Drawing the Circle:
Collaborative Mind Mapping as a Process for Developing a Constructivist Teacher Preparation Program

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As teacher education programs across the nation attempt to respond to problems that face our nation's schools, some are moving toward development of constructivist and inquiry-oriented approaches (Fosnot, 1989; Zeichner, 1983).

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Coherence between the constructivist philosophical and epistemological foundations of these developing programs, and their structure, curriculum, pedagogy, and means of assessment is of crucial importance. Further, the very processes of formulation of a constructivist teacher preparation ought to be compatible with constructivist principles. Collaborative mind mapping can serve to facilitate such a process. This paper will describe what we have discovered about this useful tool.

As we initiated the process of developing a postbaccalaureate teacher preparation program, a committee of five faculty sat together and began to talk. The nature and structure of the talk that developed led

to social and intellectual processes that transformed both the goals of the group and the way the group worked. The starting point of change seemed to be embedded in the quality of our dialogue that took place prior to the mind mapping. Some dialogic examples may help explain what we mean:

> Member A: What do we want these graduates to be like in the classroom?
> Member B: What do we believe is important? What do we really value?
> Member C: This is not going to be easy, even if we really put our minds into this. Where do we start?
> Member D: And what about the budget problems?
> Member B: First, let's just pretend there are no budgetary or administrative constraints.
> Member E: Let's dream. If we could have an ideal program, how would it look?
> Member C: Let's plan our dream program.
> Member B: No "yes, buts" are allowed right now.
> Member D: Hold judgment in abeyance until we get out our best thinking.
> Member C: What do you think?
> Member A: How can we do this?

This conversation typifies the dialogic exchanges of the group. As can be seen, the dialogue was contextual, interactive, and inquiring. Even though the conversation was strategic (e.g., holding judgment in abeyance), the qualities of questioning and imagining were predominant. We did not set out with conscious intention to use constructivist principles to guide planning. However, as we began to problem solve together, and to identify our common epistemological ground, we became aware that a social constructivist approach was in process. We have become immersed as active participants in the shared construction and collective ownership of knowledge that, in turn, is giving rise to the development of a constructivist Masters program for teacher preparation.

This shared construction has been facilitated by collaborative mind mapping. Mind mapping is a process for developing a visual, non-linear representation of ideas and their relationships. The ideas are often generated from a hub, or circle, which is the core idea or focus of inquiry. In developing a constructivist program for teacher education we have used this open-ended and non-linear process of mind mapping in several ways. The process was used: (1) as a tool for the collaborative construction of meaning; (2) as a visual representation of our "group memory," capturing the connections among and between the developing ideas; (3) as a basis for the writing which we have done as we developed the program in narrative forms; and (4) as a means of communicating to university colleagues the "story" of our thinking as we have laid the foundation for our program.

Collaborative mind mapping has applications within teacher education for a variety of endeavors. Traditional program development for teacher preparation has relied on processes that can be characterized as linear, hierarchical, and close-ended. It was apparent during our initial meetings that such processes did not

support the goals we envisioned. In our efforts to move toward a more coherent program based on constructivist principles we chose a different path. This path embraces holistic, open-ended, dynamically organic processes that are reflected in collaborative mind-mapping.

This paper will not address the diversity of positions represented by radical constructivists (e.g., von Glasersfeld, 1986), social constructivists (e.g., Yackel, Cobb, Wood, Wheatley & Merkel, 1990), ecological constructionists (e.g., Steier, 1991), and social constructionists (e.g., Gergen, 1985). These theorists debate many issues, such as where and how "knowing" occurs and the degree to which the construction of thought is mediated through social interaction, as well as the nature of reality and whether "reality" is even a viable or relevant concept. Instead of entering into the above debates, we have chosen to base our discussion here on four principles central to constructivism identified by Fosnot (1989, pp. 19-20):

1. Knowledge consists of past constructions.
2. Constructions come about through assimilation and accommodation.
3. Learning is an organic process of invention, rather than a mechanical process of accumulation.
4. Meaningful learning occurs through reflection and resolution of cognitive conflict, and thus serves to negate earlier, incomplete levels of understanding.

Explicit Connections Between
Collaborative Mind Mapping and Constructivism

Using the four principles of constructivism cited from Fosnot (1989), we will examine constructivist attributes of collaborative mind mapping.

