Inviting Explicit Thinking

Thinking Maps® Professional Development:

Tools to Develop
Reflection and Cognition

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Approved by _____Date_____

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Dedication

This project is dedicated to passionate educators who devote an unlimited amount of time truly engaged in the *art of learning*, for themselves and for their students. To teachers, seasoned and new, who attend conferences, workshops, institutes and classes to increase their understanding of content knowledge as well as pedagogy in order to transfer their learning into classroom practice. Your energy, expertise and zeal, may not be illustrated by test scores, but your respect for your craft and your enthusiasm for learning will influence your colleagues and will inspire your students.

I would also like to dedicate this project to leaders at all levels within a school district who strive to improve the education and professionalism of teachers through continuous, meaningful, and challenging professional development experiences. Thank you for realizing that educators crave opportunities to discuss our work and for structuring and supporting reflective forums to articulate and refine our practice.

Abstract

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My master's project documents my efforts to investigate how Thinking Maps: Tools for Constructing Knowledge can influence teacher reflection and cognition. I reviewed the literature to establish a connection between reflection and cognition and to locate studies which employed visual tools to promote reflection and cognition with inservice teachers. The literature indicated many benefits of reflection, including increased conceptual understanding. However, few studies outlined a structure that teachers could employ to facilitate their own metacognition. This paper follows a group of teachers involved in a six-day Thinking Maps Training of Trainers over a six month time period as they learned and applied Thinking Maps in their classroom practice. During the training, I collected field notes and artifacts as well as designed and administered surveys to the group in order to gather data to answer the question, to what extent do Thinking Maps promote teacher reflection and cognition?

From the data, I discovered teachers' understandings and applications of Thinking Maps grew over time as well as their insights into their instruction and student learning. Although teachers didn't report a specific gain in content understanding, the data indicates that student behavior, motivation, and thinking improved since Thinking Maps implementation. Teachers reported more clarity, purpose, and efficacy when using Thinking Maps in planning and instruction. Field notes, artifacts and surveys indicated that Thinking Maps provided a visual representation of students knowledge that helped teachers and students be reflective about themselves and their learning. These findings suggest conducting future research to explore the implications of Thinking Maps on student-teacher interactions and students' and teachers' cognitive development.

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Acknowledgements

I feel fortunate to have been inspired by many people while synthesizing this project: my principal; my mentor; my focus group and of course my students. They represent many ages and levels of experience, but they are all my colleagues in learning.

Thank you to my principal at Hanover Street School, Jeffrey Spiegel, for his support as I grew as an educator by granting me professional development days to explore my thinking and quench my curiosities. I appreciate the many times he willingly came into my room to witness our latest thinking accomplishments. I trust he will continue to create a climate of intellectual discourse within the school to sustain the richness of the outcomes of metacognition.

Mentor: a trusted counselor or guide. My mentor, David Hyerle, embodies much more in role and in attitude. I consider David a gifted philosopher, educator, coach and friend who innovates, inspires, listens, and questions. I continue to learn about myself and the field of education through his insightful idealism to empower students and teachers for organizational change. Working with Designs for Thinking has provided a new lens for framing my experiences. Thank you, David, for being an example of passion and possibility.

I would like to acknowledge our Thinking Maps® Training of Trainers participants from two sites: Syracuse City School District and District 27, lead by Lynn Kanter, in Queens, New York. I thank you for your willingness to try new ideas, reflect on your experiences, engage your colleagues and share your stories. Your stories and insights are the reason why I believe in what I do; I will continue this work; and I will share your thoughts through this master's paper. I appreciate the rigor of your work and your spirit of optimism.

Finally, I would like to express my admiration to my most trusting, wonderful, risk-taking, and brilliant learners; my students. The gratitude I feel toward you fills my heart. Thank you for accompanying me on my journey to implement Thinking Maps and directing our application of the tools. Your discoveries and inquiries steered us to meaningful learning.

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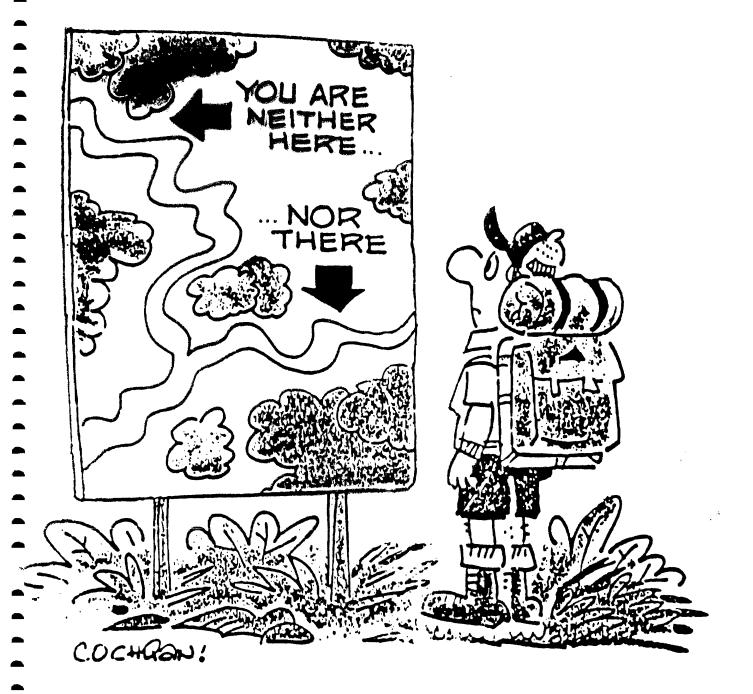# Table of Contents

Introduction

Avalanche

Perusing the titles in the education section of a bookstore or the table of contents in an educational magazines speaks volumes about the climate of education. "Achieving the Standards", "Toward a Developmental Appropriate Curriculum", "Teaching to the Test", Answering the Call for Assessment, and Success with the Standards are a sampling of the selections available. Those titles, their message and the sheer volume of the publications seem to flash at me like neon signs lining a street in Las Vegas. Educators of the twenty-first century face a terrific challenge trying to meet the needs of all students, of all languages, ethnicities, abilities, and socioeconomic backgrounds, while being held to new standards of achievement. An increase in accountability and a leveling of support render many educators feeling overwhelmed, undirected, and unprepared. Like the lights of Las Vegas, somewhat stimulating, blindingly hypnotic, and in danger of burning out.

As a teacher, I felt burdened and exhausted because everywhere I turned it seemed like I had to teach one more unit of content, administer another test, or address the NH Frameworks. Buried under district initiatives, school memos, the new math program, and a recently adopted curriculum, I could barely see the real purpose for all these improvements: increased student performance. Wanting to inspire my inquisitive, energetic, and intelligent fifth grade students, I fortified my "teaching backpack" and began climbing through the institutional layers of sediment, examining the gems at each level as I trekked onward hoping to understand the "big picture" from the view at the top of the educational mountain.

After spending months wading through topic-driven curriculum and figuratively traveling the globe and spanning centuries of time to reteach myself Renaissance history, the ancient cultures of Meso-America, and force and motion, I began designing learning experiences that would help my students discover the contributions of Michelangelo, the Mayans and Newton. I wondered, as I struggled to maintain balance among these isolated topics, how will my students be able to jump from stone to stone constructing a pathway of

understanding?

As Dennis Sparks (1991), in his book, <u>A New Vision of Staff Development</u> quotes Michael Fullan,' " the greatest problem faced by school districts and schools is not resistance to innovation, but the fragmentation, overload, and incoherence resulting from the uncritical acceptance of too many different innovations" '(Sparks, 2). My students and I were confronted with quite a task. We knew what topics we needed to learn, but did the breadth of the curriculum allow us to *learn* it or simply *know* it? The enormous amount of facts, figures and dates well exceeded the number of days in school. In this environment, how would they learn, "how to learn" rather than how to recollect?

Fortunately, my concerns were addressed when I attended a schoolwide inservice entitled, "Thinking Maps: Tools for Learning" that provided me with a set of student tools to help them navigate their educational territory. The Thinking Maps training presented background information on and the strengths and weaknesses of various visual tools such as: webbing, mind mapping, graphic organizers, and thought process maps, before demonstrating the power and possibilities of a set of visual tools based on fundamental cognitive processes. (Appendix A) Each of the eight graphic representations is paired with a cognitive skill: defining in context, describing, comparing and contrasting, classifying, sequencing, cause and effect reasoning, whole-part analysis and seeing analogies and used flexibly as a toolkit called Thinking Maps. We spent part of the day applying the tools to our own curriculum in order to introduce the maps to our students in the upcoming weeks.

Because the maps are based on thought processes, they were easy to integrate into classroom use. As part of our daily exchange, we already asked each other to explain how and why something happened (sequence, cause-effect); or how it was different from another situation or experience (compare/contrast). Within a months time, maps hung from bulletin boards, filled writing folders and most impressively peppered conversations.

Compass

As I listened and observed my students' work, I noticed the impact of these tools on learning. When I gave an assignment reading text; scientific, historical, or fictional; students comprehended the information, asked questions about it, and constructed maps that
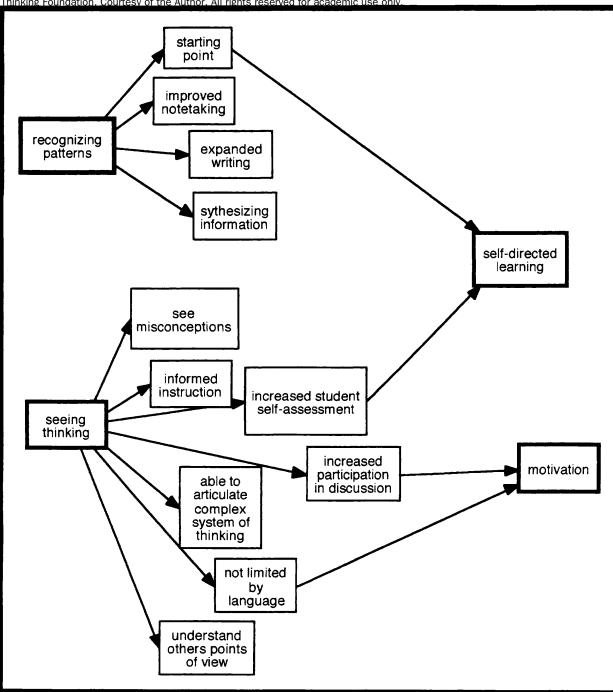
represented their thinking. The maps displayed the relationship of ideas that they understood. I recall vividly several situations in which I was prepared to give directions for an activity, when I would look out to find my students busily beginning the task. How do they know what to do? I wondered. I realized they had begun to own the tools for processing information. The maps were the compass providing them direction for learning. By using the maps consistently, we had established a way of thinking. It was as if we demystified learning. Providing the visual linked to thought processes was like tapping the students on the shoulder and saying, "Did you know that your brain functions in certain ways to connect patterns? And guess what, most information that you will encounter will be represented with these thought processes?" Fortified with this knowledge, students had a starting point. Therefore, Thinking Maps offered students the vocabulary to make metacognition explicit and the graphic to literally "see" their thinking. I became increasingly curious as to the effects of students recognizing patterns of thinking and the effects of graphically representing their thought process. Figure 1.1 shows a Multi-Flow summarizing my observations. The figure explained that Thinking Maps use lead to academic strides as well as social/behavioral changes.
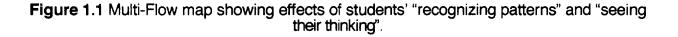
Discovery

As the year progressed, the discourse in our classroom changed. As the students became more motivated and self directed, I detected a difference in patterns of conversation. A shift had occurred since the beginning of the year regarding, who was speaking, the topic of conversation, the nature of that interaction, and the direction of the conversation. For example, in the middle of a reading discussion about author's craft concerning the book, <u>House With a Clock in its Walls</u> by John Bellairs, one of my student's shared her thoughts, "You know, Bellairs writing is a lot like watercolors."

"What do you mean?" I probed.

"Well, with watercolors, you never get the direct, full color. You get hues and different shades which is kind of like this mystery. He just gives you touches of the mystery and solution along the way, very subtly like watercolors." Her comment inspired one boy to burst from his seat sputtering, "Ms. Curtis, that is a bridge map!" I encouraged him to

Figure 1.1 Multi-Flow map showing effects of students' "recognizing patterns" and "seeing their thinking".

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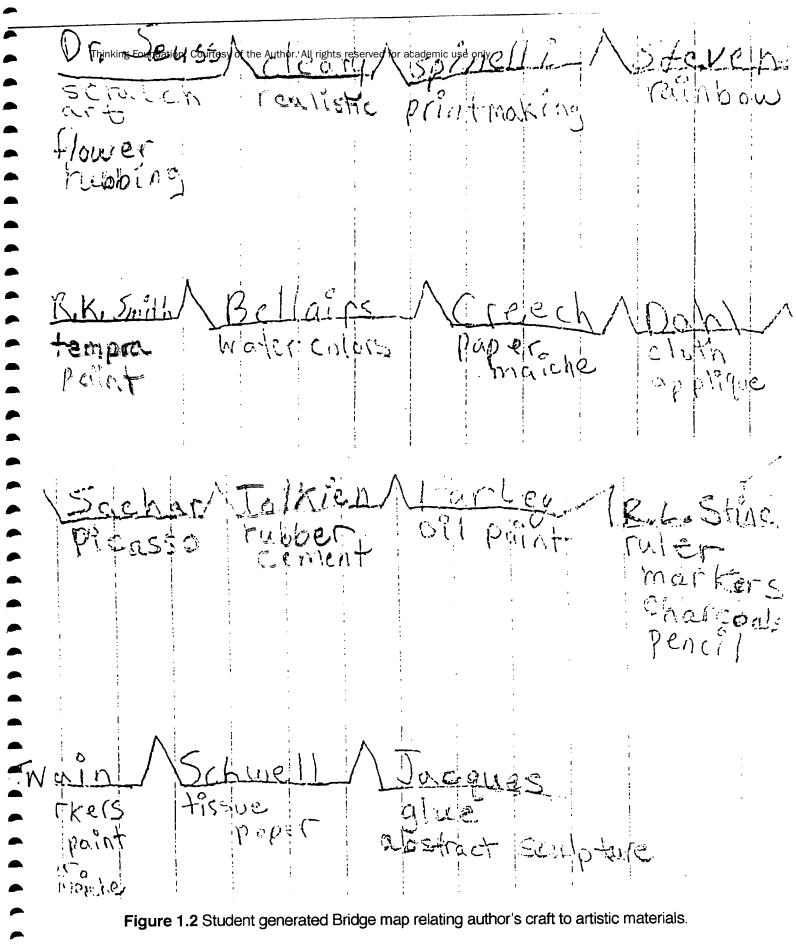
explain his reasoning and draw one on the board. The minute he had represented her thinking, the analogous reasoning was unstoppable. The children used their common visual language to express their thinking; thinking rich with connections. The class bridge map is shown in Figure 1.2. The Bridge map is read in pairs from top to bottom. The relating factor: "author's craft resembles/reminds me" "bridges" the relationship over the pairs. The pair with Dr. Seuss would read, "Dr. Seuss' writing style resembles scratch art." Further clarified by the student, "because with scratch art you know there is blue, red and yellow underneath. Just like with Dr. Seuss, you know he will have rhymes and weird characters, you just don't know how he will put it together. Just like you don't know what how the colors will combine in your picture until you start to scratch." This dialogue demonstrates the students' vocabulary of thinking and the habit of recognizing and applying cognitive processes.

Another impressive, student directed, metaphorically rich conversation occurred during an astronomy class, as we used a flow map to sequence the life cycle of a star. Working to explain the birth stage of a star in which Hydrogen undergoes nuclear fusion (a difficult concept to understand) to make Helium, one of my students who is coded learning disabled and reads at a second grade level, said, "Nuclear fusion is just like New York City. The atoms of Hydrogen are rubbing together and causing heat, just like the cars in traffic and people on the sidewalks are all packed together so tightly."

In response, I asked the class if they could relate nuclear fusion to anything else that they understood. To which another student with an IEP excitedly offered, "Nuclear fusion is like a football game. The linebackers are all lined up and push against each other creating friction just like Hydrogen. Then the football is snapped to the quarterback. That is like the Helium coming from Hydrogen. The quarterback throws the ball down the field for a touchdown, which is like the Helium traveling over thousands of years to get to the edge of the star and light it. Touchdown, a star is born."

After listening to that explanation, I thought, yes, a star is born! What amazing thinking! These bursts of brilliance and moments of radiance became commonplace within our learning community. Both conversations illustrate the ease and facility these students have to think deeply about the subject matter for meaningful learning.

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Dr Seuss — Cleary — Spinelli — Steven

scratch art — realistic — printmaking — rainbow

flower rubbing

R.K. Smith — Bellairs — Creech — Dahl

tempra paint — water colors — paper mache — cloth applique

Sachar — Tolkien — Larley — R.L. Stine

Picasso — rubber cement — oil paint — ruler markers charcoal pencil

Twain — Schwell — Jacques

rkers paint to marble — tissue paper — glue abstract sculpture

Figure 1.2 Student generated Bridge map relating author's craft to artistic materials.

I was convinced that the maps were influencing our discussions and my concept development. I could understand and articulate concepts more coherently, synthesize the disjointed curriculum and feel confident about my teaching. I wondered if my students felt the same sense of relief. So I asked them. Perhaps this method of inquiry biased the results, but I constructed a Circle Map with "Thinking Maps" as the center. Figure 1.3 displays my students thinking about thinking.

class

make them fit your ideas

groups

can see where you're going

Bubble Map

experience

studying

gives me more ideas

develops better vocabulary

conclusions

Circle Map

details

I can see things

relationships

clear

note taking

Flow Map

slows me down

opposites

can come back to ideas later

Opens up my brain

fun

a place to put all my thoughts

more complete

cause and effect

models

comparing and contrasting

Tree Map

helps me remember

HELPS TO SORT IDEAS

make a plan

Double Bubble Map

categories

helps to get you "unstuck"

thinking determines which map to use

poster

organize

process

Bridge Map

describes

takes time

CYCLES

can use them for everything

prepared

use in all subjects

brainstorming

things just keep popping up

presentations

puts things in order

time for Kids

teacher

Thinking Maps

stories

math problems

character analysis

Figure 1.3 This Circle Map captures student thinking about Thinking Maps.

I recall the shivers along my spine when Joey, a student I shared with the resource

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teacher, shot his hand high in the air. "Thinking maps open up my brain," he contributed, as he sighed deeply and his shoulders relaxed. That brief statement and his body language told me a great deal about the thought process of this child. As we continued speaking, I concluded that Joey had a tool to sort those whirling thoughts inside his head so he could actively pay attention to construct patterns of thinking.

As I stated earlier, the internalization of the cognitive processes of the Thinking Maps was evident on paper and in speech. Discussion was initiated by the students, directed by students, synthesized by students, mediated by cognitive skills toward conceptual development. The students proactive processing on multiple levels replaced traditional end of chapter, unit questions and worksheets. They were asking the questions for themselves, employing eight angles of thought to understand a situation. The language of our classroom was the language of thinking. With the maps as our compass, we found the intersections of our curriculum and constructed networks bridging the gaps of our educational landscape.

Metamorphosis

The students were not alone in their growth. By using the maps in instruction, my patterns of thinking improved. The avalanche of curriculum, assessments, district initiatives and school memos that buried me in September now seemed more manageable. I no longer felt fearful of teaching something I didn't at first understand. I didn't just start using the science kit with preselected activities to introduce force and motion or add a slightly creative twist to the unit on Reconstruction. Instead, I had a toolkit to help me understand, extend, and teach it conceptually.

Although the tools were focused on the student, I found them incredibly helpful in and out of school. Soon I was a "map junkie" which really means I became a thinker; a systems thinker. I mentally mapped my relationships, surprise birthday parties, current events, real estate prospects and possible job opportunities. Obviously, these maps weren't designed for students, these maps were designs for learning.

Despite my jubilation, the climate of stress still carpeted the school like an

unwelcome Spring frost. Complaints circulated at every grade level meeting; too much curriculum, not enough time. Already feeling overwhelmed, my colleagues felt that Thinking Maps was another piece heaped on them. No matter how many experiences I shared, they were convinced Thinking Maps required additional effort that they didn't have the energy to expend. "It's not curriculum, but a set of tools to help you teach the curriculum," I explained. I felt frustrated that the teachers' discomfort prevented students from accessing these tools. These very students that they groaned about weekly, who just "couldn't think" who could benefit from the introduction. This situation lead me to wonder, under what conditions do teachers incorporate new strategies? What leads to improved instruction? I attempted to answer these questions through my own experiences and readings. What worked for me? I felt that participating in reflective process, exploring the whys and hows of the classroom, was a positive factor in trying new approaches. What enhances reflection? Consequently, I wondered, if Thinking Maps are metacognitive tools, to what extent do Thinking Maps promote reflection? Furthermore, I pondered, if the purpose of Thinking Maps is to facilitate continuous cognitive development in students, then how can it impact adult concept development. I had witnessed a metamorphosis in myself, therefore, I decided to focus my master's project on the question, to what extent do Thinking Maps influence teacher reflection and concept development?

This paper documents recent research conducted in the fields of concept mapping, reflection, cognition and metacognition which laid the groundwork for a focus group study in which inservice teachers attended a Thinking Maps Training of Trainers. The purpose of this paper was to explore the influence of Thinking Maps on teacher reflection and cognition by gathering field notes, artifacts and survey data during and after the training sessions. The following sections describe my findings and conclusions from this teacher reported data.

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Literature Review

When defining my project, I realized my investigations were multi-layered and overlapping. My central question, How do Thinking Maps effect teacher reflection and conceptual change? touches upon many aspects of teacher education. As I consulted research articles, books and studies regarding reflection and conceptual change, those topics lead me to explore metacognition, cognition and organizational change which all seem to converge under the umbrella of learning.

I located many articles examining reflection for effective instruction, but they seemed to focus on lesson plan design or classroom management rather than concept development. Other studies used journals or videotaping methods to record practice to use as examples in reflective discussions. In my study, I wanted to make the distinction between 1) merely *conducting a reflective discussion* through *teacher-directed questions* in response to situations and 2) providing participants with a metacognitive tool to *process and direct their own reflections*.

