behavior occurred. They had five choices; never, almost never, sometimes, almost always or always. The last question in this part asked about the child's expectations for success. I worded the descriptions of behavior to reflect different dispositions as elaborated by Barry Beyer. (Beyer 1992)

I focused on two dispositions, persistence and open mindedness. I was also checking for consistency in the parents answers. The second part of the questionnaire consisted of four questions, two asking parents to describe their children's preferences in reading material and games and two asking for a description of the child's learning style. In the second questionnaire, sent home one month later, I asked questions relating to student's tendency to gather additional information on a subject and to identify prior personal knowledge. At the end of the year, I asked parents to answer the same questions again.

Questionnaire Analysis

Few inferences could be drawn from parental questionnaires due to an array of difficulties, which I endeavor to interpret. The first difficulty I encountered was the uneven return of completed questionnaires. Students returned half of the first two questionnaires and only twenty percent of the final questionnaire. In addition many parents returned only one questionnaire the entire year. This allowed me to compare responses on fifteen percent of the third and fourth grade students. This small number of responses will not permit significant generalization. However, analysis of the responses yielded useful insights.

Examining the responses I identified another difficulty. There were situations where the answers did not provide a complete picture. For example:

	always	almost always	some times	almost never	never
<i>When my child plays a board game and loses:</i>					
1. he/she becomes very frustrated.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. he/she wants to play again and changes strategy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. he/she wants to play again and uses the same strategy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

While some parents answered that their child almost never becomes frustrated, they also stated he/she almost never wants to play again and changes strategy, as well as answering that he/she almost never wants to play again and uses the same strategy. This set of answers leads me to believe some children choose not to play again when they lose a game. To be certain this group needs another response. Number four should be he/she does not want to play again.

A third difficulty occurred when tabulating the responses for the pairs of questionnaires. I expected the answers to eighteen of the questions to create a pattern indicating any changes in disposition. However, the changes in eight of

the questions canceled each other. For example, question six (see appendix C) had five responses indicating development of the tendency to identify several moves and five responses indicating an increased tendency not to identify several moves. Thirteen responses indicated no change. I attribute the lack of change to the stability of dispositions documented in studies of college students. (Facione 1997) There are several possible causes for the contradictory result. One could be the small sample size. Other possibilities are that parents' answers (and perceptions about their children) may vary with the tenor of the day, or perhaps a different parent answered the two sets of questions. Finally, some children may have identified certain moves in checkers as more effective and used them automatically.

Student Journals

There were sixty-two third graders and fifty-six fourth graders. All one hundred eighteen students wrote in a thinking journal recording their answers to the process writing questions. In reading the journals I was looking for statements showing increased 1) awareness of their personal talents and learning style preferences 2) sustained effort and/or confidence in their ability to complete difficult tasks (persistence) 3) ability to clearly state a problem and 4) a tendency to connect the enrichment activities with other experiences. There was little recorded evidence of increase as I detail below.

The journals varied greatly in the quality, quantity, and clarity of writing. The sixty-two third grade students wrote more clearly when they used a separate piece of paper. When they wrote in their journals, they tended to write one and two word answers. This made identifying what challenge and what questions they were writing about difficult. Occasionally, they would put the date before an answer, but they rarely referred to the original question in their answer. Those students who did write sentences frequently omitted all nouns

and used only pronouns. The fifty-six fourth grade journals were more consistent partly because these students keep journals in at least one other subject (language arts, science or reading). However, half of them still did not identify the challenge or use part of the question in their answer.

There was a small increase in student's expressed awareness of their personal talents and learning style preferences. All of the students were able to identify the type of help they found most effective when asked directly in the process writing questions. For example, responses to the process writing question, "What type of directions did you find easiest to follow? Your choices are: pictures, spoken directions, written directions or having someone show you." indicated they were aware of when the instructions made sense and when they remained confused. They did not volunteer this information in other journal entries. Only two or three from each class, five percent, used this knowledge when asking for help in subsequent activities. These students would ask me to show them how to do something rather than having me explain the directions verbally. Less than ten percent wrote about using it in their approach to solving later challenges. For example' one student wrote "This time I asked the teacher to show me how to do it. I didn't look at the directions again."