Principle 1:
Knowledge Consists of Past Constructions

The process of collaborative mind mapping facilitates a means for collaborators to build a visual representation of (or at least parts of) our collective past and present constructions: values, beliefs, and understandings of teacher education. Using this visual framework, we were able to create a structure based on the interactions of our constructions that literally formed the foundation of and gave rise to a new structure for our program. Continuing with a carpentry metaphor (Spivey, 1992), we have found that the lumber that we each brought for the structure contributed to the whole, and enabled us to create a much finer construction than would otherwise have been possible.

Principle 2:
Constructions Come About
Through Assimilation and Accommodation

In collaborative mind mapping, the mind map serves as a framework that visually represents the processes of assimilation and accommodation. The group is able to see through the mapping how each person's ideas are assimilated into the structure, and to consider how the mind map needs to be altered, rearranged, subdivided, or re-combined to accommodate the new concepts that are contributed. As the map is being transformed through this accommodation, care needs to be taken by the group to respect the ideas of those whose original contributions were being "rearranged."

Principle 3:
Learning Is an Organic Process of Invention,
Rather Than a Mechanical Process of Accumulation

The mind map itself is evidence of the organic (as opposed to linear) nature of creative processes. The sprawling openness of the mind map, which has many possibilities for hooking on new, more elaborated ideas, invites more fluency and flexibility of thinking than the sequential making of a list. The non-linear attributes of mind maps allow a free-flowing creative interchange. Only after the ideas are on the chalk board is it time to identify a linear outline with Roman numerals and letters. As one person in our group explained, "It is easier to produce our ideas, when we don't have to think of 'the next thing next' in linear sequence."

Principle 4:
Meaningful Learning Occurs Through Reflection
and Resolution of Cognitive Conflict, and Thus Serves
to Negate Earlier, Incomplete Levels of Understanding

We have experienced a great deal of cognitive conflict throughout our work together. Much of it occurred as we pooled our ideas, and tried to make sense of things. A key to the power of this process has been that in spite of that dissonance, we have experienced little interpersonal conflict. We attribute this, in large part, to the spirit of inquiry, and to our relationship as **connected knowers** (Belenky, Clinchy, Goldberger & Tarule, 1987). Clearly, intellectual growth has been an important outcome for the individuals interacting within the group.

Varieties of Mind Maps

Mind mapping processes have been reported in the literature as **conceptual mapping**, **webbing**, and **clustering**. These processes have been used in many contexts, and for a variety of purposes, such as providing non-linear tools for

writing (Atwell, 1990) and intuitive thinking (Buzan, 1983). Conceptual mapping is commonly used to enhance the comprehension of expository text by teachers of elementary and secondary students (Anderson & Huang, 1989; Armbruster, 1985; Armbruster & Anderson, 1984).

Researchers in the fields of artificial intelligence and cognitive psychology have used a similar representational process, creating what they have referred to as **semantic nets**. Semantic nets have been employed in educational research as a means of analysis of mathematics knowledge (Leinhardt, 1987; Leinhardt & Smith, 1985). McKeown and Beck (1990) used semantic nets to depict and analyze patterns of students' understanding of history. Recently, mind mapping was used as a data collection technique to analyze preservice teachers' preconceptions about teaching (Pankratius, 1992). Mind mapping has often been part of classroom instruction, as students were encouraged to generate ideas together (e.g., in preparation for writing, or summarizing what they have learned). As far as we are able to determine, it has not been common practice to use mind mapping as a primary tool for committee work or program planning in teacher education, as we are describing.

We chose to refer to our visualizations as **mind maps**. The notion of **mind maps** seems particularly appropriate in several respects. Maps present an overview, provide options, put things in perspective, and give ideas for direction. The maps represented our thinking more fully than lists or narratives by illustrating the relationships between ideas.

Mind Mapping as an Invitation to Thought

Our first act in creating a mind map is that of **drawing the circle**. The circle forms the "hub" of the mind map around which the ideas are generated. Drawing the circle serves to pose the question, to focus the attention, and to begin the thinking. We have realized that **drawing the circle** also represents an **invitation** for collaborative inquiry, and serves as a metaphor for the collegiality and collaborative intellectual growth that took place within the circle of the group. The experience of collaborative mind mapping exemplified for us the holistic principle that the whole is greater than the sum of the parts.