In addition to that difference, I wanted to find research that employed visual tools as part of the reflective process, not only for *craft knowledge,* but for *content knowledge.* Calderhead distinguishes the following six kinds of knowledge of experienced teachers: subject knowledge, craft knowledge, personal practical knowledge, case knowledge, theoretical knowledge and metaphors and images." (Elshout-Mohr, 1999, p. 71). I narrowed my field to visual tools for subject knowledge in teacher education. I focused on studies in which inservice teachers used concept mapping as part of a reflection process that enhanced their conceptual understanding of content matter. By using work of experts, I will define the three components embedded in my question: concept mapping, teacher reflection and conceptual change as well as discuss studies in which their applications intersect.

Defining Concept Mapping

Concept mapping emerged in the 1970's when scholars tried to ascertain students

knowledge systems and comprehension. Joseph Novak and Bob Gowin, educational researchers from Cornell University, experimented with various means of evaluation to represent children's knowledge. They felt very frustrated that the paper instruments, traditional tests, did not accurately represent what students could explain orally during interviews. To capture students' degrees of understanding, the researchers switched from student-generated written records to interview audiotapes, but found the process of coding the verbalizations difficult. During this frustrating experience, Novak and Gowin used David Ausebel's work on meaningful learning to search for patterns of concept words. (Novak, 1998) Concept mapping emerged from visually mapping the patterns of thought development. Novak and Gowin taught the method of concept mapping to both students and teachers to visually represent central ideas and the relationships among ideas (Novak, 1998). The following figures, 3.1 and 3.2 are concept maps explaining concept maps:
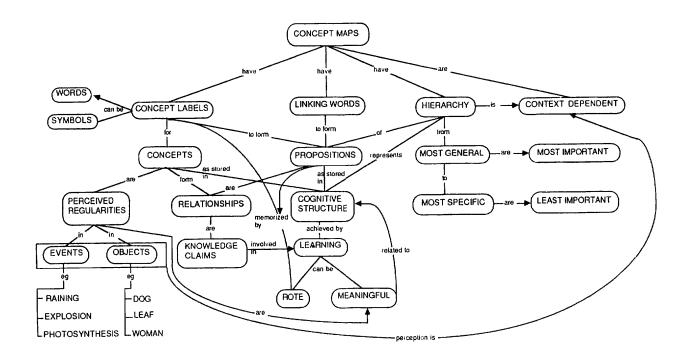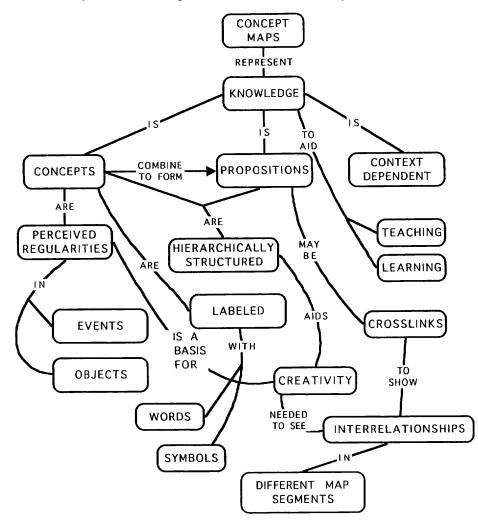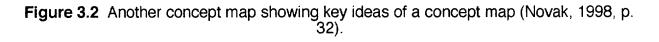
Figure 3.1 A concept map indicating features of a concept map (Novak and Gowin, 1984, p. 27).

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Figure 3.2 Another concept map showing key ideas of a concept map (Novak, 1998, p. 32).

According to Novak and Gowin, concept maps have been very effective in teacher planning and assessment as well as student organization and performance (1984). Concept maps seek to make accessible the process of meaningful learning as defined by Ausebel. Ausebel states three requirements for meaningful learning:

"1. relevant prior knowledge

2. meaningful material: knowledge must be relevant and contain concepts and propositions

3. learner must choose to learn meaningfully: the learner must consciously choose to relate new knowledge to knowledge the learner already knows" (Novak, 19).

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Therefore, concept mapping makes the inner processing public. Students and teachers have a physical and manipulative model construct meaning. "A map can also provide a visual road map showing some of the pathways we may take to connect meanings of concepts in propositions...Concept maps provide a schematic summary of what has been learned" (Novak and Gowin, 15).

John Clarke from the University of Vermont who works extensively in the field of displaying metacognition graphically, summarizes concept mapping succinctly:

> "Concept mapping has recently emerged as a graphic technique that lets us and our students see the structure of prior knowledge, plan for the addition of new information, guide inquiry from what is known toward what is not and encourage the recognition of relationships in the content areas" (Clarke, 1990, p. 166).

Concept Mapping In Teacher Education

The following research projects: "Study of Concept Maps Regarding the Nature of Science by Preservice Secondary Science Teachers" and "Using Concept Maps of Effective Teaching" describe the role of concept mapping in student teachers' understanding of content knowledge and craft knowledge.

Young-Soo Kim (1998) defines concept mapping from work completed by Novak and Gowin:

> "During concept mapping, each student uses his or her own knowledge structures to map the relationships between concepts using propositional links. These individual representations of relationships among a set of concepts that exist in the learner's mind are useful to both the student and teacher in assessing the depth of understanding regarding a particular topic. Concept maps can be an effective metacognitive tool in facilitating one's construction of knowledge...concept mapping has been found to be an effective strategy in helping undergraduate elementary students practice and monitor knowledge construction" (Kim, 3).

Young-soo Kim et al realized the importance of concept mapping to record and promote reflection with preservice teachers. They met with preservice secondary science

teachers during a semester long reflective process in which Kim used concept maps to assess understanding of science constructs. The authors of the study recognize that many teachers today learned scientific concepts, principals and terminology from text rather than through direct experience with scientific methods and process. One goal of the study was to have teachers participate in hands-on experiences to help them improve their scientific understandings in hopes that they would transfer this knowledge and the structure of inquiry-based science into their classrooms.

Citing Schon's work regarding the benefits of reflection to aid conscious learning, Kim incorporated electronic journaling and concept maps as processing techniques.

"Donald Schon (1983) describes expert practice as an artful inquiry into situations of uncertainty. Professionals engage in 'reflective conversation' with the uncertain situation, taking stances, experimenting, and learning from the 'back talk' of the situation. Current reform efforts in teacher education are guided by such models of reflective practice. Theoretical underpinnings in cognitive psychology, as well as other forces, are pushing education and especially professional education toward learning through problem solving, authentic projects, apprenticeships and field experiences, and toward learners who act as reflective practioners. Concept mapping provides education students with opportunities to participate in 'reflective conversation' ... (Kim, 3).

At the end of the course, teachers completed concept maps about their understanding of science. Unfortunately, the concept maps didn't indicate significant change. The participants reported being too tired to revise their maps and also thought their understandings hadn't changed. Despite these self-reports, the researchers felt comments in class and in the electronic journaling did not support that statement. (Kim, 6). Perhaps the novelty of concept maps interfered with expression. The study did not mention the participants level of history, use, or comfort with concept mapping. Because concept mapping demands a certain technique, their unfamiliarity with the tool could have prevented representing knowledge.

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Patricia Van Lewan (1997) from Penn State University used concept mapping with 26 student teachers as a tool for thinking about "what constitutes and contributes to effective teaching" (Van Lewan, 261). In order to build a knowledge base regarding the effectiveness of reflection, Van Lewan used concept maps with her student teachers to develop a habit for and a tool to express metacognition as they evolved in their role of teacher. "Studies of teachers' thinking and beliefs have found them to be powerful influences on teaching and subsequent learning outcomes of students." Van Lewan cites the connection between reflection and action:

> "As these teachers consider past classroom events and their own performance, they become 'researchers on their own teaching effectiveness' (Clark & Peterson, 1986, p.293)" Teachers, who aim to improve their professional practice, must recognize not only what they are doing, but also the origins, and effects of their actions, so that they might consider alternative approaches to teaching and learning..." (Van Lewan, 261)

Relating this reflective process to conceptual change, Van Lewan uses the developmental term "cognitive dissonance" to describe teachers who question, critic, and strategize along reflective thinking. "They[teachers] are less vulnerable to unexamined assumptions and more open to change when they encounter cognitive dissonance, a discrepancy between current experience and one's beliefs about good teaching" (Van Lewan, 262) From Piaget's experiments, we know that accommodation and assimilation come from disequilibrium, a sense of cognitive dissonance.

Van Lewan collected student-teacher constructed pre and post concept maps representing their views on effective teaching. The maps provided Van Lewan with valuable information for structuring the course. By examining the maps, the instructor discovered the misconceptions, gaps and understandings of the students over time. "Each provided a snapshot of an individual's conceptions of effective teaching...a developed and accessible knowledge base, a network of competencies, concepts, principles and attitudes that encompassed many facets of teaching " (Van Lewan, 271)

Not only were the maps useful for assessment by the instructor, but for self-

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assessment for the students. Students were eager to inspect their concept maps and look at the differences in their representations of effective teaching. After this experience a student commented, " ' I think it is interesting to see how I reorganized what I was thinking' ". " 'The maps showed what experience has done to affect my thought patterns.' " (Van Lewan, 275). Therefore, the maps served to inform both teachers and students as well as potentially heighten student teachers' self-awareness.

Van Lewan's study was the first I examined that employed concept mapping as a tool for reflection to delineate attributes of effective teaching. Like Kim, Van Lewan wondered how self-reported beliefs transfer into classroom practice. It is interesting to note that "student teachers that received the highest ratings in the practicum experience, created postmaps with lower proportion of instructional items, more classroom management entries, and a higher proportion of curriculum/planning references" (Van Lewan, 276). Van Lewan acknowledged her small sample, but reported that her results supported the further use of concept mapping to explore the relationship between the development of one's pedagogy and espoused beliefs about effective teaching.

Connecting Reflection, Cognition and Instruction

Reflection and concept development interests me due to their connections with improved instructional practice. I thought that perhaps the maps, metacognitive in nature, would provide a medium or framework supporting teacher reflection. Those reflections could induce situational "back talk" thus influencing a change in behavior. As I read the literature surrounding these issues, I noticed that many experts feel that reflection and concept development complement each other, contributing to better classroom practice, which can, in turn, lead to an increase in student performance. Reflection has been shown to be an effective means for examining and changing behavior.

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Defining Reflection: What does it mean to reflect? Why should educators participate in the reflective process?

Donald Schon's book, The Reflective Practioner (1983) discusses the importance of reflection as a vehicle of inquiry for everyday practice; as a means of expression of competence; and as a tool for learning. He writes:

"We are in need of inquiry into the epistemology of practice. What is the kind of knowing in which competent practioners engage? How is professional knowing like and unlike the kinds of knowledge presented in academic textbooks, scientific papers, and learned journals?In what sense, if any, is there intellectual rigor in professional practice?" (Schon, viii) "By taking the time to reflect, sometimes the practioner doesn't know what they know or think until they attempt to articulate it in speech or writing" (Schon, ix).

How would this reflective practitioner look in a school setting? Schon explains how the hierarchical, linear transmission of knowledge and duties would be replaced by a more thoughtful, flexible approach.

"A teacher as a reflective practioner would ask herself, 'How is he thinking about this? What is the meaning of his confusion?' She listens for ideas that transcend the lesson plans. A reflective teacher needs a kind of educational technology which does more than to extend her capacity to drill and practice. Most interesting to her is an educational technology which helps students to become aware of their own intuitive understandings to fall into cognitive confusions and explore new directions of understanding and action (Schon, 333).

Schon continues to explain how these actions would have a "reframing" effect on other professionals' roles within the organization.

Dr. Cruickshank (1987), who wrote Reflective Teaching and practices reflective teaching with preservice teachers, agrees with Schon's definition of reflection as a specific way of thinking and acting.

"Reflect means to think. However reflection is more than merely bringing something

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to mind...one must consider it. Teaching can be thought about and considered by means of meditation, musing contemplations, pondering deliberation, cogitation, reasoning and speculation" (Cruickshank, 3)

He continues by making the distinction between performing rote teacher tasks and preparing meaningful interactions:

"Some teachers may be adequate or even good in the immediate situation, but not wise; good in that they are technically able-that is they can write behavioral objectives, organize teaching episodes, use instructional technology...but unwise in that they understand neither why they are doing what they are doing nor when suitably to employ skills" (Cruickshank, 2).

Cruickshank explains the introspection and level of awareness required for reflection by outlining Valverde's definition of reflection.

"The teacher must examine his or her situation, behavior, practices, effectiveness, and accomplishments. Reflection means asking basic questions of oneself....What am I doing and why? Reflection is a form of slightly distorted self-evaluation-distorted in the sense that judgment is emphasized rather than data collection...reflection, then, is an individual's needs assessment and continued self-monitoring or satisfaction with effectiveness. [it is] periodic, constructive, and deliberate" (Cruickshank, 3-4)

Dewey suggest that "good habits of thought are best engendered by providing situations that initiate and provoke reflection.

"When teachers or college students have an opportunity to study their own teaching behavior thoughtfully and have opportunities for practice and appropriate and subsequent analysis, the odds are very high that they will change or modify their patterns of teaching behavior" (Cruickshank, 57).

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Schon, Cruickshank, Valverde, and Dewey all define reflection in terms of a purposeful and practiced exercise. So if reflection encourages "new directions of understanding and action", how can reflection be fostered? Therefore, what are the situations that promote reflection and how can we make them explicit?

Applying Reflection: What models or interventions have been used with educators?

As Dennis Sparks and Stephanie Hirsch have written about in their book, <u>A New Vision for Staff Development</u> (1997) ,professional development opportunities need to engender patterns of thinking and revisit the patterns of thinking in evaluating how to work in an educational setting. Past interventions or staff development efforts were targeted at methodologies or programs. However, due to our new landscape of responsibilities educators need offerings to develop content knowledge and understanding. Quality staff development begs for reflection for the purpose of conceptual change in the individual. With this movement in the education field, professional development is recognizing it's important position to take the steps necessary to build a strong and knowledgeable teacher force. One way of achieving this is not only offering inservice, but focusing on the length and depth of the staff development design.

> "Research and experience have taught us that widespread, sustained implementation of new practices in classrooms, principals' offices and central offices requires a new form of professional development. This staff development not only must affect the knowledge attitudes, and practices of individual teachers, administrators and other school employees, but it also much alter the cultures and structures of the organizations" (Sparks, 1).

"staff development is at the center of all education reform strategies-without it, such strategies are merely good ideas that cannot find expression." (Sparks, 96) Darling-Hammond and McLaughlin remind us: ' "professional development today also means

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providing occasions for teachers to reflect critically on their practice and to fashion new knowledge and beliefs about content, pedagogy, and learners." '(Sparks, 3)

Over the last twelve years, educators have moved from defining reflection to realizing it's benefits, to structuring effective professional development to practice it and to deciding to explicitly incorporate reflection into training efforts (Sparks, 21). Although the following research by Newell does not use concept mapping as a tool for recording or motivating reflection, work by Newell, Taggart, Elshout-Mohr and Costa demonstrate the implications of teaching the terminology of reflection. Newell from his research entitled, "Practical inquiry: collaboration and reflection in teacher education reform" grounds his research:

> "The link between school reform and teacher education in numerous publications, such as the Holmes report in 1990, have supported this notion that teachers need to "inquire" about their own teaching. Richardson (1990) states that change comes from giving the teachers the opportunity to converse about movements in education and their classroom practice" (Newell, 1985, p. 57).

Basically, Newell provides a forum for teachers to present and support their thinking, consider their reasons for practice, as well as to widen and deepen professional perspective and cognition. In Newell's research, he attempts to create situations for teacher discourse in order to influence collaboration and reflection. If teachers are encourage to use reflection in their classrooms, they need to understand what if feels and looks like. Therefore, he designed a course for 41 teachers to examine craft knowledge, collaboration and reflection.

Their feedback about their experiences indicated that they understand personally the benefits of collaboration and reflection. After working collaboratively over time, participants found their external awareness increased, references to academic content increased, confidence increased, and responsiveness to students increased. (Newell, 568) Therefore participants were able to generalize their experience as learners to the students in their classrooms. When teachers are put in the role of learner trying to articulate their knowledge they are less removed from the act of learning.

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Germaine Taggart and Alfred Wilson in their book, <u>Promoting Reflective Thinking in Teachers: 44 Action Strategies</u> discuss previous researchers definitions of reflection and studies designed to engage teachers in the reflective process. Although some variance in specificity exists, the definitions all include ideas about examining practice to improve technique. The dialogue doesn't center around "What is reflection?" but rather "How do we promote reflection?" and "How can we assess reflective thinking?" Unfortunately, Taggart and Wilson only answer how to promote reflection by including forty-four action strategies in their book.These strategies present teachers with numerous scenarios which they use for discussion to practice and refine their thinking. They are incorporating a constructivist approach which "advocates learning as a process of change." Taggart and Wilson used their knowledge regarding assimilation and accommodation to provide "a simultaneous process" which would allow practitioners to restructure their knowledge by making modifications to existing schemata" (Taggart and Wilson, 1998, p.16).

Through these sessions, Taggart and Wilson hoped to establish a way of examining pedagogy and problematic situations so that practioners will transfer their reflective thinking to their own situations.

"Written assignments, such as journaling, autobiographical sketches and narratives, are ways of recording reflective thought. Concerns were voiced, however, as to the ability of those thoughts to be translated into reflective action" (Taggart, 38). "Dewey (1933), Eby and Kujawa (1994), Pugach and Johnson (1990), and Schon (1983) delineate a cyclical process approach to reflective thinking...The first step to reflective thinking involves a problem...The second step...is to step back from the problem to look at the situation from a third-person perspective so that the problem may be framed or reframed (Clark, 1995; Pugach and Johnson, 1990; Schon, 1987)....These features provide the mental picture of the thought processes entertained by the reflective practitioner in an attempt to define a problem. Dewey likened the process to the scientific method... Evaluation the next stage...consists of a review of the implementation process and the consequences of the solution" (Taggart, 6).

Depending on the implementation process the problem may be "reframed" or "the process may be repeated."(Taggart, 6)

Along with Taggart, Mohr constructed an intervention aimed at transferring reflective practice into classroom practice. Elshout-Mohr, Hout-Wolters and Broekkamp (1999) from the Graduate School of Teaching and Learning at the University of Amsterdam realize the difficulty in promoting reflective thinking and change in teachers. They studied obstacles and factors that inhibit adoption of new ideas and created what they call "instructional-learning episodes" to understand when, how and why teachers will attempt change. They intend for others to use their instructional- learning episodes "to encourage teachers to assimilate and accommodate research findings about how to support learning..." To target areas of change, they divided teaching into two components: process and content. These two "knowledge systems" function to plan lessons and understand subject matter and learning goals. These researchers focused on the concept development in the content knowledge system, rather than the delivery or presentation aspect of lessons. "Teacher programs are much concerned with lesson structure, but tend to underestimate the value of valid knowledge about the actual learning processes which are required to achieve academic goals" (p.54).

To what extent, do teachers understand the material that they are teaching? To what extent will they address their misconceptions, extend their learning and apply new conceptual understandings to practice? Teachers attend and confront many new professional development opportunities in their careers. Elshout-Mohr et al wanted to understand how to bridge the gap between theory and practice.

Elshout-Mohr reviewed previous documentation to find factors that link beliefs to action.

"..new components first become incorporated into the knowledge systems and later into the routines, as a result of repeated applications and a proceduralisation process (Anderson, 1990) However, in cases in which new data are anomalous, unexpected, and conflicting with prior beliefs, sheer exposure to new information or experiences is not sufficient to bring forth a change in the conceptions of teachers, and their professional actions.(Bromme & Tillema, 1995) ...Professionals, whatever their profession is, tend to protect the preinstructional theory and keep job

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performance unchanged in the face of contradicting evidence" (Elshout-Mohr, 58)

Chinn and Brewer (1992) found key factors in which reflective theory change does occur. A situation must include:

-"influencing prior knowledge and fostering awareness of prior theories and beliefs

-introducing the alternative theory and making sure that this theory is plausible of high quality and intelligible

-introducing data that convincingly sustain the new theory and reject incorrect beliefs, and influencing processing strategies, encouraging deep processing." (Elshout-Mohr, 59)

"the issue is how to stimulate professional teachers to make better use of a growing body of scientific knowledge about instructional-learning processes. it has been suggested that a promising way to proceed involves conceptual conflict" (Elshout-Mohr, 60).

Elshout-Mohr thoughts on "conceptual conflict" resonant with Van Lewan's earlier comments that reflective thinking requires and fosters "cognitive dissonance". Both Elshout-Mohr and Van Lewan suggest "conceptual conflict" and "cognitive dissonance" as a prerequisite to uniting theory with practice.

Therefore, by presenting teachers with different learning episodes differentiated by presentation of ideas, process of material, and production of knowledge, the researchers hoped to promote reflective cognitive change in experienced teachers.

"It has long been recognized that cognition mediates teachers' behavior. Shavelson (1976) for instance suggested that the skillful teacher is not characterized by this or her ability to perform recommended activities, but by the ability to perform the right abilities at the right time in an appropriate manner, adjusted to the need of the student. (Elshout-Mohr, 70)

Once again, cognition is embedded in reflection because reflection is the venue for

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processing learning. Chinn and Brewer's key factors for change correspond quite well will Ausebel's requirements for meaningful learning. Therefore, how we learn concepts overlaps despite differences in age.

Outcomes of Reflection: How are the individual and the organization connected?

Change arises as a central theme of reflection: change in thinking, change in understanding, change in theory, and change in practice. A change in an individual can influence a change in an organization as well. The connection between individual change and organizational change mediated by reflection is stated by Osterman and Kottkamp (1993) in their publication, <u>Reflective Practice for Educators</u>:

> "We believe that reflective practice, an approach to educational improvement that is both situation specific and places the professional in the center of the attempt to create improvement, not only stands in contrast to most current ideas, but has the greatest potential of any approach for improving individuals and through them, schools and education...Reflective practice is an integrated way of thinking and acting focused on learning and behavioral change; it is individuals working to improve organizations through improving themselves....Reflective practice is based on the beliefs that organizational change begins with us...and that many blocks to change are rooted in unexamined assumptions guiding our stable behavioral patterns. Too create change, then, we must examine our own behaviors, bring unexamined assumptions to awareness and consciously self-monitor both our behaviors and assumptions (p. 1).

David Hyerle, the developer of Thinking Maps®, in his book, <u>A Field Guide to using Visual Tools</u> echoes Osterman and Kottkamp's statements about individual change leading to organizational change. He offers visual tools as the instruments to encourage and structure reflective thinking to initiate systemic change:

> "What are the habits and states of mind that we wish to develop in learners that will empower them to become aware of their own minds so that they can nimbly shift

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their own minds?