Written evidence, that confidence in their ability to complete difficult tasks increased, was slight. There were only four responses, three percent, mentioning it explicitly. The most rewarding was the girl who wrote "I feel good because I kept trying and I finally did it. Before I would give up if it was hard. Now I know I can." This was in response to the origami activity she had been reluctant to try. Comments where students said, "It was hard but it was fun" referring to the activity, indicated continuing positive attitudes towards challenging activities. The least rewarding journal entry stated "Enrichment is dumb. I think writing is stupid." This was in response to the activity on writing

notebook directions and following another student's directions. The student writing this entry is a kinesthetic learner who believes in doing things only once, going on to the next activity immediately.

The journals did not provide any evidence that the ability to clearly state the problem changed. The fourth grade students did begin providing more details in their descriptions of activities, but their problem statements did not become clearer. Students never mentioned connections between the enrichment activities and other experiences in the journals. During class discussions they became more willing to identify other situations where the knowledge might be useful. This problem may be age or developmentally related. Third and fourth graders are just beginning to learn to express themselves in writing. However, fifteen students have talked to me in the hall or on the playground about other times they used some part of the enrichment activities. Identifying the connections seems to require incubation.

Teachers Comments

Teachers comments came from the third and fourth grade teachers through informal conversations, monthly meetings, and responses to written lesson plans. These lesson plans were given to the teachers several weeks after they observed their class participating in the lessons. During the monthly meetings and conversations, teachers focused their remarks on the lessons, how well they worked, student responses to them, and connections that developed during the week. As I hoped, all the teachers drew students' attention to connections between enrichment activities and other classroom activities. They found the time spent making sense of directions and expecting the students to identify what help they needed especially useful. I observed a change in four teacher's behavior towards students requesting assistance. The teachers developed the disposition to allow students to do their own thinking,

and began asking clarifying questions of students. Instead of reacting to the statement “I don’t get it” immediately, teachers began asking “What part don’t you get?” Two fourth grade teachers reported that some students began identifying what help they needed before approaching them as the year progressed. Teachers expressed the opinion that this effectively increased the student’s ability to clearly state the problem, one of the abilities I intended to cultivate. The other disposition the teachers reported finding developing in the students, was the willingness to listen to new ideas and try other ways of doing things. This showed up in math, science and computer lessons. At the beginning of the year two or three students in each class would insist that there was only one correct way to approach a problem. By the end of the year they would still insist that their way was best, but they were willing to admit that there were other acceptable ways to obtain the correct answer.

Comments on the sponge activity by one third grade teacher describe the third grade’s reaction to challenges at the beginning of the year. She wrote: “Sponge activities were fun for the students. This year’s students were satisfied with one solution. They saw no reason to go further, and did not view it as a challenge to be explored further.” The same was true for most of the students with the game board designing and origami activities. By the end of the year more of the third grade students were able to generate multiple solutions to a challenge. In de Bono’s, *Insight Thinking Challenge*, students construct a popsicle stick platform on top of four bottles of water. In the final solution the bottles had to be a specific distance apart and the platform had to support an additional water bottle in an upright position. Initially, I required them to construct a platform that simply supported a water bottle. There was a race in each classroom to see who could come up with the largest number of different solutions.

Plans for the Future

Reflecting on the enrichment program, there are many spontaneous positive comments from students and teachers. Current fifth grade students are still talking about the bridges they made last spring. The teachers have suggestions for modifications of activities and ways they can create more connections for the students. This year's fourth grade students are already asking for favorite activities. They look forward to continuing the program and teachers feel that it makes a difference.

Unfortunately, there is no solid evidence that any differences in student behavior are attributable to the enrichment program. Examining the questionnaires and student journals the positive evidence is all anecdotal and informal. A great deal of work in documenting results remains to be done.