In looking back on our experience, we believe that in "drawing the circle" our group was engaged in **connected knowing**, a feminist constructivist epistemological stance described in *Women's Ways of Knowing* (Belenky, *et al.*, 1987).

> Connected knowers begin with an attitude of trust; they assume the other person has something good to say.... Connected knowers do not measure other people's words by some impersonal standard. Their purpose is not to judge, but to understand. (p. 116)

In contrast, separate knowers are adversarial. They "are like doormen at exclusive clubs. They don't want to let anything in unless they are pretty sure it is good"

(Belenky *et al.*, 1987, p. 104). In a group of separate knowers, participants do not feel free to risk thinking aloud, playing with ideas. Creative ideas flow more readily in the safer community of connected knowers. Our agreement to let ourselves dream and imagine and to suspend judgment promoted the safety, and thus the creativity of the group.

The structure of the mind mapping process, combined with the psychological safety of the collaborative group, created a responsive environment that allowed the members to feel heard and understood. Oldfather (1993a, 1993b) called this condition of responsiveness **Honored Voice**, and found it to contribute to motivational processes. Unlike many committee meetings which faculty experience as a drain on time and energy, we looked forward to our meetings, and found them energizing.

Using the maps during our problem solving, we promoted open-ended thinking by playing with ambiguities and uncertainties, resisting premature closure, freeing ourselves from inhibiting sets of expectations, emphasizing the incompleteness of the information, making divergent thinking legitimate, encouraging multiple ideas, letting one thing lead to another, and using humor (Torrance, 1979). In addition to thinking creatively, we were often also thinking metacognitively.

During mind mapping, awareness and monitoring of our own thinking in the safety of this group facilitated "think aloud" (Bash & Camp, 1975; Garner, 1988; Manning, 1991; Olshavsky, 1976-1977) that ordinarily would have been inhibited in the presence of professional colleagues. During the situations when a group member used "think aloud" a collaborative metacognition was possible. To explain, not only did the member who was thinking aloud discover, for example, an improved way to express something (self-correction) from hearing one's own ideas spoken aloud, but the other group members could hitchhike (Isaksen & Treffinger, 1985; Torrance & Myers, 1970) on one another's "think aloud."

Examples of other metacognitive processes that we used individually and scaffolded (Bruner, 1985) for each other were: (1) coping with mental frustration; (2) encouraging openendedness, even when closure was tempting; and (3) evaluating our thinking process. As Brown (1987, pp. 88-89) described such an experience, "[as] 'human thinkers,' we were playing with our thinking, that is [we] subjected our own thought processes to examination and treated our own thinking as an object of thought." This metacognitive social process added emotional richness and depth to our thinking, and contributed to the stance of "supported frustration" during group problem solving. As we worked toward common solutions, individual and group metacognitive thinking eventually became inseparable. Jointly they supported risk-taking that improved the quality of thought.

How to Use Mind Maps

In this section we will describe how we used mind maps to foster a process of

collaboration and give specific examples of how we used mind maps to communicate.

Drawing the Circle

As mentioned above, we began by drawing the initial circle, or hub. This circle provided us with the question to be posed, and served as an invitation for collaborative inquiry. One of the group members volunteered to serve as the recorder of the group's ideas on the mind map. In a free flowing way, group members contributed ideas that formed the "spokes" and the connections among the spokes. We generally maintained an attitude of openness to one another's ideas, so that each member felt free to suggest additions, deletions, and other alternations of the mind map.