....Learners of all ages must be able to honestly reflect on their own thinking, to become aware of the patterns that seem to work, and to see how many patterns become lifeless, repetitive, unchanging, stubbornly unchangeable. Visual tools of all kinds provide pathways for learners-lifelong-to look inward, see and then share with others how they are thinking. Thus, they can provide a visual pathway from where they are to a new version of what could be" (Hyerle, 2000, p.133).

Assessing Reflection: How do we evaluate and measure reflection?

When "mind shifts" occur, how can we quantify them? If reflection has an impact on cognition, then methods of assessment to evaluate the level of growth should exist. Taggart and others feel reflection is an important process because it enhances the level of perspective and flexibility in problem solving situations. From the research, a few scales or frameworks have been developed to interpret oral and written feedback from educators, but quantifying reflection remains a challenge.

Taggart devised the Reflective Thinking Pyramid, Figure 3.3 describing reflective thinking at 3 levels: technical, contextual and dialectical. His qualifiers resemble the studies by Sparks-Langer at Eastern Michigan University. Sparks-Langer's framework, Figure 3.4 includes seven levels of reflective thinking. As practioners progress from Level 1 to Level 7, they consider the issues from multiple points of view or frames of reference.

In addition to providing a reflective framework, Art Costa and Robert Garmston developed Cognitive Coaching: a comprehensive model of reflection that emphasizes cognition. Cognitive coaching is as model for improving teachers concept and pedagogical knowledge through dialogue, questioning techniques and investigations. Like Cruickshank, Mohr and Schon, Costa and Garmston appreciate that the multi-tiered processes of quality teaching are grounded in cognition:

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Dialectical Level

Addresses moral, ethical or socio-political issues; disciplined inquiry; individual autonomy; self-understanding

Contextual Level

Looks at alternative practices; choices based on knowledge and value commitments; content related to context/student needs; analysis, clarification; validation of principles

Technical Level

Reference past experiences; teacher competency toward meeting outcomes; focus on behavior/content/skill; simple, theoretical description

Figure 3.3 Taggart's Reflective Thinking Pyramid describing reflective thinking at 3 levels: technical, contextual and dialectical

Level	Description
1	No descriptive language
2	Simple, layperson description
3	Events labeled with appropriate terms
4	Explanation with tradition or personal preference given as the rationale
5	Explanation with principle or theory given as the rationale
6	Explanation with principle or theory and consideration of context factors
7	Explanation with consideration of ethical, moral, political issues

Figure 3.4 Sparks-Langer's seven levels of reflective thinking.

"...teaching is a highly intellectual process involving continuous decision making....Jackson and Conrad were among the early theorist who moved us beyond teacher behaviors toward a cognitive notion of teaching, and we now accept that the overt behaviors we observe in classroom performance are the results and artifacts of invisible decisions and complex intellectual processes in the teacher's mind...." (Costa, 85).

"...we regard coaching as a process of engaging, enhancing, and mediating the intellectual functions of teaching..." (Costa, 89).

" Research shows that teachers with higher conceptual levels are more adaptive and flexible in their teaching style, and they have a greater ability to empathize, to symbolize human experience and to act in accordance with a disciplined commitment to human values. These teachers choose new practices when classroom problems appear, vary their use of instructional strategies, elicit more conceptual responses from students, give more corrective and positive feedback to students and produce higher achieving students who are more cooperative and involved in their work.....Teachers at higher stages of intellectual functioning demonstrate more flexibility, tolerance for stress and adaptability. They take multiple perspectives, use a variety of coping behaviors, and draw from a broader repertoire of teaching models. High-concept teacher are more effective with a wider range of students, including students from diverse cultural backgrounds" (Costa, 6, 7).

Cruickshank and Taggart established a framework to evaluate reflection. Similarly, cognitive coaching employs VanMannen's framework to categorize expressions during coaching episodes. The following is an outline of the taxonomies of reflectivity and teacher thought.

Taxonomy of Reflectivity

(which is a hierarchy for measuring growth or planning a sequence for learning)

VanMannen's levels of Reflectivity:

3 levels

Level 1: The teacher examines techniques to reach given objectives...concerned mainly with means rather than ends, technical application of educational. knowledge. Reflections are on objectives, strategies,, lesson plans, classroom control, and student progress."

Level 2: "The teacher establishes relationships between the principles and practices. ..expresses a need to assist the educational, esthetic, and psychological implications and consequences of his actions... main concern processing info by "analyzing and clarifying individual and cultural experiences, meanings, perceptions, assumptions, "At this level, the focus in on interpreting and understanding experience in terms of practical choices"(Costa, 230).

Level 3: "teacher uses deliberate rationality as the ideal to pursue worthwhile educational ends in self-determination, community, and on the basis of justice equality and freedom. Teachers may express the links between professional activity and social and political forces in society (Costa, 230).

Taxonomy of Teacher Thought

Descriptive Stage:

Level 1: Teacher is unable to describe an example of teaching

Level 2: Teacher is able to describe a recent example of teaching but without using pedagogical concepts

Classification Stage:

Level 3: Teacher describes a recent example of teaching using pedagogical concepts to relate the events.

Level 4: Teacher does above but cannot explain using pedagogical concepts why the

lesson was successful or unsuccessful

Explanation stage:

Level 5: Teacher describes example with pedagogical concepts; can explain why lesson was successful or not, relating to pedagogical principles

Conditional stage:

Level 6: Teacher does above and relates the success or unsuccess of the lessons "to the students, classroom, community or larger society" (Costa, 231).

Level 7: Teacher explains using the above criteria as well as explaining lesson and level of success in terms of "universal moral, political, ethical principles" (Costa, 231).
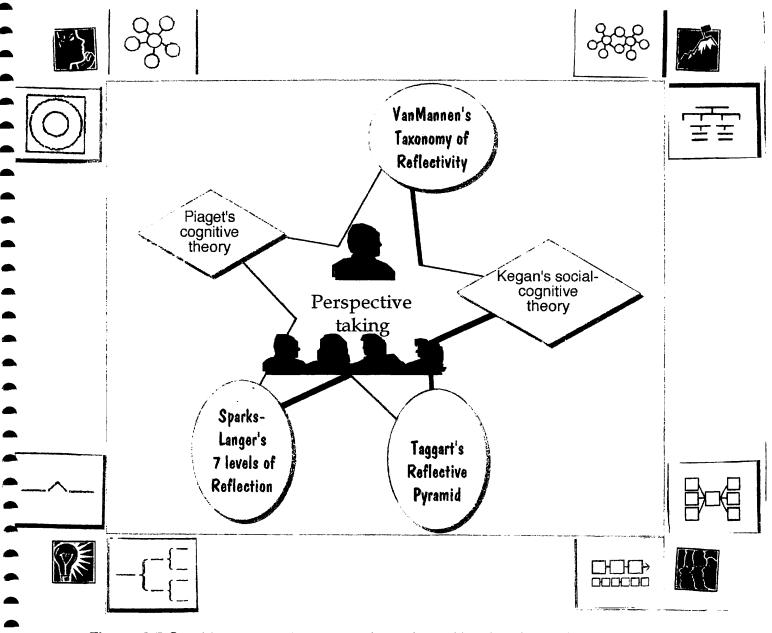
Comparing Taggart's Reflective Thinking Pyramid; Sparks-Langer's Seven Levels of Reflection; VanMannen's Level of Reflectivity and Taxonomy of Teacher Thought, one can clearly see that these stages of reflection mirror stages of cognitive and social development As a practioner proceeds up and through the levels and stages, his/her range of explanations regarding perspective widens and deepens. Individuals come to see themselves as part of an active evolving community rather than an isolated practitioner.
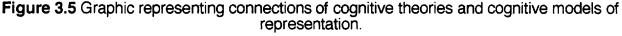
In Piaget's model of cognitive development and in Kegan's subject-object cognitive-social theory, they delineate stages by a person's ability to view a situation in abstract ways separate from themselves. In Kegan's cognitive-social cycles (1996), a person spirals through development based on their subject-object balances. The subjective piece being what a person is embedded in, while the objective component defines their ability to disembed themselves from what they are and see things from other points of view (Kegan, 164). As a practitioner moves from a basic level of reflection to a more proficient stage of thought s/he is able to articulate knowledge and practice from multiple perspectives. Figure 3.5 represents the connection between the internal processes and the external representations of metacognition. This figure graphically represents the relationship between cognitive, social and reflective theory as they unite through perspective taking. Habits of Mind symbols, explicit dispositions of thinking, are embedded in Thinking Maps' graphics. The theories are framed by Thinking Maps, a system for representing reflection, that is based in cognitive skills. These cognitive skills provide the underpinning.

To summarize, if cognitive development (Piaget) is the act and process of knowing;

social development (Kohlberg) is how we interact with others; and Kegan's metatheory is how the social and cognitive work together; then reflective development is how we examine and articulate our metacognition. So if these levels exist, part of our challenge is structuring a program that develops professional perspectives and provides a way of representing our knowledge.

Figure 3.5 Graphic representing connections of cognitive theories and cognitive models of representation.

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Metacognition

Representing Reflection: How do we make metacognition explicit?

Many of models of reflection attempt to make metacognition explicit. Like having a set of terms for mathematical processes and a way to represent them, experts are developing tangible, practical and accessible ways to name and to represent their thinking. Costa's quote, "Thinking about thinking begets more thinking" is more likely to be actualized if a vocabulary of thinking is cultivated, so thinking becomes an exercise that is reinforced. More and more research brings to the forefront the explicit teaching of metacognition which emphasizes not *what* we learn or teach, but *how* we learn and teach.

Habits of Mind: Dispositions for Thinking

Art Costa and Bena Kallick, both internationally known for their research and work with critical thinking, have edited a series entitled, <u>Habits of Mind</u> in which they and others in the field of "thinking about thinking" research discuss the importance and suggest a plan for introducing and practicing the 16 habits of mind outlined below :

Persisting

Managing Impulsivity

Listening with understanding and empathy

Thinking flexibly

Thinking about thinking

Striving for accuracy

Questioning and posing problems

Applying past knowledge to new situations

Thinking and communicating with clarity and precision

Gathering data through all the senses

Creating imagining, innovating

Responding with wonderment and awe

Taking responsible risks

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Finding humor

Thinking interdependently

Remaining open to continuous learning

Practioners appreciate that being aware of how we process is equally important as what we are trying to process. How can we comprehend a body of knowledge, if we do not understand the pathways to understanding it, rather than memorizing or recalling it? By explicitly teaching the vocabulary and modeling the questions thinkers ask themselves, educators are demystifying learning.

"Teaching students to be alert to the cognitive process embedded in written and spoken language can help them become aware of their own language and thought. This instruction also can help them decode the syntactic, semantic and rhetorical signals found in all languages, and students can learn to integrate the complex interaction of language, thought, and action" (Marzano & Hutchins, 1985).

Costa and Kallick explain by using earlier research of Vygotsky, Feuerstein, and Flavell:

"... cognitive processes that children derive are embedded in the vocabulary, inflections, and syntax of adults' language. From birth, children imitate the sounds, words, phrases, and thought patterns of the significant adults in their lives....language is a foundation for the habits of mind. A person must have both inner and expressive language to be able to develop the habits of mind... if students do not have inner language (talking to themselves), they will have difficulty thinking through a problem or being aware of their own thinking so they can use what they have learned in other situations. If a person does not have expressive language (talking to others), they will be unable to participate in social thinking or articulate questions." (Costa & Kallick, 15).

In much the same way scientists use the terms hypothesis, and prediction as their language in the laboratory setting, Habits of Mind schools consciously model their behavior and structure their lessons to activate and engage "mindful language"(Costa & Kallick, 25). Costa and Kallick site the research findings of Astington and Olson, 1990 to support their

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reasoning:

>"When adults speak mindful language, using specific, cognitive terminology and instructing students in ways to perform certain skills, students are more inclined to use those skills." (Costa & Kallick, 25) As students hear these cognitive terms in everyday use and experience the cognitive processes that accompany these labels, they internalize the words and use them as part of their own vocabulary." (Costa & Kallick, 26)

Using the terminology creates a classroom climate in which students actively seek and use cognitive terminology to process and to propose questions.

>" When children describe the mental processes they are using, the data they are I asking, and the plans they are formulating, they think about their own thinking, or metacogitate. When teachers use mindful language, they cause the covert thought processes students experience to become overt." (Costa & Kallick, 29)
>When we consider the possible outcomes of overt metacognition, we must entertain the fact that unsuccessful learning may be the result of inefficient processing techniques and methods of expression rather than behavioral, motivational, or perhaps cognitive difficulties.

Thinking Maps: A Representation System of Knowledge

In addition to modeling and encouraging these behaviors verbally through questioning and discussions, another representation system,Thinking Maps® engender and extend these behaviors and reinforce cognitive terminology **visually**, Appendix A. However the shared language of Thinking Maps® is based on cognitive skills rather than dispositions. Thinking Maps®, developed by Dr. David Hyerle, based on thinking research by Albert Upton, language acquisition studies by Vygotsky and the work of Piaget and other cognitive scientists, are a set of graphic primitives that visually represent eight fundamental cognitive processes. Dr. Hyerle developed this model by looking at other ways in which people have attempted to represent knowledge through visual tools:

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webbing, graphic organizers, and concept mapping. He realized the strengths and shortcomings of each type of visual tool. Webbing can be effective for generating ideas, but what happens after the brainstorm? Are learners able to extend and use that knowledge? To what extent did webbing facilitate thinking at deeper levels? The use of graphic organizers emerged from the need to provide more structure to thought. Graphic organizers focus thinking and provide a plan of action, but to what extent is the thinking extended? How do graphic organizers give learners insight into their own patterns of thinking? Therefore, a drawback of graphic organizers is their dependence on the instructor to provide a graphic that they think fits the thinking. Thinking has to fit the graphic, rather than the graphic reflect the thinking (Hyerle, 2000). Concept mapping as explained earlier with Novak and Gowin's work actually teaches learners how to look for hierarchical patterns of thinking and how to visually represent them in a specific form. Learners construct their own representations of knowledge. However, concept mapping emphasis on framing things hierarchically, can stymie systems thinking. Hyerle created a synthesis model to represent knowledge called Thinking Maps® which combines the dynamism of webbing, with the structure of graphic organizers, with the connections of concept mapping, but grounded in fundamental cognitive skills.

Just as Habits of Mind are explicitly taught, teachers instruct children in the use of the eight graphics and the cognitive vocabulary associated with each Thinking Map®. Therefore, cognitive terminology is supported by graphic representations of students' thinking. The importance lies in the fact that each map reflects a cognitive skill, so whenever students and teachers are using maps they are applying specific thought processes. Students and teachers can literally, see their thinking. These tools are used across all content areas and grade levels for continuous cognitive development. (Hyerle,106)

If the theories and research regarding overt use "of cognitive terminology to process and propose questions" is valid for students, then perhaps the same graphic representations could encourage similar opportunities to "metacogitate" for adults. The next section of this paper explores the reflective and cognitive implications of using Thinking Maps with inservice teachers.

Methods of Data Collection

Over a five month period, I conducted action research with a group of 15 elementary school teachers from the Syracuse, NY City School District. They represented eight schools within the district, ranged from 5 to 31 years (19 years average) in teaching experience and instructed at the kindergarten, second, third, fourth(3) and fifth grade levels. In addition to full time classroom teachers, our group included two reading specialists and three teachers working on special assignment as subject area facilitators and curriculum coordinators. These specialists worked with other teachers' classrooms and were responsible for grade level staff development at their sites.

We met a total of six days as part of a Training of Trainers Institute to discuss and deepen their initial Thinking Maps professional development so that they could become facilitators within their schools and ultimately their district. During our two day training sessions in August, November and in March of 2000-01, we structured time to share how they implemented, applied, and modified the maps in their classrooms; inquired how learning episodes using the maps were effective and meaningful; participated in new experiences which extended their map knowledge, application and integration; and designed activities across subject areas that they could use with their students. (See Appendix B for daily agendas)

I collected data at these sessions by 1) observing, questioning, and taking field notes; 2) having participants construct Thinking Maps showing their feedback and learnings and 3) completing a survey after the final training session. Figure 2.1 outlines what type of data collection occurred at each stage of the training.
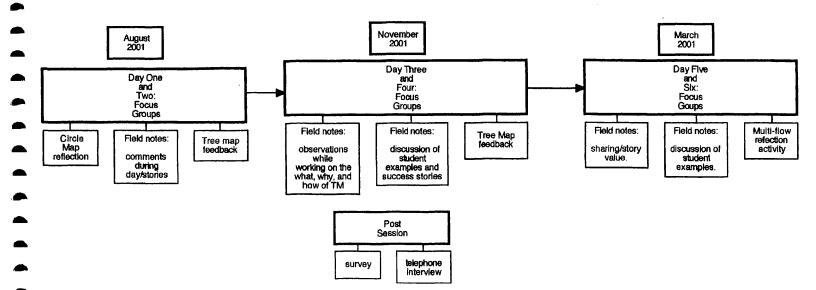
Figure 2.1 Methods and Time line of Data Collection

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Field Notes and Observations

I recorded observations during focus group discussions, because discussion encourages clarity and evidence to support one's thinking, extends explanations, takes a natural flow, offers a less threatening medium, and adopts a more open-ended structure. With this framework, colleagues were more likely to be spontaneous, make connections, pose questions, offer theories, convey voice, tell stories and extend each other's ideas.

I wanted to collect information during each session as I was curious to hear what the trainers viewed as obstacles, successes, and learnings. The notes allowed me to record their evolution of thinking over time. I was curious if I would see and hear a change in what they discussed, just as I witnessed the change in student discourse within my own classroom. I wondered, what kinds of questions will they ask? Will they be about the functions of the maps, about their curriculum, instruction and assessment, or about their own thinking?

Thinking Maps

Participants constructed various Thinking Maps at the end of each 2-day session to provide individual and more formal information regarding what they learned, what they still grappled with, and in which direction they would like to travel next. They constructed a Tree Map, "Thinking about Thinking" at the end of the August and November sessions and a Multi-flow map, "Implementing Thinking Maps" at the final meeting in March. (see Appendices C-F) I used these tools because they represent the very same tools that the participants used with their students for concept development. I wanted to show them another application of the maps: reflective processing, and utilize the tool for data collection at the same time.

Analysis: Finding Themes in Data

As I reviewed my observations and their thought process maps, I looked for patterns of information regarding student and teacher growth. I pooled the field notes from the focus groups and their feedback from the maps to categorize my findings. This

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"cooking" process illuminated areas which needed further exploration.

Surveys

Seeking specificity, I surveyed the group. Their earlier stories and responses intrigued me and I felt their comments could be elaborated. I designed a survey of twenty questions, Appendix G, targeting educational history, basic issues of use, applications, effect on student performance and teacher instruction, as well as the Thinking Maps format of professional development. The first two pages provided some baseline data, while the other sheets required more thoughtful, detailed answers. A cover letter, Appendix H, was attached requesting their participation, explaining the purpose, and describing the survey. I invited them to respond in sentence format or by mapping.

Increasing the Sample

Participants' responses made me more curious about changes over time, however, having relied on field notes during the sharing sessions, I become concerned that I might be hearing/seeing what I wanted to discover. To combat possible selective monitoring and to gather more evidence, I choose to increase the number of participants completing the Tree Map and Multi-Flow map exercises as well as the survey. To ensure trustworthiness of my data analysis, I asked for "Thinking About Thinking" tree maps from two K-5 faculties in Brattleboro, VT and a K-5 faculty in Westerly, RI who had each attended a Day One Workshop. I also solicited post-session survey feedback from another group of Trainers in Training. (see Figure 2.2)

The director of the consulting company distributed the survey to another group of Trainers in District 27 in Queens, New York. This group followed the same 6-day training sequence during the 2000-2001 school year. This population consisted of a broader range of teaching years of experience, positions within the school and ethnic backgrounds. Once again, after obtaining the data, I synthesized the information by theme and noted similarities and differences across sessions and interactions among themes of responses.
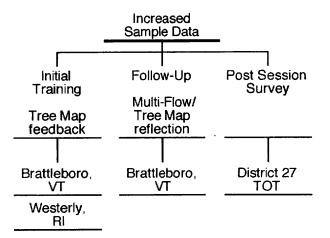
Figure 2.2 Groups and Feedback Data used to increase sample size.

Results:
Expedition of Thinking

My wonderings from my own professional and personal experiences applying Thinking Maps, fueled my desire to see what happened in other classrooms, more specifically, what happened in the minds of teachers as they used Thinking Maps with their students. Would teachers employ Thinking Maps in other ways besides classroom instruction and instructional planning? Would they use Thinking Maps to process content information that they didn't understand or to make personal decisions or to solve personal conflicts outside of educational boundaries? In what areas of life would teachers use Thinking Maps to represent their knowledge system? Would these patterns of thinking, made explicit by eight graphic representations, guide and stimulate them in their thought process? With these questions in mind, my master's project set out to find: To what extent do Thinking Maps influence teacher reflection and cognition?

As a consultant for Designs for Thinking, I lead focus groups of two sets of fifteen teachers: one group located in District 27 in Queens, NY and one group from Syracuse City School District in Syracuse, NY. Over a period of seven months, Dr. David Hyerle and I conducted a Thinking Maps Training of Trainers. This series of six day workshops, split into two-day sessions throughout the school year aimed to develop participants' map expertise and to facilitate map use school and district-wide. For detailed training agendas see Appendix B. Although the training was designed to support reflection regarding student use and responses as well as curriculum design, I collected data in the form of 1) field notes and observations, 2)Thinking Maps feedback evaluations, and 3) post-session surveys, to record teacher reflection regarding teacher thinking and content knowledge.

During our trainings, we would share Thinking Maps examples from different buildings, clarify map understandings, deepen the development of thinking across content areas and design applications for future use. I eagerly anticipated the trainings because the educators stories shared such amazement, pride, satisfaction and success. The excitement soared and the energy electrified the room as everyone relayed their accomplishments. Listening to their achievements empowered us all. During these sessions, I recorded field

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notes and observations and collected artifacts. Following the training, I coded the data according to the themes that emerged and later designed a survey to obtain more specific information about Thinking Maps uses, outcomes and benefits.

I discovered many similar themes of responses between the two groups and a similar shift in the nature of their responses over time. The comments moved from focusing on the practical matters of map implementation, knowledge and applications in the earlier sessions, to student thinking and performance toward the end of the training workshops. As I compared my field notes from sharing examples at the beginning of the training to the end of the training, I noticed a shift from the initial focus on the maps themselves to the later emphasis on student thinking. Although I wanted to discover information about teacher reflection and cognition regarding content area, I discovered a wealth of reflection about instruction and insights into their students' thinking and learning. In the following pages, I will explain the changes over time in teachers' responses and use the theories and frameworks of reflection as a lens to describe and explore teachers' responses. Figure 4.1 serves as a guide to the changes I ascertained over time.