This year in addition to the other methods of evaluation, students will be participating in a validation study of the California Measure of Mental Motivation (in future I will refer to this as CM-3) developed by the California Academic Press. The purpose of this test is to measure the disposition of children towards different aspects of critical thinking. The California Academic Press will score the tests and provide us with a written report for our site based on the validated version of the CM-3. The report will include scores for each child by identification number that we will use for pretest/posttest purposes. (Giancarlo 1997) I look forward to this evaluation as an opportunity to document changes likely to be due to the enrichment program. The CM-3 is being tested with other third and fourth grade classes in other locations. Further it may provide some evidence by comparing fifth grade students (former fourth graders) to peers in other settings. I am looking for differences in the scores for open-mindedness, truth-seeking and CT self-confidence. These are the dispositions I anticipated affecting through the enrichment program.

I also expect to continue using, with some modifications the qualitative methods I described here. Teachers gave the initial parent questionnaires to the parents during the November parent-teacher conferences. This improved the return rate slightly higher from fifty percent to sixty-five percent. I plan to send the end of the year questionnaires home in the third quarter report cards in April. This gives a comparison after less exposure to the enrichment program but increases the likelihood of a fifty percent return.

Journal writing is also modified this year. The directions are much more specific. Students are expected to write the title of the challenge above their answers and each question is prefaced with the requirement that the answer be given in complete sentences. Some classes begin with time spent writing in the journals about some aspect of the previous weeks challenge. Other weeks the questions are given at the end of the enrichment class and the teacher supervises the students journal writing during another part of the day. So far, this is working well. There appears to be less resistance to writing in the journals this year and the responses are easier to read.

This is just a beginning. Additional modifications will undoubtedly be made during the year, both in response to teachers' suggestions and new insights that stem from my own reflections. I invite the reader to join in the effort to document the effects of practices that focus on both the dispositional and skill components of improved intellectual performance.

APPENDIX A

Comparison of Thinking Skills and Thinking Dispositions

Thinking Skills	Thinking dispositions
1. clearly defining the problem, examining complexities, clarifying issues, beliefs, word and phrase meanings.	the urge to question, inquire, wonder, pose problems, probe further, look beyond what's given.
2. considering points of view, suspending judgment, examining assumptions	the impulse to explore other points of view, be open-minded, be flexible, try new things and ideas, be playful.
3. examining root issues and purposes evaluating arguments, distinguishing relevant from irrelevant facts	the desire to seek clarity, gain understanding, be precise, be thorough, remain alert to possible error.
4. developing criteria for evaluation evaluating arguments, exploring implications and consequences	the urge to be orderly and logical, be planful, think ahead, approach things in a calculated and methodical fashion
5. examining thinking process	the tendency to devote time and effort to thinking
. uncovering significant similarities and differences, making interdisciplinary connections transferring insights to new contexts	the impulse to connect different areas of knowledge

[Paul, 1993 #18, p 320] [Tishman, 1995 #16, p 39-40,155]

Table 1

APPENDIX B

Comparison of Proven Programs and Stand Alone Materials

Proven Programs

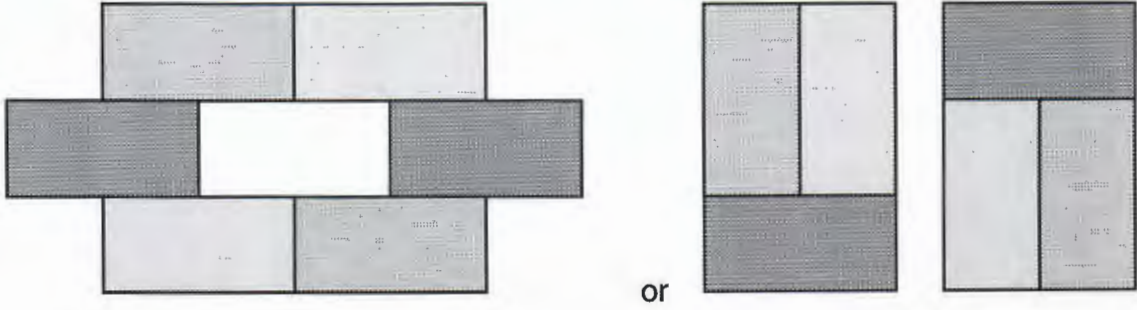
1. extensive teacher training and scripting including theoretical background
2. contains mediated learning experiences (MLE)
3. activities lead to creation of mental models
4. activities and/or directions for creating transfer
5. program deliberately creates a sense of community among the learners