Training Begins

On a cool clear morning in August 2001, David Hyerle and I drove to a typical brick school building for our first day of training with fifteen teachers from six different schools within the Syracuse City School District. Participants wiped the summer-slumbering-in sleepy seeds from their eyes as they trudged up the steps with training manuals in hand toward the empty media center. We pushed the mops, boards and dust rags from summer maintenance work aside and pulled up our sleeves to begin the work of thinking.

These educators; some teachers, administrators, and instructional specialists had joined a Thinking Maps (TM) Training of Trainers Institute to improve their understanding of Thinking Maps and to support and encourage map use in their schools. Prior to attending this advanced series of workshops, they had participated in an initial school-wide Thinking Maps training in which they learned the purpose of each map and how to introduce the maps to their students. Therefore, when we met them six months later, they had practiced using the maps, had some degree of experience with various maps, and brought examples of student work and experiences to discuss.

Day 1	Day 2	Day 3 and 4	Day 5 and 6	? Survey

Day 1
questions about:
• map knowledge
• content applications

Day 2
• purpose in instruction
• purpose of maps
• qualities of maps
• enthusiasm
• workshop design

Day 3 and 4
• map applications
• qualities of map
• classroom climate
• assessment
• school wide applications

Day 5 and 6
• responses to tools
• behavior
• comfort

→ • student directed instruction
• automaticity

→ • organization
• communication
• instruction

Survey

student data
writing:
• focus
• vocabulary
• fluency

→ • cognition
• motivation
• organization

teacher data
Planning:
organization
purpose
clarity

→ Instruction:
motivation
structure

→ Reflective Planning

→ student-teacher interactions

Figure 4.1 Themes of teacher-reported data from the 6 day TOT sesssions and post-session surveys.

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Day 1 and 2: Outfitting the Campers

To determine a course for our presentation and assess our participants prior knowledge, we asked the future trainers to construct a Circle Map placing "Thinking Maps" at the center and using the outside circle to write anything that came to mind. Participants completed the Frame by writing what shaped or influenced their knowledge and reflections of Thinking Maps. The Frame can be used to answer questions such as: "How do you know what you know about the topic? What information/knowledge/belief system influences or shapes your ideas about the topic?" (Appendix C) In this brainstorming exercise, we used the tools themselves to reflect about the tools.

The Circle Map, Figure 4.2 displays an individual's thinking about Thinking Maps. Figure 4.3 represents the collection of responses from the whole group as they took turns reporting their most significant thoughts about the Thinking Maps.

Figure 4.2 A participant's individual Circle map used for reflection about the tools.
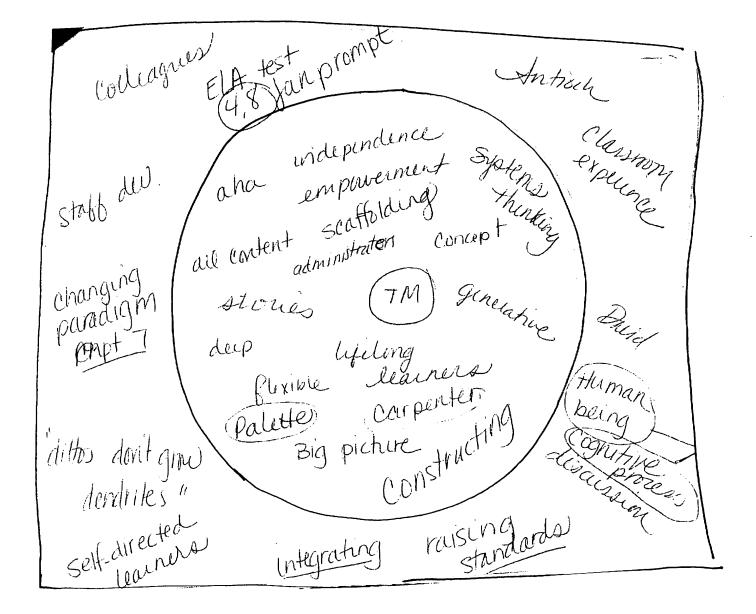
Figure 4.3 A Circle Map displaying whole group reflective responses regarding Thinking Maps.

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Some feedback focused on the nature of the tools, what they are; while other comments named what the maps embrace, academically and affectively. Thoughts such as: flexible, all content, concrete, creative and visual described the attributes of the tools themselves; their adaptability and generativity. Empowerment, pride, fun, shared ideas and scaffolding speak to what they foster in student behavior, interaction and achievement. Putting Thinking Maps as the center of this metacognitive tool and referencing the frame enabled educators to remove themselves from the everyday uses of the maps and offer a larger view of what TM represent . One teacher compared the TM to an artist's palette; a variety of colors to combine and choose from with which to create a whole picture. Another participant likened the maps to a carpenter's belt; a physical set of tools for constructing knowledge. During this discussion of constructing knowledge and building foundations, a specialist introduced the frame of reference. Capturing the phrase, "constructing knowledge", she realized that the Thinking Maps were influenced from a constructivist point of view. At which point, another teacher addressed Thinking Maps being a vehicle in and for the paradigm change in education. She cited numerous examples to support how views of knowledge, instruction and assessment have been influenced by the "thinking movement" including Multiple Intelligences, Balanced Literacy, and Think Aloud programs. Programs and models of teaching attempt to match new theories about the way we learn with practical tools in the classroom. Her comments support an Einstein quote from David Hyerle's book, A Field Guide to Using Visual Tools:

> " 'The significant problems we face today cannot be solved at the same level of thinking we were at when we created them ' " (Hyerle, 2000).

Our changing context doesn't mean we should abandon the successful practices that are effective. As Einstein so wisely states:

> " ' New frameworks are like climbing mountains-the larger view encompasses, rather than rejects, the earlier more restricted view' " (Hyerle, 2000).

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When I listen and look at the word choice and conversations during these exchanges, I hear and see responses which correspond to the technical and contextual levels of Taggart's Reflective Pyramid and Levels 1 and 2 of VanMannen's Levels of Reflectivity. Overall, the feedback was less about how they actually used the tool and more about the quality of the tools. The teachers seemed to be excited by the creativity, flexibility and the "fun" of the maps. When asked why their students thought the maps were fun and easy to use, the teachers thought it was due to their novelty or perhaps the maps link to drawing and art. Therefore their reasoning wasn't connected to a research or theory base. Using the Taxonomy of Teacher Thought, explanations of this type would hover between the Descriptive state and the Classification stage. Teachers are able to describe a recent successful example of instruction but without using pedagogical concepts. However, the artist's palette and carpenter's tool belt analogies demonstrate the participants understanding of the tool in a larger context than just motivating their students or meeting their goals in a lesson. Introducing evidence relating to the "thinking movement" meets the criteria from what is effective in terms of the student, based on what we know in the context of learning. When teachers explain the maps and their use in terms of theoretical knowledge which extends into the whole field of education, teachers move from referencing their personal past experiences to better choices related to the context.

Since the teachers were just learning the maps themselves and were basically in an introductory period of usage, I was not surprised by their responses. I think it would be unrealistic to expect a high level of reflectivity about the tools with a limited level and opportunity for use and discussion of Thinking Maps. Limited feedback from students and peers, effected the ability to have something about which to reflect. In other words, it seemed almost inappropriate to measure their ability to contextualize given their context! If I considered my own experiences in learning anything new, I recalled being focused on how to make it work: How can you see the forest, when you are busy studying how to draw the bark on the tree?

Because they were developing a knowledge and comfort base, the first two days of training addressed their questions about map knowledge and map applications and integrations. Although they understood why their district had implemented this initiative due

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to changing ways of teaching, they heavily emphasized the importance to connect the maps to the New York State Assessment program, particularly the dreaded ELA, an on-demand writing test administered to fourth and eighth graders in January. They did not want theory supporting the effectiveness of Thinking Maps, they wanted technical and practical information.

Map Knowledge Inquiries

•How do I use a Brace, Bridge and Multi-Flow?

•Which map do I use when?

•Did I make this right?

•What is the difference between a Venn-Diagram and a Double-Bubble?

•What is the difference between the Brace map and the Tree Map? Isn't the Brace just a Tree on its side?

Map Application Concerns

• How does this work with the standards?

• How does this work with our programs: Soar to Success, Success for All?

• How can this help with assessment: ELA and DBQ?

At the close of our first two days together in which we clarified the questions above, the educators completed a Tree Map (Appendix D) to reflect on their learning thus far and define areas of concern and confusion to be addressed at the next training. I grouped individual feedback as shown in Figure 4.4. I tallied numerous positive and enthusiastic comments into categories representing the presentation itself, map knowledge, applications and transfer. As you can see, I dedicated one column to discoveries and Aha moments although those ideas could also be placed in the previously mentioned categories. I notice not only, a change in knowledge, but a change in punctuation. By the end of the second day, exclamation points replaced question marks.

TOT data:
After Day 2

Map knowledge	Site support	Nature of maps discoveries	presentation	Future inquiries	Application or transfer	Affective
more knowledgable (all)	understand my role	amazing how across curriculum and grade level these are(2)	small groups (4)	how to combine more maps	does align with programs	enthusiasm
need more experience	supporting school efforts	how easily we established the common language	discussion/ collaboration(4)	software	natural transfer from Think Alouds	boosted confidence
learned more maps have specific purpose (4)	opportunity to plan for building support	brain compatible and does align with programs	partner/team	NYS testing	transfer maps to all areas	contagious
deeper understanding 3		very flexible and dynamic	conversations between collegues (all)			comfort with maps
connection with subject matter 8		can be combined and expanded	actually modeling the maps (2)			
knowing what specifics each map should have 3		how easily ideas for use of maps started to flow	hands on experience (6)			
everymap has its discipline or tool		enthusiasm! We could become a cult!!	showing 3 student work			
all maps can fit into any lesson or content		difference between graphic organizers and TM	relaxed atmosphere			
internalized brace map 1			humor 3			
			cartoons 3			

Figure 4.4 Tree Map indicating themes of responses from teachers following Day 1 and 2.

The comments concerning Map Knowledge matured from questions to comprehension. Comments like, " every map has its discipline or tool", [I] "learned more maps have a specific purpose", and "knowing what specifics each map should have" conveyed participants' understanding of the explicit and definite purpose embedded in the maps. I suspected these understandings could provide better direction for map application. This clarification could be the first step in making the vocabulary explicit. One participant articulated the connection between the metacognition modeled in the Think Aloud program and the Thinking Maps. "Thinking Maps are a natural transfer from Think Alouds." Perhaps, the participants' effusive appreciation for the opportunity to work collaboratively captures my attention the most; particularly in light of what Schon, Costa and Garmston all state regarding the possibilities for cognitive development within a reflective framework.

A Similar Trek: Increased Sample and Data Collection

I worked with many teachers and districts around the northeast providing Thinking Maps staff development and collected artifacts from two other school systems: Springbrook Elementary School in Westerly, RI and Green St., Oak Grove and Canal Street Elementary Schools in Brattleboro, VT. Although these teachers are not currently participating in an in-depth TOT model, their time lines for implementation mirrored the NY contingency. I felt it would be interesting to record their feedback over time as well to provide a wider and perhaps more meaningful range of responses.

In both training sites, I presented Thinking Maps to a faculty who already had a handful of members using the maps from an earlier capacity training. Therefore, other teachers had seen the maps being used in various grade levels and populations. Both schools choose to invite me to train them, so a certain amount of investment existed. At the conclusion of the Day 1 initial training, teachers completed the same Feedback Tree Map as did the TOT group to record their thoughts on the day. From the day's focus on thinking, they articulated their personal thinking experience from working with the maps. Their responses relating to metacognition impressed me. What a window into their thought process!

"I liked the way I was able to actually see my thinking process unfold as I worked on a map"

[An "Aha" for me was] "Having the opportunity to experience my own thinking change as a result of the experience"

"I think these will help not only my students, but me!"

"Helped me think about my own thinking"

"Where was this when I was in school?"

"Working with the maps and making mistakes helps you figure out the functions."

"I was surprised at how some maps just seemed to click or fit situations. It was a better way to organize my ideas."

I was curious to see how my next meeting with them in September 2001 will proceed, because they seemed to have focused on their own thinking rather than the students. Their questions were equally as fascinating and informative.

"How do I keep from liking one map better than other?" This participant realizes the value in multiple patterns of thinking and how her own thought process may bias her learning or her instruction.

"How do I use them and use them meaningfully?" hinted at this teacher's knowledge that the maps have a purpose and are different from the traditional teacher-directed graphic organizers she utilizes.

Before they left for the day, I opened the presentation to comments, reactions, etc. Looking out into the audience, even their posture indicated how truly thoughtful they were. One woman tipped her head slightly, staring at the poster set of maps on the wall with a inquisitively wrinkled brow and stated, "You have to be really sure of your purpose when you use these. "

As my spirit danced inside, I answered, "Yes, yes you do. You have to know the purpose and goals of your lesson for these to be successful."

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She nodded her head in agreement. Her wheels kept turning and so did mine. "She gets it!" I silently cheered. I wonder if she was the same person who wrote, "You need to review the curriculum to was that because the maps are so purposeful, teachers would actually target the thinking behind the lesson rather than just complete an activity. The curriculum drives the content, but the activities should drive the concept. Knowing what map to use is understanding the structure of the knowledge system at work. If teachers cannot indicate which map to use, that really means they don't understand the thinking tasks involved.

Day 3 and 4:
Locating the Key

The beautiful foliage of Fall drifted to the ground and Winter started it's white dusting of snow when we returned to Syracuse to resume our work. Once again, the excitement of the group was contagious and melted the snow off our boots. We began this session slightly differently. Instead of using their own frame of reference to define thinking maps, we wanted them to define Thinking Maps for an outsider. We posed the question, "if someone asked you what Thinking Maps are, what would you say? Create a definition of the Thinking Maps including what they are, how they work and why they work." As we facilitated their thinking to piece together a coherent definition, one teacher called Thinking Maps a "metacognitive machine". "It helps you turns the gears in your head," she explained. As a group, they constructed the following definition, "Thinking Maps are visual tools for thinking that provide a common visual language, that is consistent, flexible, easy, and fun to use that increases oral and written language across content in a non-threatening developmentally appropriate structure."

Sharing the Point

Since part of their role as trainers involves becoming an expert at their site and a representative within their district, we probed them further about the depth of the tools and

the justification for district-wide implementation. They discussed their student responses and applications since our last meeting. One fourth grade teacher talked about the increased curiosity and awareness that the whole class exhibited around the maps. She described a situation in which a boy came to her desk for help and saw the blue Thinking Maps manual on her desk. "That's the maps book, huh?" he said, eying it inquisitively. Later in the week, as the teacher was leading a lesson with the maps, she was having difficulty managing the information and told the students the maps were a new experience for her as well. She invited them to figure it out together. "Maybe you better look in the book," the same boy graciously offered. He didn't want her difficulty to impede their use of the map.

Other teachers also noticed the signs of ownership, motivation and evidence of self-assessment among their students. Students were starting to understand the purpose of the maps, "Oh, I know this, this is a flow map. I can plan with this." When working on a story, one student noticed his Flow map was long, indicating his story was getting out of hand. "This is too big, what parts do I really want?" he contemplated as he revised his writing. I felt these examples were important markers in the transition from an instructional tool to a student tool. Students had begun to decide when and how to use Thinking Maps effectively for their learning.

The teachers reported an increased level of understanding during their lessons. A fifth grade teacher discussed how the maps *seized* the teachable moment and *created* teachable moments as well. A fourth grade teacher in charge of a particularly challenging group of kids agreed, "I was teaching a lesson in social studies and I must have asked a question every conceivable way I could think. Nobody participated. So I put up a TM on the board and got where I wanted to go!" I think those examples capture the power of Thinking Maps as a common visual language. These experiences also make me question, "Why are the children so curious about and comfortable with the maps?" I think the maps seem "to click" because they embrace the organic process of thinking. As humans, we metacogitate and when we are able to access, influence and represent our thinking accurately, there is a comfort in demonstrating capability. Yes, knowledge is power!

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Directing the Course

The remainder of the two-day session with the TOTers emphasized designing curriculum units. We had shifted the focus from using TM in instruction to actually using the maps as a planning tool. As the woman in Westerly, RI indicated, you need to know the goal or purpose of your lesson, if you want to successfully integrate the maps. We proceeded purposefully to use the maps to help define the purpose of our lessons.

To start from a common base and to review the maps, we handed each participant a copy of a non-fiction article about volcanoes from a "Time For Kids" magazine and asked them to sketch the maps that they "saw". (Appendix I) This activity helps participants to understand what happens when reading with the "maps in mind". As teachers read the text and were aware of the thought processes involved, learners began to actively map the content. The mind pays attention to key words of sequencing, description, and cause and effect; the thinking skills which represent each map. The participants found the thought processes represented within the text structure and commented how this exercise was similar to what they ask of students during notetaking or answering comprehension questions. In their excitement, we wanted to point out that the goal is not to use all eight maps in a lesson, but figure out which ones would be appropriate depending on the task at hand. We asked the TOTers to partner and decide how they could turn this article into a week's lesson. What would be their goal? Which series of maps would assist in this goal?

After sharing these units and seeing the various products that could result from one simple article, we asked the teachers to use TM to plan their next unit of study. We referred them to a Flow Map in their manual (Appendix I) to assist them in specifying the steps or considerations in their instruction. The teachers worked for two hours and begged for more time. "I'm starting to see it now!" Examples of some completed unit designs are included in Appendix F.

One teacher narrowed her focus by identifying her final product, "Write an original Cinderalla" in the center of the Circle Map. (see Figure 4.5)

2 Compare & contrast versions

Copies of various versions of Cinderella

List common elements of all Versions

Write an original Cinderella

Cinderella Videos

Description of Cinderella (general)

Elements of a fairy tale

family relationships

Cinderella's family

Royal family

Rising Action flow map → for action in the story
use for conflict
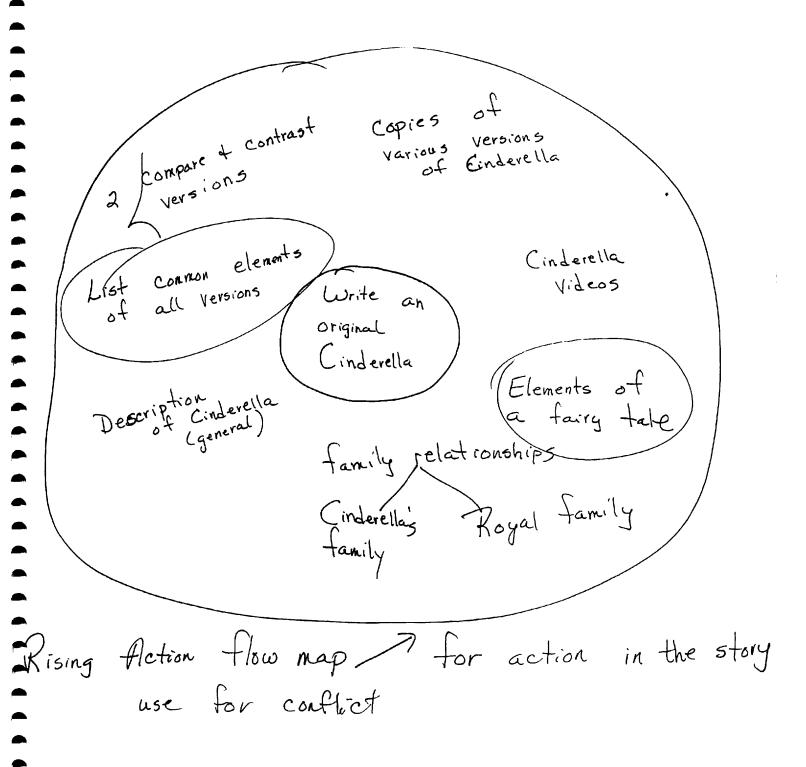
Figure 4.5 A TOTers curriculum brainstorm using a Circle Map.
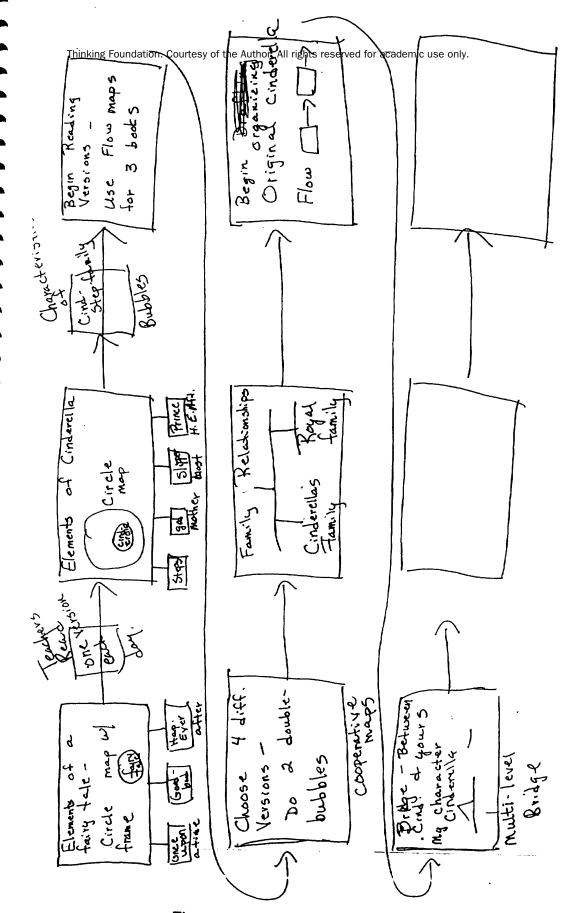
She taught this same unit last year and was very dissatisfied with her students' writing performance. At this session, she brainstormed all the materials and understandings involved in being able to achieve the final product. From her brainstorm, she selected the most important items that would enable her students to write quality Cinderella stories and matched those components with appropriate Thinking Maps, Figure 4.6, which would help them notice the patterns in various versions of Cinderella. She mapped out the beginning of her unit using a Flow Map, Figure 4.7. As she exited that day, she felt very confident in her ability and her students' abilities to find the essentials within a Cinderella story.

Multi - Level   Bridge   map

                    Original   Your Choice   Your Own

Setting   England as   as

Main
Character   Cinderella

Has the
quality of   Kindness

is in
Conflict w/   Step family

Resolution

Figure 4.6 A Bridge map comparing essential elements of the fairy tale, Cinderella, across many versions.

Begin Reading Versions – Use Flow maps for 3 books

Characteristics of Cind. Step family — Bubbles

Elements of Cinderella Circle map — Step, ga Mother, Slipper boot, Prince H.E.AA.

Teacher's Read "One version each day"

Elements of a fairy tale – Circle map w/ frame — Once upon a time, Good-bad, Happ. Ever after

Choose 4 diff. Versions – Do 2 double-bubbles — Cooperative maps

Begin organizing Original Cinderella Flow □ → □

Family Relationships Cinderella's Family, Royal Family

Bridge – Between Cindi. of your 5 Mg character Cinderella Multi-level Bridge

Figure 4.7 A Flow map showing a unit plan for Cinderella.

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Themes of Reflection: Classroom Climate and Student-Teacher Interaction

At the conclusion of Day 3 and 4, we asked the TOTers to reflect on their work by using the same Tree Map format from the Day 1 and 2 training. Comments related mainly to the curriculum application area as that was how we spent the majority of our time. The participants were pleased to have incorporated multiple maps together. Teachers designed the maps to be combined within a lesson in order to facilitate deeper thinking. Finding connections between TM and all content areas widened the range of future applications. Frequently, teachers immediately see applications in reading comprehension but don't realize the same type of thinking is required in math, science and history. The lesson plan designs gave them an opportunity to practice transferring their thinking. "I enjoyed playing with TM to find the purpose, format and function." As their teacher, I wondered if they supported their students' learning with the maps and other strategies with as much practice and support that we offered. While we were together, I hoped that they learned as much about thinking as they did about appreciating the time it takes to think. Hopefully, they returned to their classrooms respecting processing time.

In addition to responding to issues about map applications, educators' Tree maps contained items related to classroom climate and student-teacher interactions, similar to the experiences cited earlier from the fourth grade. "I am letting the kids just go with it. I give the assignment and they choose their own map." Student ownership and fluency with thinking is embedded in this comment. If I think about what that looks like in classroom instruction, I see a more student-directed learning environment rather than a teacher-lead classroom. Although the tools are designed to be taught to the students for their use, depending on the teacher's style of presentation or instruction, the students might not understand they can choose how to think about something, rather than have the teacher choose the map. If the choice stays in the teacher's hands, the decisions also remain in the teacher's mind. Therefore the teacher does the work, doesn't share her thinking process, and the students could be passive learners. Students try to make their thinking fit the way the teacher conceptualizes something. Thankfully, these educators attending the TOT seemed to foster students'

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gradual steps toward independence.

Integrating Thinking Maps into daily practice, collecting artifacts of success, and affirming their thoughts with others at the trainings convinced these educators of the value of the tools for their students, themselves, and their schools. As I analyzed the data from their Thinking Maps, I observed a lack of questions about how, when, and where to use maps and more concerns voicing how to build depth and enthusiasm within their schools. They wanted to share their expertise and accomplishments, guide and promote interdisciplinary applications in order to change some colleagues views about the maps.

"How do I get the school on board?"

"I'm afraid they will go by the wayside at my school."

"I need to conduct a needs assessment."

The participants broadened their context as a result of their practice with applications which formalized and solidified the link between content and thought process. This training session seemed to be a turning point for them. I titled Day 3 and 4, Thinking Maps: From Add on to Automaticity. As one participated debated, "They aren't something extra, they are something efficient." A teacher's uncontrolled enthusiasm is apparent in Figure 4.8. A great way to use the common visual language to express herself!

Figure 4.8 A participant used a Bubble Map to reflection on the importance of the tools

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Day 5 and 6:
Evaluating the Trip

We had no idea what map maniacs we had created! In March, we concluded our Training of Trainer Sessions. The experiences, examples and insights of Day 5 and 6 were powerful learning opportunities for us all. Just like the participants' students had taken ownership of their learning and thinking in their classrooms, our students directed the learning, made the connections, and offered solutions at our last class together. As we met through the year, the teachers stumbled to trainings balancing writing pieces, chart paper, shower curtains and bulletin boards containing Thinking Map work. The number of examples increased and the duration of the sharing increased as the training sessions progressed.

Wanting to extend their understanding of the effectiveness of the maps, we instructed the teachers to tell the story behind the map. "If we just look at the map alone, we see a finished product. We don't know about the child that created it and what the map construction experience was like." In relating the experience, we asked the participants to explain: "Why is this example significant to you? What can we learn from your story?"

Travelers' Logs: Themes of ownership, motivation, participation and automaticity

The significance and the support provided for the significance was astounding. The stories are best told from the teachers themselves. Hope, a reading specialist who works with many teachers in a K-6 building relates a map moment from a colleague. This teacher works in a classroom with a paraprofessional teaching six students with non-verbal language disabilities due to various emotional traumas. In the Syracuse system, this structure is called a 6:1:1 classroom. These students rarely initiate communication and are involved in an intensive educational program. The teacher had used Circle maps to teach letter-sound correspondence. During class, the teacher would select a letter for the center of the circle and the students would cut pictures from magazines that began with that letter. Each day she repeated this process with a different letter. A particular boy in the class watched his

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classmates from afar. He didn't participate in group work and became uncontrollable if forced to. He had been observing his classmates since September. At the start of the second week using the Circle Map in group, the boy joined the table and drew his own Circle Map on a piece of paper and began drawing pictures that matched the center letter. His teachers were floored.

The TOTers shared in the amazement. "What can you learn from that story? What is the story value? How does this relate to what we know about the maps?" David asked the group. The group explained the effect the maps can have at all levels. Many participants recalled that their children with special needs or who receive resource help do benefit the most significantly within their classrooms. Teachers shared similar stories with the needier population, but we revisited the question, "What do those experiences tell us? Why are they important?" Was he involved simply because he had figured out the routine? No it wasn't. They had the same routine before the maps, but just worked on the goals differently. The teachers thought the child successfully participated in the group because he had become comfortable with the visual tool. With the visual tool, he could tell what he knew. Establishing the common visual language allowed the boy an opportunity to take a risk and feel safe. His behavior reminded us that how we ask for the information we want is equally as important as the question itself. The representation system for the knowledge has to be accessible to the knower.

The discussion moved from speaking about specific populations to examples of how the maps encouraged more risk taking with other resistant learners. Faye, a third grade teacher, explained a situation with her most challenging writing student. She contended that he is a very bright student given his sense of humor and participation in class discussions. However, when it comes to writing tasks, forget it. He sharpens his pencil every five minutes and activates any stall tactics he can muster. If a lesson requires writing, he rarely completes the assignment. Tuesdays are his favorite days, because his psychologist removes him from class for an appointment during writing period.

One Tuesday, the whole class was working on a Flow map on the board when the psychologist peeked his head in the door to get the student. Usually, the boy bolted for the door at the slightest sight of this professional, but not today. He perched on the edge of

his chair watching them write the story. He held up his finger and said, "Just a minute, we are working on something here."

Our TOT group validated the story with nods of understanding and noted how often negative behavior is a defense mechanism for confusion or fear. Perhaps this student wanted to participate in writing, but could not organize his ideas or sequence his thoughts. He did not have a tool to prioritize his thoughts.

Just down the hall, within the same school, Jeanine describes the academic motivation these tools seem to engender. Students were asked to create a Double-Bubble map comparing and contrasting themselves with another classmate. Three boys wanted to work together on the task. "What happens when you have three things?" they asked.

"Oh, guess you can't do it."

"Yes, we can!" they exclaimed.

"Go ahead then," she challenged. These boys did not want to stop working. They asked if they could stay after school to figure out the *triple-bubble map*. Jeanine's jaw dropped at their request. These students never did more than they were asked although they are certainly capable. This story begged the question, "Why are the maps motivating?" Because they are flexible, visual representations of our mental processes. They are brain compatible. The foundation on which they were developed: research on visual tools and the brain, are the reasons why they are effective. The simplicity of their design and their ease of mastery and manipulation contribute to intrinsic motivation. After hearing these anecdotes, the group concluded that the need for a tool to adequately match process and product united Hope's, Faye's, and Jeanine's stories.

In the middle of the success stories about students with behavioral issues and attention problems, one woman exclaimed, "Thinking Maps can replace Ritalin!" After the initial laughter died down and folks suggested that Dr. David Hyerle should write out prescriptions for Thinking Maps, we explored the plausibility of this exclamation. Would that initiative work? One teacher thought Thinking Maps would be a viable alternative therapy.

"Thinking Maps works for these kids because it is consistent when nothing else in their life is. They go home to a place without rules, responsibility and consequences. Their home life is chaotic. No routine, no schedule. Sometimes Mom is home, sometimes not. No one is looking out for them. They can do whatever they want, whenever they want. They might sit in front of the TV or walk the streets.They don't have a bedtime.

Although they might like the freedom, they don't have a sense of order or control. They come to school wanting that power and sense of control. The consistency of Thinking Maps can give them a sense of ownership. I can do this. I know how to do this. They feel like they are good at something."

Consistency can lead to motivation, empowerment, and ownership. Ownership might take the form of student -directed learning and student-directed teaching as in the following example. A kindergarten teacher excitedly displayed her class' Double-Bubble Map for comparing and contrasting two books about George Washington. This mapping experience was significant for her because she learned *about* her students and *from* her students. In preparation for the lesson, Lynne had drawn the Double-Bubble Map with four bubbles for the similarities and three bubbles on the outside for the differences. Students gave her information from the two books that they had read earlier in the week. Within moments, they had exhausted her template. "You need more bubbles!" they chorused. She couldn't believe what they remembered and what they noticed about the illustrations as well as facts from the story. She couldn't believe their powers of observation and attention to detail. This experience was important for her because she learned how attentive her students were and planned to use that information to inform her instruction and hold them accountable in other situations. The map was an unexpected assessment tool. She planned to use it as a benchmark for their ability to think. Moreover, the experience taught Lynne not to assume a certain level of knowledge. "My thinking could have limited their thinking!" Lynne connected her own metacognition and patterns of thinking to that of her students. This experience showed her how to be more open minded to where the map may lead. "Who says kindergarten can't do this?!" she scoffed.

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In another elementary classroom across town, students' fluency with the tools surprised their teachers. When working on an animal report, a student struggled with a format for her presentation. "I don't think a tree map will fit." In the middle of a math class brainstorming what the students knew about time, a student anticipated, "I feel a Circle Map coming on!" Comments like this offer teachers an outward expression of the cognitive process. Defining explicit terminology for thinking, students and teachers can communicate and self-assess.

Automaticity is best proven perhaps when students work without teacher assistance. After six months using the Thinking Maps with her students, Linda, a third grade teacher, administered a practice language arts test to ready her students for an upcoming exam. She periodically wandered about the room, curious to see if the students would use some type of map to help them write. They had used the Circle, Tree, Flow map sequence in their previous assignments. By the end of the testing time, she walked back to her desk disappointed by the small number of students who used the maps. Feeling somewhat daunted, she debriefed their predicted performance and strategies. "How was it? How do you feel you did? What did you use to help you?"

"Well, I used a map."

"You did? I didn't see it on your paper," Linda replied, as she thought to herself, "brown noser."

"I don't use them out there (pointing to the paper), I use them in here."

Phew, Linda's efforts weren't in vain.

Most examples cited student applications of the maps, but students are not the only ones in need of help at school. Patti, a second grade teacher at a low-performing elementary school, found herself in an anxiety-producing situation when an outside group of consultants selected her for observation. The school had purchased a very specific program, "Wings" aimed to improve mathematical computation skills. In order to guarantee results, the company structured quality checks at participating sites. Patti was slated to teach a lesson on subtraction and feared their presence because the children were having a difficult time with subtracting two-digit whole numbers. Patti wracked her brain to figure out a

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method to help them. "I was thinking what the kids had problems with. In the middle of the problem, they seemed to forget the next step." She decided to use a Flow map to show the sequence of steps in subtraction. The next day, the students accurately completed the problems using the Flow maps at their desks. She felt proud: proud that she could help them and proud that they had a tool to be successful. The observer thought the lesson was sensational and asked if she could keep a copy of the Flow map. "The Thinking Map helped me get my ideas in order and really think about subtraction." Patti used the maps to aid her own thinking as well as the students.

From the Observation Tower: Results from the last session

Like Patti, many educators reported "improved organization" as a major result of implementing Thinking Maps. We used the Multi-Flow map with "Implementing Thinking Maps" as the center event to collect data at the final TOT session. Figure 4.9 shows one school's reflections. The previous Tree Map gathered information regarding what the participants learned. This time, we focused on the results or effects of Thinking Maps implementation. What had happened in the schools since the initial training half a year ago?

TOTers reported effects or improvements in student writing, school communication, and map applications. Half the responses centered on writing, a major area of concern motivated by state testing. Participants noticed a change in students focus, vocabulary, and ability to categorize information.Specifically, they stated that students were able to stay on topic, write more quickly, take less time, write more and take better notes. When asked why students could write more quickly, a teacher thought the maps gave students a process and a starting point. The participants could not articulate why students were able to write more, meaning generating longer pieces of writing. Therefore, teachers could state that their students were successful with writing but not relate it in pedagogical terms. These justifications gave me some insight into the teachers' levels of thinking. At some points of the training, they answered with more educationally grounded support or contextual information. However, the questions regarding writing were difficult to answer. Perhaps, the teachers were so relieved at the writing progress due to the pressures of the testing

program, they didn't spend time thinking about what else the students' facility of volume could tell them.

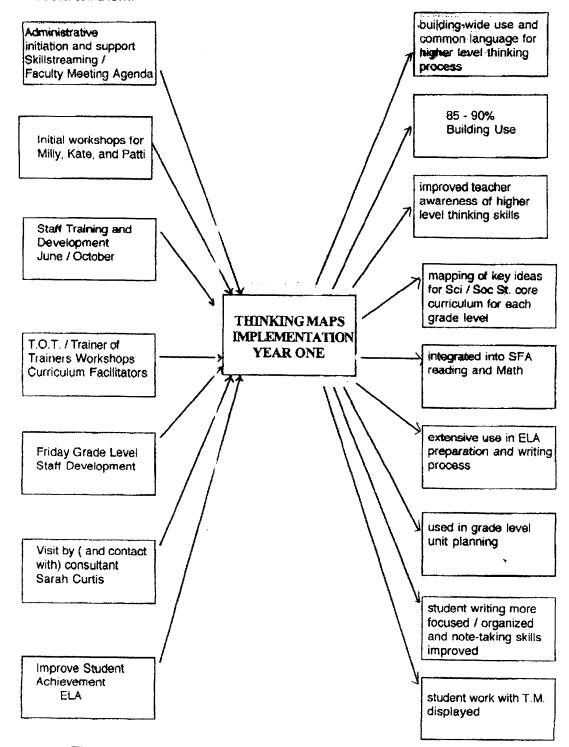| Inputs		Outputs
Administrative initiation and support Skillstreaming / Faculty Meeting Agenda		building-wide use and common language for higher level thinking process
Initial workshops for Milly, Kate, and Patti		85 - 90% Building Use
Staff Training and Development June / October		improved teacher awareness of higher level thinking skills
	THINKING MAPS IMPLEMENTATION YEAR ONE	mapping of key ideas for Sci / Soc St. core curriculum for each grade level
T.O.T. / Trainer of Trainers Workshops Curriculum Facilitators		integrated into SFA reading and Math
Friday Grade Level Staff Development		extensive use in ELA preparation and writing process
Visit by (and contact with) consultant Sarah Curtis		used in grade level unit planning
		student writing more focused / organized and note-taking skills improved
Improve Student Achievement ELA		student work with T.M. displayed

Figure 4.9 One school's Multi-Flow map indicating the results of Thinking Maps' Implementation.

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In the area of communication and cognition, teachers reported that the Thinking Maps provided a common language among grade level teams, a framework for planning, a goal for planning and a focus on thinking skills. A teacher shared her lesson plan check. "When I think back on the day, I look in my lesson plan book and think of the maps we did." If I used Thinking Maps, I know exactly how we thought. The more maps I use, the more we think." In this master's project, I wanted to see how Thinking Maps influenced teacher reflection and cognition. I don't know if teacher's used the maps to reflect on their own subject matter, but I can surmise that implementing the maps and being part of the focus groups gave them a reason to reflect about their instruction.

A Parallel Journey: Reflections from another population

Realizing fifteen was a small population, I wanted to collect data from other professionals involved in a similar pattern of use with Thinking Maps. I used two elementary schools in Brattleboro, VT, Green St. and Oak Grove/Canal St., that had used the maps for six months and eight months, respectively. Green St. completed the same Multi-Flow activity as the TOT group to construct a map of their results at the end of their first year of implementation. As a whole faculty, we had eight contact hours together. The Flow Map below, Figure 4.10 outlines the basic training model they and Oak Grove/Canal St. experienced. Figure 4.11 shows Green Street's whole group responses before analysis and Figure 4.12 illustrates my synthesis of their ideas.
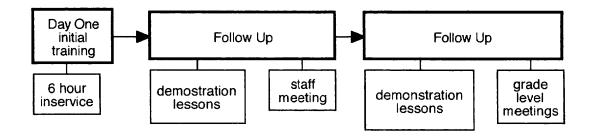
Figure 4. 10 Basic Flow map of Thinking Maps training at Brattleboro, VT sites.
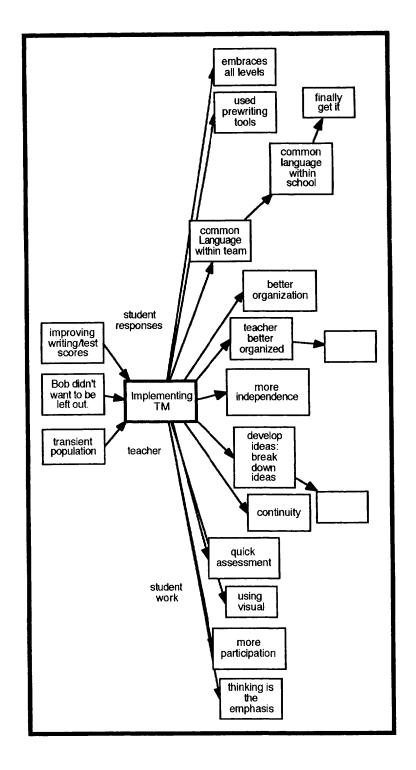
Figure 4.11 Green St School reflections after using Thinking Maps for four months.

Green St. data

Writing
- starting point
- used prewriting
- transforming notes
- writing more on target and appropriate
- less hesitant to begin

Thought/cognition
- develop thoughts
- break down steps (3)
- thinking is the emphasis
- students using the language
- develop own ideas
- kids better at sequencing/retelling
- more fluent
- deeper thinking
- expanded thinking
- well thought out
- prethinking before answering/acting

Organization
- students more organized
- plan for things
- teacher better organized
- give structure
- more organized presentations

Interaction
- more class participation
- sharing work outloud
- Look at all my thinking!
- more (3) independent
- okay to make mistakes
- selecting map makes you think
- not just plop ideas on
- listen to kids
- asking more questions
- enthusiasm
- kids reference visuals

Communication
- common team language
- continuity between classrooms/teachers
- uniformity
- less repeating directions
- kids look for map
- school wide support

Assessment
- quick
- visual
- more productive

Nature of TM
- embraces all levels
- on task
- want to fill space
- useful
- resourceful
- visual benefits all learning styles

Planning
- know purpose
- clearer lessons
- more extensions on existing lessons
- thoughtful
- I'm more creative
- use visuals more

synthesis from multi-flow

Figure 4.12 My analysis of Green St.School responses regarding changes since implementation.

The Green St. faculty had more responses regarding metacognition, planning and classroom interactions. From the students perspective, the Green St. faculty replied more frequently about thinking, but shared ideas about writing focus with the Syracuse group. It is interesting to note how often the word "thinking" was used in their responses. The difference in responses between Green St. and Syracuse probably corresponds with the testing climate within New York state.

We also had an interesting conversation about organization. I think teachers need to identify what organization is before they can expect it or teach it effectively. How can you tell your students are more organized? What does "more organized" look like and sound like? I challenged them to describe behaviors that would be evidence of organization. What does it mean to be organized? With all their responses regarding thinking, I wanted to see how thinking skills complemented their thoughts on organization. What can we learn about our students if they are organized? How does that help us instruct? The teachers cited examples from student presentations and conversations that demonstrated that the students had a clear purpose and their ideas flowed.

A teacher offered her opinion, "I don't know what affect the maps have had on my students, but I'm a lot more organized and focused." At an earlier session, this teacher had once again stated how the maps aided focus. "I wish I had these earlier. These are skills people need to use and develop everyday. Think about if the Department of Transportation guys had these. I bet they would be better able to think of consequences to some of these winter storms and plan a system for action. Wow, you'd be a great thinker, if this is the way you thought."

Oak Grove and Canal Street schools, also in Brattleboro, completed a different Thinking Map for data collection after their first year of implementation. The lead consultant at that site, David Hyerle, distributed an open ended Tree Map with the major categories and subcategories identified. The faculty used this map to facilitate their assessment of the maps. Dr. Hyerle synthesized their results in Figure 4.13.

Oakgrove and Canal Street Schools Thinking Maps data

Teaching

- Curriculum Design
  - helps organize teaching and planning
  - great tool for curriculum design
  - helps focus on key skills and concepts
  - supports social skills curriculum
  - all maps can be used for any theme
  - enables objective conversations on curriculum development

- Interaction
  - helps start with what kids know
  - use of multiple maps together
  - helps kids stay on task: visual reference points
  - helps teachers focus
  - evaluate what's working

- Unique
  - consistent tools across subjects and grade levels
  - maps for making small steps
  - "helps me to recognize my assumptions"
  - early grades: use of "forms" helps students
  - Bubble Map: good way to teach use of adjectives

Learning

- Content
  - helps organization of content knowledge
  - triple Bubble Maps for comparing three things
  - helps Math problem-solving
  - builds vocabulary; encourages new vocab.
  - supports drawing conclusions
  - tools for pre-post field trip: gathering knowledge

- Processes
  - helps organizing thinking processes
  - facilitates connecting of ideas-scaffolding
  - construction of knowledge
  - maps work over time
  - brainstorming
  - see multiple perspectives
  - supports multiple intelligences/learning styles
  - depth of processing
  - points of reference

- Unique
  - build maps as study progresses
  - validation of ideas
  - shows: what do ideas look like?
  - supports learning social skills
  - kids develop language of thinking
  - supports visual learners
  - visualizing
  - supports cooperative learning
  - objective conversations with learners

Assessment

- For Teachers
  - documentation
  - assessing reading strategies
  - indicates content knowledge
  - easy reference to standards
  - useful for pre-post testing
  - maps as products showing content learning
  - reveals conceptual understanding

- For Students
  - oral presentations
  - patterning thinking
  - helps retrace steps
  - helps create a record of where kids are in learning process

- Student Self-assessment
  - students can self-assess
  - portfolio items
  - electronic portfolio with software
  - retrace steps
  - see different perspectives

Figure 4.13 Assessment of Thinking Maps after one school year of implementation.