Stand Alone Materials

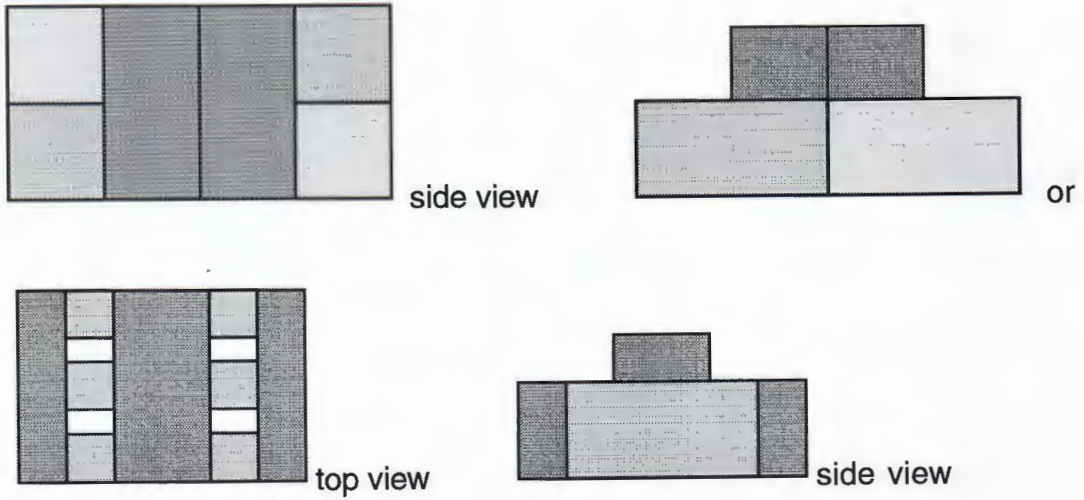
1. limited discussion of theory except in professional literature
2. experiences designed to be mediated learning experiences
3. experiences designed to lead to the creation of mental models
4. only in workbooks focusing on transfer activities or professional literature
5. activities are left as an exercise for the student

APPENDIX C

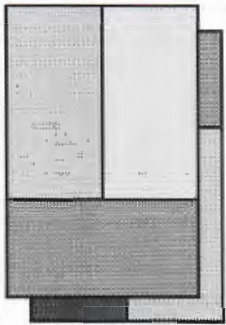
Solutions to Sponge Challenge I



Solutions to Sponge Challenge II



Solutions to Sponge Challenge III

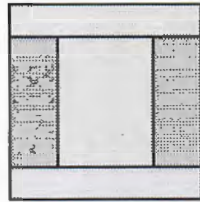


Top view



side view

or



top view



side view

(the room)

These have a space in the middle

APPENDIX D
Questionnaire 1

Child's Name _____

Grade _____

Please return by October 9, 1996

Parents,

Thinking Skills Enrichment begins this week, for grades three and four. I visit each class once a week for 45 minutes. The children explore different ways of approaching challenges and different strategies they can use in school and at home. Since standard tests are poor measures of thinking ability I am asking your help in recording any changes there are in your children's thinking. This way I can get a better picture of what is happening. The answers to the questions on these two pages will give me some background information so I know where your child is starting. You will receive a new questionnaire with each report card. This is your chance to share what you see happening. Please answer the questions thoughtfully and feel free to call the school and ask me questions. I am at Lee Central School Wed. and Fri.