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Looking across the categorizes, I notice some of the same themes of organization, focus, vocabulary development and assessment. I am particularly interested in three responses that I consider to be reflective:
"helps me to recognize my assumptions"; "enables objective conversations on curriculum development"; and "objective conversations with learners".

The first quote demonstrates this persons ability to consider their point of view or frame of reference and how that may impact their interactions. The word assumptions calls to mind the definitions of reflection from Schon and Cruickshank. Recognizing assumptions might be the first step in changing behavior.

I think the ability to be objective from the last two quotes refers to the behavioral and psychological factors of map use. Having a physical map as a reference point allows the people in the conversation to depersonalize the emotional component of a situation. This teacher referenced the work of philosopher Martin Buber to explain the triangular relationship of teacher, student, and materials used in the learning process in the open classroom. (Silbermann, 1969) Silbermann quotes the work of Dr. David Hawkins (1969):

> "the three points correspond to Martin Buber's 'I,' 'Thou', and 'It'; as the child (I) becomes involved with the concrete materials (it), the teacher shares his involvement, so that it becomes 'we' confronting 'it'... concrete materials makes it easier for teacher and child to form the triangular relaltionship...involvement with materials helps teacher and child come alive for each other, and makes it possible for them to communicate on a new level and with a new dignity (p. 364).

The conversation is not about you or I, the conversation focuses on the it, the map. Functioning in this way, Figure 4.14, the maps create an objective means of exchange.
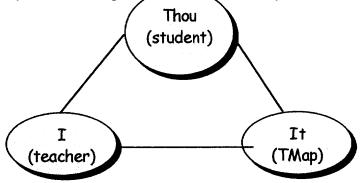
Figure 4.14 Martin Buber's triangular relationship of student, teacher and it. Thinking Maps represent the it.

Post Session:

Ascending the Final Peak

As students and teachers applied the maps across more situations and with more frequency, Thinking Maps became a successful tool for behavioral improvements and scholastic achievement. Within teachers' testimonials, I heard as much about the maps as I heard about student-teacher relationships. By examining student constructed Thinking Maps which made the metacognitive explicit, teachers discovered student interests and connections. Teachers used the visual connections of knowledge to construct emotional links with their students.

The ending of the Training of Trainers initiated a new beginning for the participants involved. They had the expertise and the enthusiasm to blaze new trails, to experience new peaks and valleys, and to lead meaningful excursions within their own landscape. I witnessed how our focus group meetings would excite, challenge and energize their Thinking Map use and hoped that their efforts continued to be affirmed and extended. Moreover, I wondered, how would the TOTers synthesize their learning at the TOT and their classroom practice? What would happen when our physical support was removed? In what ways would they continue to grow? What understandings, thoughts, beliefs, and patterns of thinking had been formed from our work together?

With these questions in mind, I designed and mailed a post session survey to the participants in late April. I designed a survey of twenty questions, Appendix G, targeting

educational history, basic issues of use, applications, effect on student performance and teacher instruction, as well as questions about the Thinking Maps format of professional development.

Survey Results

For each set of surveys, Syracuse and District 27, I analyzed the responses and separated the data into two populations: student impact and teacher impact. I organized the data based on the themes that emerged from the teachers' responses. Both groups indicated that they had witnessed an improvement in student cognition, organization, motivation and behavior since the implementation of Thinking Maps. Many of these themes coincided with data from Day 5 and 6 of the last TOT session. Writing continued to be an area of improvement in the Syracuse population. As I examined the data, the agreement among the responses and even the frequency of word choice struck me. Figure 4.15 and figure 4.16 present the themes and responses from the survey data.

Student Purpose and Performance

In both sets of data, many phrases indicated clarity and purpose within the area of student cognition. Teachers from Syracuse report:

"students process their thinking, add to ideas as they see their thinking"

" they can explain their thinking"

"There is more follow through. They complete the entire thinking process."

"see the whole process"

"They are able to 'vision' their thinking from beginning to end."

"can prepare for endpoints"

"I have found students to be much more capable of 'showing what they know'

"The influence has been extremely positive. The students understood the maps uses almost immediately. Their comfort level with the maps allows their thinking to be a top priority. The incidence of kids staring into space saying, "I'm thinking!" has almost disappeared.

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Many of these same thoughts about student cognition resonate with the teachers in D27. They see the Thinking Maps influence on comprehension and follow through.

"Aid to comprehension. Gives them the physical and visual tool needed to complete understanding."

"Students have a better understanding of an assignment and material within an assignment."

"They have been extremely helpful because with the use of the maps, the children have a better understanding and they don't stress over assignments. This leads to deeper thinking and a better product."

These responses demonstrate the success that comes from clarity of expression and direction. The ownership of the common visual language of Thinking Maps helps students understand their process leading to product. Like Novak and Gowan explained, " concept maps can provide a visual road map" showing the pathways we take to connect meaning.

SYR survey data: Student Impact

Organize
- thinking
- writing
- steps to a problem
- variety allows organization
- info for research
- notetaking 4
- see whole process
- prepare for endpoints

Writing
- process
  - stays on topic
  - more focused
  - provide direction
  - brainstorming
  - express thought process
  - write words or phrases
  - better use of descriptors, adjectives
  - peer conferencing/assessment
  - common language so peer editing
  - carrying out writing
- product
  - completing a task
  - meaningful sentences
  - increased volume
  - more organized
  - less rewrites
- motivation
  - not as overwhelming:
  - more manageable
  - more ideas gives starting pt. 2
  - Not a chore

Motivation/ownership
- developing new tools
- kids construct
- enthusiasm
- love to do them and make models of excellence
- develop new tools
- develop new uses
- they feel comfortable not confined to # of responses
- generate ideas 2

Cognition
- process thinking, add to ideas, see thinking
- can explain thinking
- student's understood immediately
- comfort allows thinking to be priority
- solidifies knowledge
- "see" their thought process 3
- better sequencing and summarizing
- task take less time
- more fluent with thoughts
- more successful with knowledge
- follow through: complete entire thinking process 2

Work habits/behavior
- independence
- add to maps as progress
- almost never a discipline problem when class as a while is involved in a TMap activity
- if summarize with flow, everyone is engaged
- engaged
- focus on the task at hand

Math
- finds more solutions
- steps in order
- flow maps with hands on math program:synthesize activities
- multi step 2

Nature of Tools
- easy to read
- understand
- visual
- common language

How/When used
- elect individually
- groups
- book club
- review
- assessment what know 2
- used consistently to get to student ownership

Discussion/interaction
- excellent prove it
- statements of predictions
- more participation
- everyone has something to add
- get ideas from each other: collaborative, cooperative

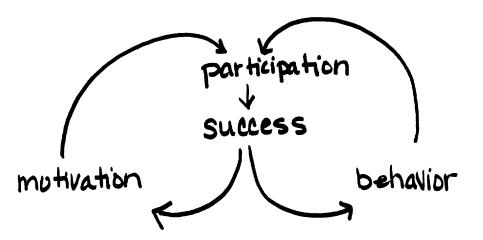**Figure 4.15** Themes of survey responses regarding Thinking Maps' influence on student learning and performance in Syracuse, NY.

D27 survey data: Student Impact

student cognition
- figuring out what skills your aiming at
- students understand their thought process
- develop thinking, inquiry and insight into a subject
- skills are clear
- see relationships
- aid to comprehension: gives them the physical and visual tool needed to complete understanding
- When students think, they understand something!
- better understanding of assignment and material within an assignment
- deeper thinking and better products
- students understand why and how to use the tools

student motivation/work habits
- tool for expressing their thoughts
- students do not feel threatened responding to questions using thinking maps
- learn a method to apply knowledge that is expressed in a clear organized and concise way
- kids are comfortable because they can be successful
- love colorful, playfulness and style of Thinking Maps
- more willing to restate and recall information
- very motivating: hands on, manipulative
- help get to final product like to create

student ownership
- students are constructing thinking maps on tests
- they have something to refer to 2
- provides practice of skill so they can learn how to think
- they see how maps simplify the process for them

interactions/engagement
- children listen when a thinking map is used
- use in small group
- after, modify the tool
- each child has a place to contribute
- greater participation
- improvement in language used in discussion
- students can recall, organize and engage in conversation

writing/learning
- starting point
- great visual
- writing more fluent pieces
- more elaboration
- tool for passing exams
- recalling details
- work is easy to present
- Improvement in retelling and summarizing
- understand how to use words in a meaningful way

organization
- helps (3) organization
- learn a method to apply knowledge that is expressed in a clear organized and concise way
- place to use brainstorm information
- organize prewriting thoughts and responses
- work flows
- students can recall, organize and engage in conversation
- organizes steps

behavior
- use cause and effect
- develops confidence thus less behavior problems
- remain on task 3
- give focus
- have fun, less fooling because freedom and flexibility in maps
- motivating
- less stress about assignments

work quality
- organized
- developed
- thorough
- rich detail
- write successful stories

Figure 4.16 Themes of survey responses regarding Thinking Maps' influence on student learning and performance in D27, Queens, NY.

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Motivation

If students had a tool to be successful, it is understandable that they would be motivated to use that tool. As one teacher stated, "the kids are comfortable because they can be successful." **Figure 4.17** shows a feedback loop of how success, behavior, motivation and participation are interconnected.

IThe following responses from both TOT groups demonstrated the increase in motivation from the use of Thinking Maps.

"Students use them in any situation that requires more than one thought. They love to do them and to create models of excellence."

"They feel comfortable not confined to a certain # of responses, can add to them as lessons progress, can use them on their own as well as in group."

"Writing is not a 'chore' anymore. They help to organize information which helps to organize their thinking."

" Kids like them because *they 'construct'* . They also try to think of new ways to use them."

"Students are more willing to restate and recall information using a TM"

"As far as I can see, the students benefited the most. They love the playfulness of the maps, the color, and the organizational style about them."

The following story from a fifth grade teacher illustrated why students were motivated to use Thinking Maps.

I woke up one morning about three weeks ago to the weatherman saying, "We now have had 190 inches of snow this winter. I scrapped my planned math lesson, divided my kids into trios and told them to, "Show me 190." They did a really nice job. Some used yarn, some rulers put end to end and one group walked to the bag of 1 inch tiles and laid them end to end.

When the first group came to me announcing their success, I checked out their work and started to tell them that the next task involved writing down what they'd accomplished. There was no argument but I could immediately see that there was **no** *enthusiasm for that idea. As they began, I brought them a piece of copy paper, put it down and suggested a flow map. I wish I could describe the facial expressions-they were priceless! The girls were done in minutes, hadn't left out a single thing and now had another reason for pride. All the other groups followed suit.*

Using the maps allowed the students to sustain their level of accomplishment and pride.

Behavior

Teachers responses described situations in which students had direction, understood assignments, tried to develop new tools, and felt comfortable and competent in their own work. Positive behavior seemed like a natural outcome of this level of comfort and success. Teachers reported:

"Almost never a discipline problem when class as a whole is involved in a

TM activity."

"If we summarize chapter by chapter and put in on a flow map, every child is engaged in the book."

" The maps develop confidence thus less behavior problems."

"They have fun with the maps. There is less fooling because of the freedom and flexibility of the maps."

What does an improvement in behavior tell us about learning? Negative behavior is a result of frustration with traditional models of instruction and production. Students behavior is directly related to how students see themselves as learners. Being able to participate and having a method to communicate what they know removes fear of failure. An improvement in behavior indicates that students had the ability, but not a means, to represent it.

Classroom Climate

An improvement in processing and attitude changes classroom climate. The following responses indicate changes in classroom discussions and interactions.

"Using Thinking Maps has led to more class participation."

"Children listen when a Thinking Map is used."

"They get ideas from each other. More collaborative and cooperative."

"Thinking Maps are excellent for their 'prove it' statements or predictions."

"Everyone has something to add."

"Each child has a place to contribute."

"Improvement in language used in discussion."

"Lesson direction is more determined by students."

"Students can recall, organize and engage in conversation."

A fourth grade teacher summarized her class' experience with Thinking Maps during a post-session telephone interview:

I think kids like Thinking Maps because they are comfortable with them. The maps feel safe: they can experiment with the design, play with it, color code it, expand the tools in anyway they want and feel okay.

"How has it influenced my teaching?" It meets my needs to have my kids learn.

If I reflect for a minute, I think it has widened our horizons because kids are empowered over their learning. They are more willing to take risks because with a map nothing is wrong. You can show your thinkng how you want. It doesn't have to be the same as the next persons.

They are failure proof. They feel comfortable about learning because the maps are familar. The maps are a real nuturer. That's what I would say, the maps nuture them to learn more. The kids just grab a hold of them and learning flows.

Oh, I know this is corny, but you know what the Thinking Maps are? They are a fluffy blanket that makes people comfortable. The Thinking maps are like your mom, patting you on the back.

I think of my toughest kid who thinks the maps are fun. He is a child who doesn't like to risk things, but these maps have empowered him and he feels like hot biscuits!!"

Teacher Purpose and Planning

Perhaps, student clarity and performance result from teachers' clarity in planning, instruction and presentation. If teachers plan and implement more purposeful instruction, students can have a better sense of direction themselves. When I compiled teacher data from the surveys, teachers reported that Thinking Maps were most helpful during planning, instruction, and assessment. (see Figures 4.16 and 4.17) Teachers frequently cited the connection between the teacher's ability to use the maps and students' rates of success with a task.

"They help me organize and lessons involving the use of Thinking Maps have a far greater chance of reaching their objective."

"Method decisions are much easier and students are more successful."

"I just wish more people would see the effectiveness of how a TM connects to our thinking. I've used TM as part of a staff development workshop agenda and have planned using TM. Ideas which may have been 'clouded' become clear for both student learners and adult learners."

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Figure 4.17 Themes of survey responses regarding Thinking Maps' influence on teachers' work in Syracuse, NY.

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D27 Teacher
impact

instruction	planning	assessment	interaction	behavior
have a tool	focus on thinking to teach	I can clearly see if children understand subject mattter.	motivation	confident
student centered learning	match with maps		own excitement	
used as a motivator	easier	check map generated against writing	reach all levels in all subject areas	
start with a map	quick focus		school is excited to learn about maps	
facilitates understanding	helpf to decide what I want to teach the outcome	see where they are		
use when I want them to discover and save information	clear focus	know when to move on	information that is easily transferrable.	
provide structure and motivation to beginnings of lessons	purposely to utilize multiple maps			
my lessons flow	ask myself, What map will help them see better?			
visual aide	Always thinking how can I help with the visual aspect of teaching something?			
	working hard trying to undestand			

Figure 4.18 Themes of survey responses regarding Thinking Maps' influence on teachers' work in D27, Queens, NY.

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Many teachers used the maps to plan faculty or grade level meetings in addition to planning units.

> "I can use the maps to categorize different topics to be discussed."

> "Thinking Maps have been most helpful to me in organizing my thinking. I especially like the tree and flow maps to plan meetings, prepare presentations and next steps."

> "I use thinking maps to help me understand new programs."

> "Most helpful in creating a clear and concise outline for our staff of the requirements and concepts to be covered in the NYS core curriculum."

The following teacher is both using and developing the tools:

> "I'm just beginning to feel that the maps are simply an everyday part of what I do. However, I must be using them in the classroom a great deal because several colleagues have commented on the fact that every time they walk by, I'm using Thinking Maps. I plan to do next years' long-term planning with a flow map and I'm working on a plan book format."

Several teacher use Thinking Maps and the language of thinking for "reflective planning". They ask themselves questions as to the goals and efficacy of their instruction.

> "Now I am much more aware of the thought process I am working on with each assignment. I know I am reaching higher levels of thinking."

> "Thinking Maps help to decide what I want to teach and the outcomes."

"As I plan, I think, what TM would work to get the point across?"

"I ask myself, "What map will help them see this more clearly?"

"I'm always thinking, "How can I help with the visual aspect of teaching something?"

I cannot assume that teachers conceptual content knowledge improved because their comments do not directly indicate that. But if teachers reported that they used maps in planning to articulate a focus and to sequence their instruction, I deduced that teachers understand their goals within a topic or unit study. Furthermore, if teachers tried matching thinking skills to lessons, they must have been aware of the purpose of an activity. Therefore, to be reflective about the choice of tool indicated reflection about content.

To what extent did Thinking Maps influence teacher reflection and conceptual content development? At the beginning of this study, I emphasized teacher reflection and conceptual development regarding subject matter. I had used TM in school to instruct my students and outside of school to understand the very concepts that I taught and experienced. The maps were my tools for thinking in my professional and personal lives. Did other professionals act similarly?

Although I didn't record any responses specifying increased understanding or reflection in *subject matter*, such as force and motion or long division, I did notice a growth in reflection and cognition in a *subject that matters*, students. Students are the subject matter with schools. Teachers can understand the mechanics and concepts of a pulley system, but without an understanding of their students, where are they?

When I examined my results as a whole, I heard the voices of the students and teachers within those classrooms. The stories painted a vivid picture of enthusuastic parties engaged in authentic discovery. I think simultaneous learning experiences, by students and teachers, created those dynamic classrooms. Being able to see their thinking gave students and teachers new insights into themselves and each other. Their success and enthusiasm will reinforce the use of the tools and will encourage future connections and communications.

will reinforce the use of the tools and will encourage future connections and communications. Thinking Maps provided a new window for examining knowledge systems.

The teachers' and students' stories reminded me of the reasons for my master's project: passion and possibility. Passion for learning. Passionate that teachers and students can be empowered. Passionate about the possibilities for other learning communities. Passionate that Thinking Maps, a graphic representation system for knowledge, could inspire shared conversations about inner dialogues creating a climate of intellectual discourse. To what extent, did Thinking Maps inspire passion about learning? To a great extent.

Conclusion: Back at the Base Lodge
Improvements and Implications

While conducting this project and after analyzing and compiling the data, I thought of many improvements and implications for my master's study. My results indicated possible areas of improvement in research design and Thinking Maps' implementation models, as well as potential implications for individual and organizational change in the educational setting.

Improvements

Redesigning the Research

In reviewing my methods, I discovered ways to refine the administration and analysis of the data collection process to structure a more precise and formalized research design. I envision many ways to strengthen the validity of the Thinking Maps method of data collection and the survey.

Thinking Maps

Thinking Maps provided an open-ended and comfortable means of data collection. However, in the future, I would alter the timing and types of maps used to collect data. First of all, I would use the same "Thinking Maps" Circle Map activity as a pre and post measure with the group. If I had administered the Circle Maps as a post-session measure, I could have had a better visual and content comparison over time. The information in the frame of reference would have informed me about their educational and personal context as well. The Multi-Flow activity, "The effects of implementing Thinking Maps" was a beneficial exercise but didn't lend itself to a parallel comparison with the initial Circle Map.

On the third and fourth days of training, I would have asked the participants to select a Thinking Map of their choice to show their insights, learnings and responses to TM. I could have gathered different reflection data had the participants chosen and constructed their own maps and connections rather than completing a starter map with predetermined headings.

Surveys

Given the field notes and observational data I collected, I expected the surveys to

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be equally as dynamic. I think mailing them versus completing them in person, as well as the timing of arrival, close to April vacation, accounted for the brevity in responses. I was disappointed because participants didn't make many maps to communicate their thinking although Thinking Maps was a common language we shared. Participants could have tired from completing the rather lengthy survey. In retrospect, I would administer the survey in sections so teachers could stay focused and energized. Questions 11-20 were more reflective in nature and unfortunately, occurred at the end of the survey. I was particularly interested in the TOTers thoughts on how their teaching and learning experiences had changed since incorporating Thinking Maps, question 19 on the survey. We could have completed that question as an activity within our training sessions using a Double-Bubble Map comparing the situations. I also wonder how participants would have responded if I just left space, no lines or starter maps, after questions. As a variation on the data collection, I could have designed two different surveys, one with starter maps and one without, and compared TOTers' responses. In future trainings, I can adjust the location, length, and timing of the survey as well as assign points to the questions. These modifications might lead to more sound and elaborate data.

Additional Measures

In addition to improving the existed instruments of data collection, I would have employed other research measures to structure a cleaner design. At each TOT meeting, teachers could have rated their use and students use on a basic point scale. I could have introduced specified issues on which to respond as well, such as classroom participation, homework habits, or time on task. Basically, I could have used the themes that emerged from their feedback and created a behavioral and academic checklist. This checklist could have given a balance of data (formal and informal) and offered a quantitative measure over time. If participants knew of specific checklist criteria in advance, perhaps they would be more aware of behavior and academic performance between sessions.

To obtain more measurable data, I would also structure documentation. We could have requested that teachers identify a student and collect student-generated maps over time. Creating and examining portfolios would support teachers' responses about thinking and learning and provide another opportunity for reflection about instruction and cognition.

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Since much of this study relied on teachers' self reports, documents would substantiate teachers' responses. Overall, modifications to the administration of the Thinking Maps and survey data and additional checklists and document collection would formalize the data and provide more quantitative results in future training populations.

Possible correlations

I could change, not only, the tools for measuring data, but the process of analyzing the data I collected. The survey contained information about basic use, patterns of use, student ownership of maps, influence on student performance and learning, influence of teacher instruction and planning and the professional development format. I am curious to see if some of the data interact. For example, does the number of times maps are used in a week correlate with ratings of student ownership? How does years of teaching experience correlate with frequency of use? How does years of teaching experience correlate with student-directed learning? Does teacher use in planning and instruction interact with student behavior ratings? When I analyzed the data, I returned to some of my original questions about professional development efforts and the nature of educators. These questions resurfaced: Under what conditions will teachers incorporate new programs or staff development initiatives? What bridges the gap between theory and practice? What leads to improved instruction? What enhances reflection?

I wonder what role teacher personality and personal educational philosophy play in changing attitudes and ultimately practice. For example, are educators who engage in risk-taking behavior, more likely to change their practice? Are educators who have a higher self-concept more likely to try new ideas? How would top educators score on both the Myers-Briggs Inventory and Piers-Harris Self Concept scale? I feel a connection exists between people's understanding of self and how that understanding presents itself in classroom practice. Therefore, philosophies of self complement philosophies of education.

I am reminded of the structure of educational philosophy. Philosophy is based around three categories: 1) metaphysics, the nature of reality 2) epistemology, the nature of truth and knowledge and 3) axiology, the nature of what is valued (Knight, 1998, p.7) I wonder how teachers' beliefs about the nature of truth and knowledge, relative or absolute, actively constructed or pre-set/fixed, influences their likelihood of introducing new models of

learning. I am curious about this because incorporating Thinking Maps can change the dynamics and power structure of a classroom, altering who has the knowledge and how knowledge is constructed. Do educators who view their role as transmitting a known body of content to their students integrate or see the benefits of Thinking Maps? If educators articulated as Schon calls it their "theory-in-use" how would it align with educational philosophy? Could they articulate it? Better yet, if educators were to engage in Elshout-Mohr's "learning-episode" research design for reflective processing, how would they react to certain teaching/learning scenarios and how could that inform us about their educational philosophy? Would the participants in the TOT session be aligned with more constructivist theories of education? Would their educational philosophy have changed over the course of our sessions? I would be interested in linking educators' philosophies with their Thinking Maps integration.

Implications
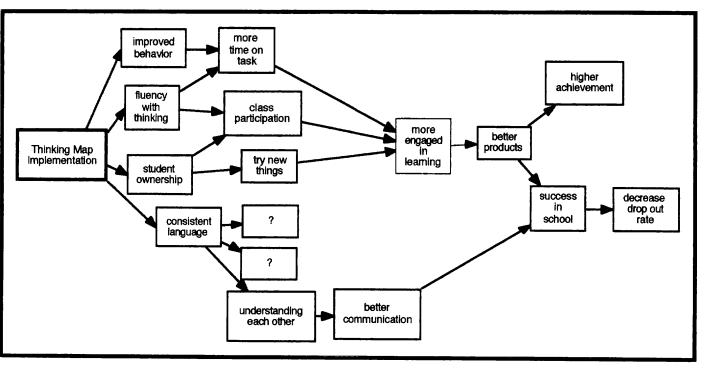
The results of my data indicated that Thinking Maps has influenced student behavior and performance and teacher curriculum and instruction. Figure 5.1 indicates teacher reported areas of improvement since Thinking Maps implementation. Based on my findings, what is in store for the future?

Figure 5.1 Teacher reported areas of improvement in student performance and teacher instruction.

Future Research

Just as "thinking begets thinking", action research begets more research. If having a representation system for knowledge can improve student behavior, motivation, participation, and cognition, what are the implications for each one of those areas. Figure 5.2 uses a Multi-Flow map to display both short and long term results from improved academic and behavioral performance.

Future research designs will attempt to quantify measurements of some of these dispositions. Such as, how does an increase in confidence contribute to scholastic achievement? Since many of these improvements involved behaviors, it would be interesting to establish a connection between the dispositions of the Habits of Mind and the cognitive skills of Thinking Maps. Would classrooms that use Thinking Maps report a greater presence of some of the Habits of Mind?

Due to the change in classroom climate, future research should include discourse analysis to identify the different patterns of speech, power and language in a classroom as teachers and students become fluent with the cognitive skills represented in Thinking Maps. Although Thinking Maps are a visual form of communication they promote patterns of thinking. Much of our speech reflects our thoughts. Therefore, it would be interesting to learn

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who speaks, when, and the content of their speech change over time.

Despite my study's focus on teachers, my findings centered on students. Instead of hearing from teachers, future research should involve hearing or collecting evidence directly from students. Systematically conducting student interviews and collecting student work would provide data of the uses and effectiveness of Thinking Maps on cognitive development.

Extending the Training Model

The results from this project warrant future research as well as an extension of our company's professional development model. The improvements to the research model could occur during my next six-day Training of Trainers. If I created more benchmarks and better instruments of data collection, I might be able to establish a stronger connection between Thinking Maps implementation and increased student performance. To address teacher cognition and reflection, I could design an advanced training for teachers in which we would use the tools to explore educational issues rather than implementation issues. The focus would not be on the maps, but on school concerns. The next steps would involve using Thinking Maps specifically as a reflective tool for identifying the role of the teacher, devising a safety plan, selecting a new math curriculum, or learning a science activity. The tools would be embedded in everyday practice and learning.

Educational Systems

I would not only extend the length of the training, but the population participating in the training sessions. If we think about Thinking Maps staff development in terms of systems thinking, we have a tool designed for students' cognitive development that teachers also apply. Not surprisingly, the use of the cognitive model improved teachers' performance as well. Since this tool is based upon thought processes and communication, Thinking Maps could be applied for further change within the bureaucratic hierarchy. Administrators should be part of this common visual language within a school community as well. Administrators could use Thinking Maps to problem solve and manage and facilitate site-based decision making. Think about the implications organizationally if a whole faculty is fluent with the maps. If Thinking Maps are embedded in the culture, then members of that community incorporate those patterns of thinking. They examine the cause and effects of

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situations and contemplate the frames of reference involved. What could be accomplished if parties could represent their thoughts visually? They could understand themselves and other which could lead to richer dialogues and more meaningful interactions. If teachers reported a change in classroom climate from Thinking Maps' implementation, then why not a change in school climate?

Costa and Garmston(1993) from their research on cognitive coaching state the benefits of positive relationships. Integrating Thinking Maps at all levels of a school coaches educators to be aware of and develop their cognitive skills.

> "positive intrapersonal relationships [which] are the energy sources for adaptive school culture and productive organizations. The pattern of adult interactions in a school strongly influences the climate of the learning environment and the instructional outcomes for students...coaching provides skills and tools for coaches to work with other adults and students and open and resourceful ways. ...promotes cohesive school cultures where norms or experimentation and open,honest communication enable everyone to work together in healthy, respectful ways" (p.8)

Organizational Change

As facility with thinking radiates from student to teacher to administration to school, why not continue it across whole learning communities and the profession of education itself? Imagine the language of thinking integrated into our current climate of education. David Hyerle (2000) speaks about the disconnect between education and thinking:

> "students may exit our schools with the ability to read text, but not build meaning. Our students' cognitive skills development-the foundation of every school's goals or mission statement-are randomly supported, rarely raised to the level of fluency, and nearly absent as a distinct dimension of assessment. We now know that "information doubling" abounds beyond our students' capacities or necessity to learn all the new content. And as we know from brain research, we must facilitate the patterning of content knowledge as a foundation for learning. Thinking Maps, as a language of visual tools based on fundamental thinking skills, has been proven as one route for unifying content and process instruction and assessment of products (p. 102).

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If learning communities shared an emphasis on and a system for thinking, we may see the improvement we want. How would Thinking Maps be useful in our political context concerning voucher systems, charter schools, teacher reform and merit pay?

According to Bartunek and Moch, authors on organizational change, organizations cannot alter patterns of behavior unless they undergo a change in schemata. They link cognition and frames of reference to institutional change.

Change can occur through a cognitive basis by reframing the schemata that surrounds the context. In education, for example, reframing what knowledge is, how to instruct students...The cognitive sciences suggest that the world as it is experienced does not consist of events that are meaningful as themselves. Rather, cognitions, interpretations, or ways of understanding events are guided by organizing frameworks- or schemata " (1987, p. 484).

Perhaps Thinking Maps are tools for helping our profession reach professional status.

Just like cognitive developmental theory, my improvements and implications have progressed from the egocentric concerns to the socioeconomical, moral and political perspectives. I started my research recommendations by improving measures for and the process of data collection and ended with implications for the educational arena. Thinking Maps are a simple set of tools offering solutions to complex situations.

Advice to Future Researchers

Much of my advice for future researchers revolves around topic choice and data collection from my own experience. Your focus question and topic will change frequently which I think is a sign of an aware researcher. As you muddy around in the waters, some things will become more clear while others may sink to the bottom. Do not fight the course of nature. Listen, observe and experience. Your senses will guide you toward your inquiry and data collection. You are already immersed in a complex setting. As a researcher, find an aspect to track and discover. First and foremost find your passion. Situations that evoke tears of joy or tears of pain take us on the most fulfilling journeys. Your heart will be invested and will sustain your energy over the course of the project. If your topic is personal, it will be meaningful.

Start the process early. If you think you have selected a direction, start recording your observations and your musings. Keep a file of questions and artifacts and categorize them and annotate them on a monthly basis. These artifacts will help you design a method of data collection that will formalize and specify something that already exists. When designing your study, make sure you will have enough contact time with your population. If you are mailing a survey or questionnaire, send it early and offer an incentive to complete and return it. Find additional populations that you can tap to increase your sample size.

Talk, talk, talk. The more you share your process and interests the more focused you will become. Critical friends are essential to shaping your project. Discussion will help to prioritize your thoughts and construct a worthwhile literature search. I conducted my literature search too early without reflection and received too many articles on too many subjects. I didn't know how to select the most appropriate articles. It all seemed interesting, but I ended up with a survey course in education instead of a specific area of study.

Draw on previous course work. As I synthesized my findings and reflected upon my work, I was amazed to return to the fundamentals of education: human development and philosophy. Keep your notes and books! Dewey and Kegan are timeless.

Data analysis is difficult and rewarding. Compiling the results of my survey was the most exciting part of the process. A body of knowledge came alive right in my hands. I figured out a means to categorize the responses and felt the power of my project. Make sure to "simmer, cook and stir" the data many times to reveal its true flavor.

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As your project comes to a close, remember your data might not have provided an answer to your focus question. That is why you start with passion! The questions only fuel more questions and demand further inquiry. Action research doesn't have to prove something. Action research proves you are curious about how your environment works and are brave and intelligent enough to try to fit the pieces together. This project is like Springer Mountain on the Appalachian trail. It is a hard climb, with a great view, but only the beginning of the trek. Zip up your back and resume the hike!

Final Reflections

I started this master's project as I began a new position. I chose to leave the classroom to inspire other teachers to experience our level of success. I missed the students terribly, but felt strongly about improving teacher morale and competency. Students are resilient creatures bubbling with theories, wonder and excitement. With emphasis on curriculum, testing, and standards, teachers are rarely described the same way. I watched the increasing measures of accountability alter the personal nature of even the strongest, most enthusiastic teachers. Furrowed brows replaced the bright eyes of my colleagues. I was disheartened by this transformation and felt I needed to support teachers.

Since Thinking Maps brought new life to my classroom and illuminated new patterns of thinking, I was eager to share Thinking Maps and that enlightenment with others and begin healing the mistrust created by our educational system. In my position as a consultant, I met other professionals from around the Northeast and helped them to meet their standards and to regain their confidence and enthusiasm. The stories I heard, the examples I saw and the intellectual discourse in which I participated rejuvenated all the members of the TOT groups. This type of professional development is essential to creating competent, reflective and empowering teachers. Teachers want to improve their practice and discuss ways to solve their problems. I wish that our sessions together were the norm for all districts.

Although the sessions are over, the work continues. Using Thinking Maps, two participants are facilitating a whole school meeting about balanced literacy, another teacher is scheduling a community night with parents, while other continue to email me with their latest success stories and insights. These situations indicate that we created a reflective process

for our practice and an enthusiastic climate for our work. I think the following quote from P.

Woods and B. Jeffrey from <u>Teachable Moments</u> unites thinking and feeling quite well:

> "Good teachers are passionate about ideas, learning, and their relationship with
> students...These teachers did more than teach to set standards or use approved
> techniques. Their classroom relationships featured 'interest, enthusiasm, inquiry,
> excitement, discovery, risk taking and fun.' Their cognitive scaffolding of concepts and
> teaching strategies was "held together with emotional bonds" (p. 91).
>
> "Recently, a Dutch psychologist tried to figure out what separated chess masters
> and chess grand masters. He subjected groups of each to a battery of tests: IQ,
> memory, and spatial reasoning. He found no testing difference between them. In the
> end, the only difference he found was this: Grand masters simply loved chess more.
> They had more passion and commitment to it" (Costa & Kallick, 2000, p. 91)

I close by returning to passion and possibility. I was and still am convinced in the power of
Thinking Maps for lifelong learning. The power lies in empowerment. Our goal as teachers
is to empower students to access their knowledge and to find their voice. I feel that Thinking
Maps invite explicit thinking and present a way to communicate their metacognition. While
reading literature on metacognition (Costa, et al, 1991), I recently discovered this quote
from Lao-tze, which articulates my view of the role of teacher.

> "A teacher is best who is always there-when students barely recognize they are
> being helped, not so good when students watch and say yes, worse when they
> intimidate or belittle. But of a good teacher who talks little-when their work is done,
> their aim fulfilled, students will say, we did it ourselves" (p. 207).

I feel privileged to be involved in such significant work from the individual level to the
institutional level and feel confident in the tools to promote change. I look forward to
exploring new questions in my future excursions and to designing the next peaks in the
educational landscape.

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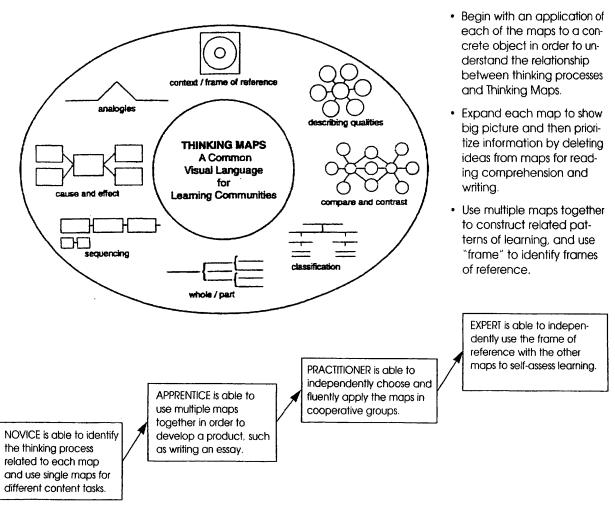
Wolfe, P., & Sorgen, M. (1990) Mind, memory, and learning. Napa, CA: Authors.

Appendix A
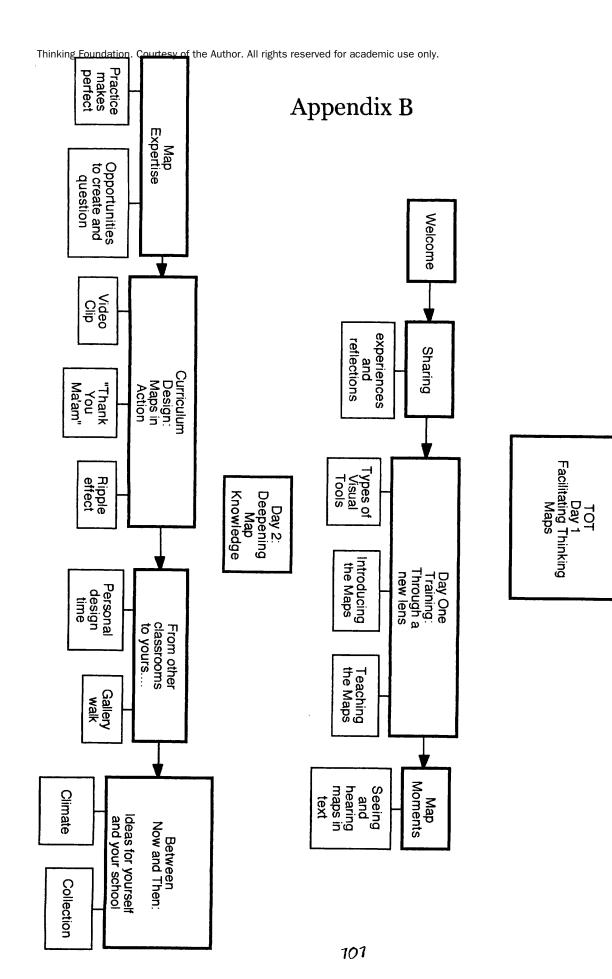
FIGURE 6.3

Thinking Maps Overview

BACKGROUND: Thinking Maps is a language, or tool-kit, of eight thinking process maps, developed by David Hyerle. Each map is graphically consistent and flexible so that students may easily expand the map to reflect the content pattern being learned. Thinking Maps are introduced to students as tools for reading and writing, content-specific learning, and for interdisciplinary investigations. Over time, students learn to use multiple maps together and become fluent in choosing which maps fit the immediate context of learning. Thinking Maps and Thinking Maps Software are used in whole schools through faculty training and follow-up.

BASIC TECHNIQUES

- Begin with an application of each of the maps to a concrete object in order to understand the relationship between thinking processes and Thinking Maps.

- Expand each map to show big picture and then prioritize information by deleting ideas from maps for reading comprehension and writing.

- Use multiple maps together to construct related patterns of learning, and use "frame" to identify frames of reference.

context / frame of reference

analogies

describing qualities

THINKING MAPS
A Common
Visual Language
for
Learning Communities

cause and effect

compare and contrast

sequencing

classification

whole / part

EXPERT is able to independently use the frame of reference with the other maps to self-assess learning.

PRACTITIONER is able to independently choose and fluently apply the maps in cooperative groups.

APPRENTICE is able to use multiple maps together in order to develop a product, such as writing an essay.

NOVICE is able to identify the thinking process related to each map and use single maps for different content tasks.

Source: Hyerle, D. (1999b). *Visual tools video and guide* (p. 15). Lyme, NH: Designs for Thinking. Copyright © 1999 by David Hyerle.

Appendix B

Syracuse City Schools

TOT
Day 1
Facilitating Thinking Maps

Welcome

Sharing

- experiences and reflections

Day One Training: Through a new lens

- Types of Visual Tools
- Introducing the Maps
- Teaching the Maps

Map Moments

- Seeing and hearing maps in text

Map Expertise

- Practice makes perfect
- Opportunities to create and question

Curriculum Design: Maps in Action

- Video Clip
- "Thank You Ma'am"
- Ripple effect

Day 2: Deepening Map Knowledge

From other classrooms to yours....

- Personal design time
- Gallery walk

Between Now and Then: Ideas for yourself and your school

- Climate
- Collection

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Syracuse City
Schools
Training of
Trainers
Day 4

Curriculum
Design
Time

reading
comprehension

Your
Applications

Thinking
Maps
Software

the
basics

teaching,
learning,
assessment

Mapping
the
Standards

Setting the
the
Standards

Going
across
Disciplines

Write From
the
Beginning:
Overview

focus
points

putting it
all
together

NEXT
STEPS

review
resources

refine
design
work

collecting
school-wide
work

Syracuse City Schools
Training of Trainers
Day 3

Thinking Maps in a Nutshell
- why?
- what?
- how?

Sharing Experiences
- your applications
- school-wide

questions / *concerns*

successes / *learnings*

Integrating Section: Thinking
- design
- cooperative learning
- problem solving
- conflict resolution

Transferring Section: Thinking Maps across disciplines
- video
- Map Expertise
- reading comprehension

Experts on Trans. section
TG 3-3-5

structure
templates
with

cards

12-15 min. section
examining P.)
What different P.)
new ideas
1
2
3
4
SS. — Pru. la
Scir — Jess.
Math — Pat-Cathy
(on K. — Patty)

Final TOT meeting
March 1 and 2
Syracuse, NY
Agenda

Welcome
- How is your school working with the maps?

Sharing
- What improvements in map use have you witnessed?
- What are the various multi-map and cross discipline applications at your school?

March 1st

Curriculum Design
- How will Thinking Maps help us to define purpose and to reach our goals?

March 2nd

Software
- What is in the program and how does it work?
- How can we use it with students and our curriculum?
- What are the benefits and implications of Mapping the Standards?

Write From the Beginning
- How does this model support NY Language Arts Assessments and develop competent writers?

Assessment
- How do Thinking Maps effect student thinking and performance?

Resources
- What are key pages to use with colleagues?

Year 2 Planning
- What needs to happen to ensure growth over time?

Appendix C

What is
influencing or
shaping your
knowledge,
use and
response to
Thinking Maps?

Thinking
Maps

Appendix D

Thinking Back on the Day

positives

changes

interesting

AHA

next steps

Appendix E

Thinking Maps

- Teaching
  - Curriculum Design
  - Interaction
  - Unique
- Learning
  - Content
  - Process
  - Unique
- Assessment
  - For teachers
  - For students
  - Student self-assessment

Appendix F

Implementing
Thinking Maps
in the
classroom

use
thinking
skills
everyday

attended
workshop

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Thinking Maps Survey:
Feedback regarding Applications, Effectiveness and Implementation

Please answer the following questions, maps, and charts as fully as possible. Feel free to add more comments on an additional sheet if more space is needed. Thank you in advance for being thoughtful about your experience with Thinking Maps.

Name: (helpful if clarification needed)_____

Years teaching experience: _____

School:_____

Grade Level:_____

# of students:_____

Map Use

1. How long have you used Thinking Maps?

2. How often do you and your students construct a Thinking Map? Circle one

Daily   Weekly   Monthly

3. During a typical lesson, how many Thinking Maps are used?

One   2 or 3   Multiple Maps

4. Complete the following tree map by classifying your level of use with each map according to the categories. You may add your own category and other relevant information.

```
                    Thinking Maps I
                         Use
          ┌──────────────┼──────────────┐
     All of the     Some of the      Rarely or
        Time            Time           Never
    _____      _____       _____
```
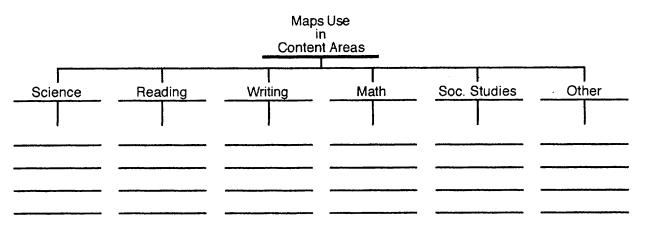
Content Application

5. Please rank the content areas in which you use Thinking Maps from

1- most often   to   5-seldom/never

Reading   _____

Math   _____

Science   _____

S. Studies   _____

Writing   _____

Fine Arts   _____

6. Within that content use, do you use certain maps in certain subject areas? If so, please write the names of the maps under each content area on the following Tree Map.