Linda Taylor

In 1-10 please check the box that comes closest to describing you son or daughter.

		almost always	some times	almost never	never
<i>When my child plays a board game and loses:</i>					
1. he/she becomes very frustrated.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. he/she wants to play again and changes strategy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. he/she wants to play again and uses the same strategy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>When playing a game like checkers:</i>					
4. he/she moves quickly into the first opening.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. he/she takes forever choosing one of several moves.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. he/she sometimes sees several moves, and sometimes just moves quickly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>My child enjoys trying new:</i>					
7. games	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. foods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. situations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. My child expects to be successful in everything.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11. What games does your child like to play?
12. What books does your child like to read?
13. Describe how your child learned to ride a two wheeler.
14. Describe how your child puts together a jigsaw puzzle or builds with blocks (legos, wooden, etc.).

Questionnaire 2

Child's Name _____

Grade _____

Please return with the Report card

Parents,

I have visited your child's class once a week for 45 minutes for the past month. We have been working with sequencing. By that I mean we have been placing objects according to specific rules. The directions have been either verbal or written or both. My goals in these activities are for the children to develop their ability to:

- clarify directions (what parts they understand and what parts they don't understand)
- recognize knowledge they already have that can help solve the problem
- look for additional information from the environment and other sources

Please answer all the questions even if they seem to be asking the same thing. It helps me check that I have asked the question I think I am asking. Feel free to call the school and ask me questions. I am at Lee Central School Wed. and Fri.

Linda Taylor

In 11-20 please check the box that comes closest to describing you son or daughter.

	almost always	some always	almost times	never	never
<i>When my child does not understand instructions he/she</i>					
11. does what he/she thinks is wanted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. asks what the instructions mean	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. takes extra time figuring out the instructions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. walks away from the game or problem	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>When my child is playing a new game he/she</i>					
15. compares it to games played before.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. starts playing before listening to or reading all the directions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. makes sure all the rules are understood first	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. changes the rules during the game to help win	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. changes the rules of the game as problems occur.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. My child connects things that happen at home or other places to things learned in school.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Additional comments are welcome. Please use the back or another piece of paper.

Questionnaire 3

Child's Name _____

Teacher _____

Please return by May 23, 1997

Parents,

Evaluation of this year's enrichment program is underway. Since this program is paid for through a state grant we need to submit a year end report outlining the activities and results of the program before they consider our application for next year. To create an accurate picture we need to collect information from as many points of view as possible. These are the same questions you answered at the beginning of the year. Please take the time to answer them so we can identify any changes in your responses. Thank you for helping us to continue the program.

Linda Taylor

In 1-20 please check the box that comes closest to describing you son or daughter.

	almost always	some always	almost times	never never
<i>When my child plays a board game and loses:</i>				
1. he/she becomes very frustrated.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. he/she wants to play again and changes strategy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. he/she wants to play again and uses the same strategy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>When playing a game like checkers:</i>				
4. he/she moves quickly into the first opening.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. he/she takes forever choosing one of several moves.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. he/she sometimes sees several moves, and sometimes just moves quickly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>My child enjoys trying new:</i>				
7. games	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. foods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. situations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. My child expects to be successful in everything.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Child's Name _____

almost some almost
always always times never never

When my child does not understand instructions he/she

- | | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 11. does what he/she thinks is wanted | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 12. asks what the instructions mean | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 13. takes extra time figuring out the instructions | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 14. walks away from the game or problem | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

When my child is playing a new game he/she

- | | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 15. compares it to games played before. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 16. starts playing before listening to or reading
all the directions. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 17. makes sure all the rules are understood first | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 18. changes the rules during the game to help
win | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 19. changes the rules of the game as problems
occur. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20. My child connects things that happen at home
or other places to things learned in school. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

21. What games does your child like to play?

22. What books does your child like to read?

23. Describe how your child puts together a jigsaw puzzle or builds with blocks (legos, wooden, etc.).

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