_____ No significant difference in which maps used among subject area

_____ Some patterns of use as indicated on the Tree Map below

Maps Use
in
Content Areas

Science	Reading	Writing	Math	Soc. Studies	Other
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
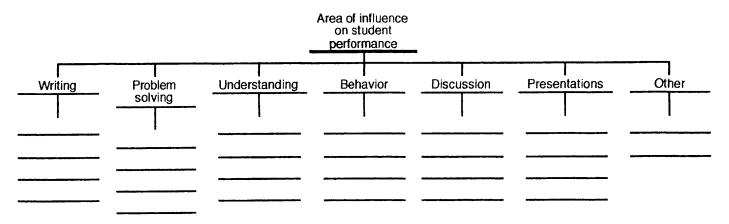
Instruction

7. How do you use Thinking Maps in the classroom? Circle all that apply.

classroom duties (agenda, rules, etc)   student processing

morning Warm-up   projects/reports   notetaking/review

assessment   other_____

8. Under what instructional conditions, are you and your class creating Thinking Maps?   **Please circle all that apply**.

Teacher Directed Whole Class Instruction   _____

Small group   _____

Partners   _____

Individual   _____

9. Look at the circled answers for #8. Use the _____ to the side, using **1-4,** to indicate which condition occurs **most often (1) to least often(4).**

Implications for student performance

10. Since implementing the Thinking Maps, how do you feel the maps have effected student thinking and learning? Please draw a multi-flow map to show your thinking, if you wish.

return to: Sarah Curtis

11. How have Thinking Maps influenced student learning/thinking in the following areas? What anecdotes or "proof" do you have? Please jot comments or stories under each category of the Tree Map or add your own category.

			Area of influence on student performance			
Writing	Problem solving	Understanding	Behavior	Discussion	Presentations	Other

12.
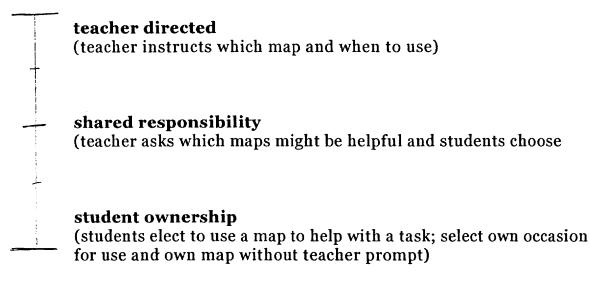
a. In what circumstances or learning situations, have your students found Thinking Maps helpful?

_____

_____

_____

_____

_____

b. Why do they find them helpful?

_____

_____

_____

13. Where have you noticed the **most significant impact** of Thinking Maps in your classroom? Why do you think that is so?
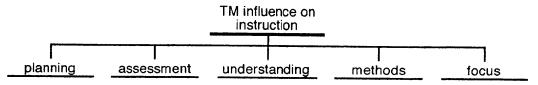
_____

_____

_____

_____

_____

14. Looking at the vertical scale below, please mark where most of your students are in their fluency with the maps.

teacher directed
(teacher instructs which map and when to use)

shared responsibility
(teacher asks which maps might be helpful and students choose

student ownership
(students elect to use a map to help with a task; select own occasion for use and own map without teacher prompt)

Implications for teacher instruction

15. How have Thinking Maps influenced your thinking, learning and teaching? Feel free to make a multi-flow map showing your thinking.

16. After examining your response to #15, please add comments under each branch of the Tree Map, where they apply, indicating how TMaps have influenced your instruction.

TM influence on
instruction

| planning | assessment | understanding | methods | focus |

return to: Sarah Curtis PO Box 839 Lebanon. NH 03766   603-448-6656

17. How have Thinking Maps been **most** helpful to your work?

_____

_____

_____

_____

_____

18. What units have you taught before integrating Thinking Maps and after integrating Thinking Maps? List 2 or 3.

_____

_____

19. Thinking about those units, how would you compare and contrast those teaching and learning experiences?   You could use a double -bubble map to compare and contrast, for example, "Mayan unit without using TM" and " Mayans unit using TM".

Implementation Process: Big Picture question

20. How does Thinking Maps staff development and effectiveness as a tool compare with other staff development strategies, workshops and conferences that you have attended and implemented?

_____

_____

_____

_____

_____

_____

_____

_____

_____

I cannot thank you enough for taking the time to reflect upon your work with Thinking Maps. If you would like to share anything else, stories, student samples, etc feel free to attach them to this survey. Please return this paperwork to me in the self-addressed, stamped envelope provided.

Enjoy the Spring!

Sarah

Appendix H
DESIGNS FOR THINKING

www.mapthemind.com
David Hyerle, Ed.D.
Consulting • Research • Systems Change
Curriculum Design

144 Goose Pond Road
Lyme, New Hampshire 03768

Ph/Fax: 603-795-2757
Email: designs.thinking@valley.net

Dear TOTers,

Congratulations and HELP! Yes, a cause for celebration and a call for assistance. First of all, you will find a certificate in this packet, announcing your skills as a Trained Trainer...a bit redundant don't you think! I know with all the testing in New York, you were wondering if you would pass. But yes, you did! You even earned points for "style and voice".

All kidding aside, congratulations on your Thinking Map efforts within your classroom, school and district. I want to thank you for the opportunity to work with each of you. Your reactions, questions and applications challenged and impressed me. Syracuse has a lot to gain from your expertise. I have taken what I learned from you, and fortified the next Training of Trainers which started last month. The excitement continues to build. Ella and I are discussing ways to unite both TOT groups for a truly amazing collaboration. You'll be hearing from us soon!

This letter is also a selfish cry for help from me, personally. As some of you know, I have been trying to complete my Master's degree this year. After hearing your stories of successes and struggles, I wanted to incorporate teacher voices in my thesis and document these learnings. To meet that end, I have enclosed a survey that I am **begging** you to complete. Although it looks lengthy, it touches upon many things we discussed in our TOT meetings.

The questions address basic issues of use, applications, effect on student performance and teacher instruction, as well as the Thinking Maps format of professional development. The first two pages will provide some baseline data for me, while the other sheets ask for a little more thought.Throughout the survey, maps are included. You may elect to use them in your response or not. Just trying to use that common visual language.

I have provided a stamped, self-addressed envelope in order for you to return your responses. (Now I am on my knees...) Could you please find about 30 minutes to complete this survey and return it to me **before April 20th?** When I receive your completed survey, I will call you to mail you your choice of "thank you" gifts. (I got that idea from Franklin's principal). If you have any questions, please call me @ 603-448-6656.

Thanks so much in advance for taking the time to help me. I feel the desperation of finishing and fear of graduation subsiding already.

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Sincerely,

May 3, 2001

Dear TOTers,

Hope you enjoy an action packed day of Thinking Maps work! Wow, you are "graduating" from the training and sustaining the energy and map expertise at your school. I'm so sorry I can't be there hearing the latest Thinking Map stories, listening to Audrey razz Ruben, and helping you compile your collections of best works from your schools. I am in the midst of putting my best foot forward by composing my master's project. So far, procrastination seems to be a problem...can you relate? Therefore, I am enlisting your assistance.

As I compile my research, I would like to include your impressions and experiences with the maps. Each time we met, I was rejuvenated and electrified by your successes and would like to share your reflections with others in education. Often times with professional development, we might try something new, but not stop to evaluate it. I am attempting to gather some data that synthesizes the results of Thinking Maps implementation for students and teachers. I have enclosed a survey which I would greatly appreciate you completing and returning to David. Feel free to use another sheet of paper if I haven't provided enough room and to answer using a map if that is more efficient. After all, it is our common language. Thanks so much for your time and effort! I may graduate, yet!

Happy Spring!

Sincerely,

Sarah

May 1, 2001

Hello folks,

It is me again, the maniacal master's marauder! My deadline is rapidly approaching! Huge thank you's for the returned surveys. They were most helpful and I have choices for thank you gifts. Please indicate your preference below:

_____Chapter 6 from the Visual Tools book
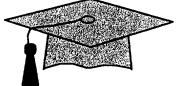
_____ Thinking Maps bumper sticker

_____ Thinking Maps T-shirt

Another plea for help. Please look in your notebooks and TOT notes for the circle map that you completed at our first training session with "Thinking Maps" as the center. No, I am not kidding!! Secondly, I can't believe I forgot to collect your multi-flow maps at our last meeting with "Implementing Thinking Maps" as the center event. Those thoughts are gold to me so pretend it's 1849 and dig for them....please, please, please... This is really the last harassment you will incur!
When you find those documents, fax 603-448-6656 or mail: PO Box 839, Lebanon, NH 03766 them to me ASAP along with your Thank You gift selection.
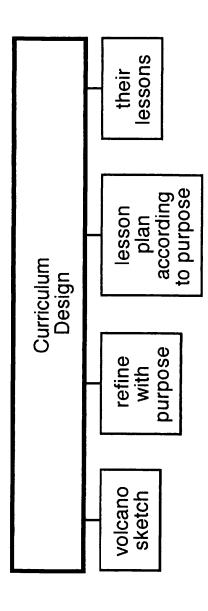Once again, thanks for contributing to the "Help Sarah Graduate" campaign!!
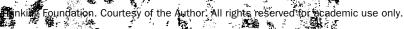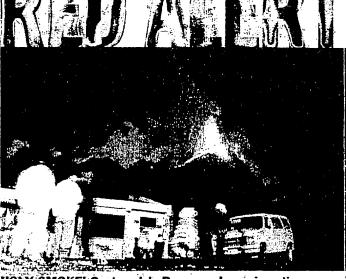
Respectfully and desperately submitted,

Sarah

Appendix I

Flow Map

Curriculum Design

| volcano sketch | refine with purpose | lesson plan according to purpose | their lessons |

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Page 1

5/3/01

RED ALERT!

Last week thousands fled as volcanoes on opposite sides of the world blew their tops

HOLY SMOKE! Guatemala's Pacaya volcano in action

DEADLY CLOUDS Fleeing Filipinos wore protective masks

GLOWING RED LAVA SHOT straight into the sky. A towering cloud of smoke and ash stretched miles high. About 200 miles from the Philippine capital of Manila, Mayon Volcano was erupting. On February 24 it exploded 14 times!

Two more blasts followed on February 28 and yet another on March 1. The eruptions from the Philippines' most active volcano sent lava racing down its 8,100-foot slopes. Hot rocks and brownish-gray ash as much as two inches thick landed on nearby towns. More than 83,000 people within the five-mile danger zone fled to evacuation centers, mostly schools.

As Mayon Volcano blew its stack, farmers raced to harvest and protect their crops. A haze of ash made it hard to see or breathe. The dusty ash "is everywhere," said

Pedro Oribiana, a village chief.

The heavy ash killed fish and destroyed rice fields. It shorted out power lines, leaving thousands of villages without electricity. According to Cedric Daep, a disaster-management official, 49 villages are threatened by superheated clouds of debris that burn objects in their path.

In its deadliest eruption, in 1814, Mayon Volcano killed 1,200 people. Filipino scientists warn that fierce eruptions may continue for weeks. U.S. officials promised to set up tent cities and provide clean water for refugees.

ANOTHER DANGER SPOT

A second volcano on the Pacific Ocean's explosive "Ring of Fire" (see map) cut loose last week too. Near Guatemala City, Guatemala,
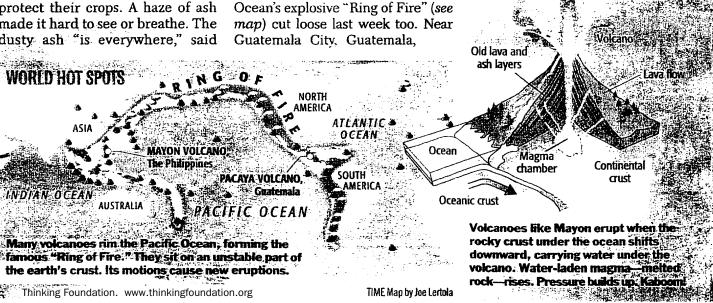
8,371-foot Pacaya volcano sprayed ash over neighboring villages in its second eruption this year. Dozens of families near the crater had to flee.

Luckily, volcanologists can listen to early rumblings from volcanoes and warn people living nearby to get out of the way.

—*By Laura C. Girardi*

HOW A VOLCANO WORKS

Volcanic ash and rock

Volcano

Old lava and ash layers

Lava flow

Ocean

Magma chamber

Continental crust

Oceanic crust

Volcanoes like Mayon erupt when the rocky crust under the ocean shifts downward, carrying water under the volcano. Water-laden magma—melted rock—rises. Pressure builds up. Kaboom!

WORLD HOT SPOTS

RING OF FIRE

ASIA

NORTH AMERICA

ATLANTIC OCEAN

MAYON VOLCANO
The Philippines

PACAYA VOLCANO,
Guatemala

SOUTH AMERICA

INDIAN OCEAN

AUSTRALIA

PACIFIC OCEAN

Many volcanoes rim the Pacific Ocean, forming the famous "Ring of Fire." They sit on an unstable part of the earth's crust. Its motions cause new eruptions.
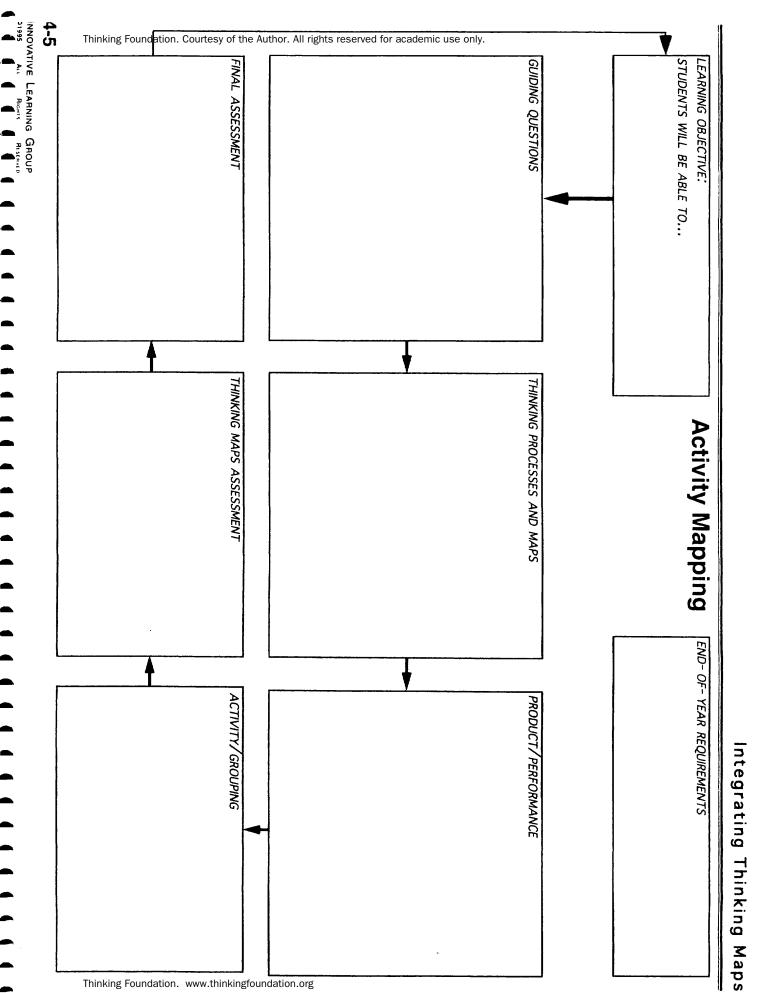
TIME Map by Joe Lertola

Activity Mapping

The Activity Mapping guide on the opposite page is used for integrating Thinking Maps into curriculum planning, including lesson and unit planning. This page is not a replacement for your own lesson planning design or process but is a guide for thinking through how to use Thinking Maps as tools for learning and assessing learning.

Here is an overview for using Activity Mapping:

1. **Learning Objective:** The learning objective is stated as an outcome based on what the student will be able to do by completing the activity. (Correlate this with your End-of-Year Requirements for students.)

2. **Guiding Questions:** Guiding questions are the few questions which clarify the learning objective and key concepts while also facilitating the thinking processes of students.

3. **Thinking Processes and Maps:** Identify the thinking processes students need to use to respond to the question(s). Choose the appropriate Thinking Map(s) that students could use for thinking about and responding to these questions.

4. **Product/Performance:** Identify the actual product or performance that students will use to demonstrate having met the learning objective (writing, oral report, science project, etc.).

5. **Activity/Grouping:** Design an activity that is based on the four steps above. Also, consider various grouping options within the activity (individual, paired, cooperative, etc.).

6. **Thinking Maps Assessment:** Students need to "show their work." As a dimension of the final assessment, consider this question: What will the completed Thinking Maps show as evidence of student learning?

7. **Final Assessment:** The assessment of the outcomes of the activity need to be aligned with the learning objective. Are you using an assessment tool and process which reflects the Learning Objective?

4-4

Activity Mapping

Integrating Thinking Maps

LEARNING OBJECTIVE:
STUDENTS WILL BE ABLE TO...

END-OF-YEAR REQUIREMENTS

GUIDING QUESTIONS

THINKING PROCESSES AND MAPS

PRODUCT/PERFORMANCE

FINAL ASSESSMENT

THINKING MAPS ASSESSMENT

ACTIVITY/GROUPING

4-5

Thinking Foundation. www.thinkingfoundation.org

Algonquins / Iroquois

Appendix J

Activity Mapping

LEARNING OBJECTIVE:
STUDENTS WILL BE ABLE TO:
1. Identify NA as first inhabitants
   - Iroquois and Algonquian
2. Identify basic needs
3. Uses of environ / how N.A. were influenced
4. Accomp. and contributions of NA.

END-OF-YEAR REQUIREMENTS
Standard # 1
History of NYS

GUIDING QUESTIONS
1. Who were the first N.A. inhabitants of NYS? (p. 5)
2. What were the basic needs of N.A. and how were they met? (p. 46)
3. How did N.A. use the environment / influenced by environment?
4. What were the accomplishments / contributions of N.A.? Contributions (p. 52)

THINKING PROCESSES AND MAPS
- Describe Iroquois / Algonquin using Bubble, Double Bubble
- Classify basic needs using tree map; explain cause of needs / how they were met using multi-flow
- Use circle map to brainstorm environment used / environment use multi-flow to analyze effects of environmental use

PRODUCT / PERFORMANCE
- Write a paragraph comparing / contrasting Iroquois / Algonquin
1. Construct tree map using symbols (NA) or drawings (p. 52-53 Heath)
2b. As a teacher-directed activity, students create multi-flow map. Students will create a thesis statement explaining the causes / effects of one need

ACTIVITY / GROUPING
1. With partners, read articles on pp. 48 and 56 Exploring NY (Heath)
2. With partners read pp. 67-69 in L about NYS
3. With partners View video and record notes using tree map
4. With partners, read pp. 66 L. NYS

THINKING MAPS ASSESSMENT
- Categorize accomplishments / contributions of NA.
- Teacher collects each map for informal assessment

FINAL ASSESSMENT
Given the topic: DBQ (See back)
Use a tree map and a flow map to create 5 paragraphs.

Created by: K. Palumbo

4-5
INNOVATIVE LEARNING GROUP
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Activity Mapping

Integrating Thinking Maps

LEARNING OBJECTIVE:
STUDENTS WILL BE ABLE TO...

END- OF- YEAR REQUIREMENTS

GUIDING QUESTIONS

THINKING PROCESSES AND MAPS

PRODUCT/PERFORMANCE

(2b cont.) Compile each gps statements into a class paragraph / or poster, etc. for o'splaer

(3a) Create indiv. circle map from notes about basic needs

(3b) As a class create multi. flow showing the causes / effects of environmental use.

(4) Use a tree map to develop questions for speaker about contributions of n 4 cultural and accomplishm nts. Record notes on tree map

FINAL ASSESSMENT

THINKING MAPS ASSESSMENT

ACTIVITY/GROUPING

Maytay Fally — Solace School

3rd Junior Grade... — call — in Liverpool

Activity Mapping

Integrating Thinking Maps

LEARNING OBJECTIVE:
STUDENTS WILL BE ABLE TO...
explain where sources of water in communities (urban + rural) originate

Prior Knowledge

Vocabulary on back

GUIDING QUESTIONS
→ What is a rural and urban community?
→ What is the source of household water in an urban and rural community?
→ What is a water treatment plant?
→ What is a well?

THINKING PROCESSES AND MAPS
→ describe each community using a bubble map
→ flow map to describe process of water in water treatment plant at home, and rain as going water in a well & a home.

Begin with a circle map — What do you know?

PRODUCT/PERFORMANCE
— Create a poster showing characteristics of a rural & urban community & the path of their water source.
— Use resource books, internet to find water sources in a comm.
— Logic: School Bus
Tree: Waterworks

bubble map?

END-OF-YEAR REQUIREMENTS

ACTIVITY/GROUPING
— Class is divided into 2 groups (or 11-½ to 12yr + ½ another). Each group becomes expert in understanding the route/process water takes in a comm.
— Each group present to their class & end (source to time)

FINAL ASSESSMENT
— each child will create a model/diagram of a river for urban water house
— key Choice
— Write a story about the use of water & its

THINKING MAPS ASSESSMENT
Use double bubble map to compare/contrast urban & rural comm. and their sources for water
— use a bridge map to connect and water flow
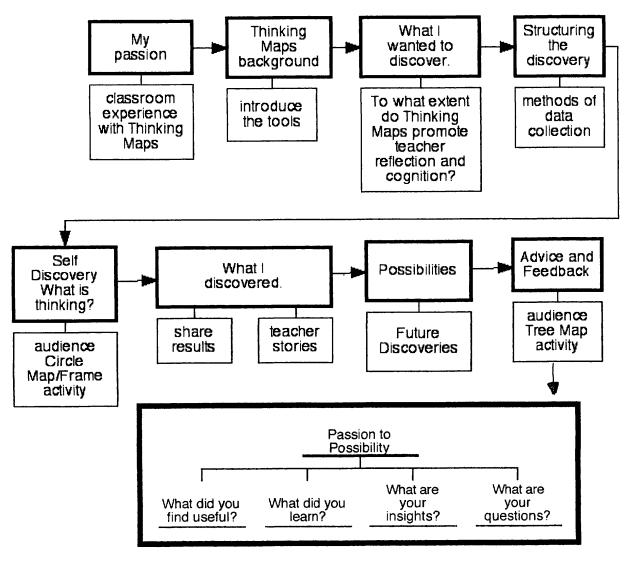
Presentation
Passion to Possibility

Master's Symposium Day

Antioch New England Graduate School

July 7, 2001

During my presentation, I indend to provide the audience with background about myself and my personal experience with Thinking Maps so they can understand my interest and the tools. This information will supply the passion before I discuss the results of my project and ponder the possibilities. The following is Flow Map of the sections and activities of my presentation.

Sarah Curtis PO Box 839 Lebanon, NH 03766   603-448-6656