Moving From Mind Map to Narrative

After the group reached consensus through mind mapping, smaller groups of two to three members were formed to translate the mind map into narrative form. The mind map was a coherent representation of the group's ideas and served as a guide for further elaboration. Each small group was then able to structure and sequence the ideas into a linear form that led directly to the narrative. After the initial draft of each section of narrative was written, the larger group examined the narrative to see if it accurately reflected the mind map. Figure 1 illustrates the translation into narrative form of ideas generated in the mind mapping process. For example, the narrative on cultivating thought shown at the bottom of Figure 1 was based on the ideas developed in one portion of the mind map shown at the top of Figure 1.
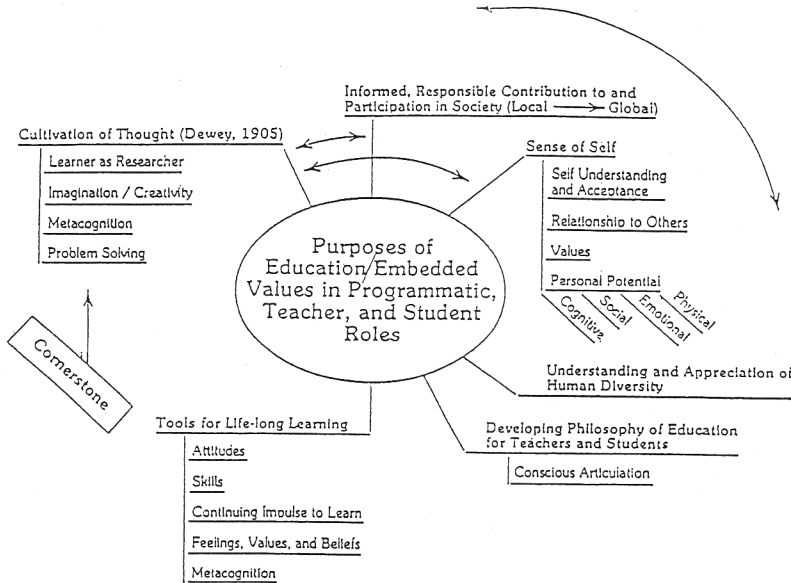
Communication to Others Through Mind Maps

Figure 2 represents the interactive influences of group thinking and individual thinking, as well as the spinoff to contexts beyond the original group. We have used the mind maps to communicate ideas that will undergird the new teacher education program, as well as to show the processes we went through to develop those ideas. In fact, we have relied more on the mind maps than on the narratives to communicate our ideas when presenting the proposed program to colleagues within the university. In one instance, our colleagues expressed concern about aspects of the curriculum for the proposed program. We responded by inviting them to construct a new mind map of the curriculum. The open-ended, collaborative nature of the dialogue that ensued allowed this group to become involved in a highly productive way about the questions they posed. Through this interaction, new ideas were brought into the planning, we understood each other more clearly, and our colleagues in another department became much more committed to supporting the new program.

We have also extended the mind mapping process to other program develop-

Figure 1
Translation from Mind Map to Narrative

Informed, Responsible Contribution to and
Participation in Society (Local ———→ Global)

Cultivation of Thought (Dewey, 1905)

Learner as Researcher

Imagination / Creativity

Metacognition

Problem Solving

Cornerstone

Sense of Self

Self Understanding
and Acceptance

Relationship to Others

Values

Personal Potential

Cognitive Social Emotional Physical

Purposes of Education/Embedded Values in Programmatic, Teacher, and Student Roles

Understanding and Appreciation of
Human Diversity

Tools for Life-long Learning

Attitudes

Skills

Continuing Impulse to Learn

Feelings, Values, and Beliefs

Metacognition

Developing Philosophy of Education
for Teachers and Students

Conscious Articulation

Foundation of the Program: Purposes of Education

It is central to the educational values of the program that the primary purposes of education include: cultivating thought, nurturing tools for lifelong learning, developing a sense of self and community, promoting appreciation of human diversity, and encouraging informed, responsible participation in society. The intent of the program is to model ways of teaching and learning which will enable future teachers to carry these values into classrooms, and in turn, be able to model these values and approaches for their own students. As we discuss these purposes of education they will apply to both the students in the teacher education program and to the students in classrooms.

Cultivating Thought

Dewey discussed the importance of teaching teachers to work independently and thoughtfully. He believed that teachers should function as problem solvers about issues of curriculum and instruction. There are principles that can serve as guidelines for solving the problems of teaching but when teachers functions as problem solvers there are no definitive rules about teaching and learning. The quality of reflection about classroom issues involved in teaching necessarily requires the use of imagination and creative thinking based on observation and participation in educational setting. Prospective teachers will pose problems about their own practice, test hypotheses, and consider the implications for teaching in different contexts. As a result, teachers can articulate a clear rationale for their decisions about daily classroom life. A key component for teaching is awareness by teachers of their own thought processes as well as the thought processes of their students. Teachers who draw from these principles will be able to provide a learning environment that will foster students' independent, creative, and reflective thinking and problem solving.
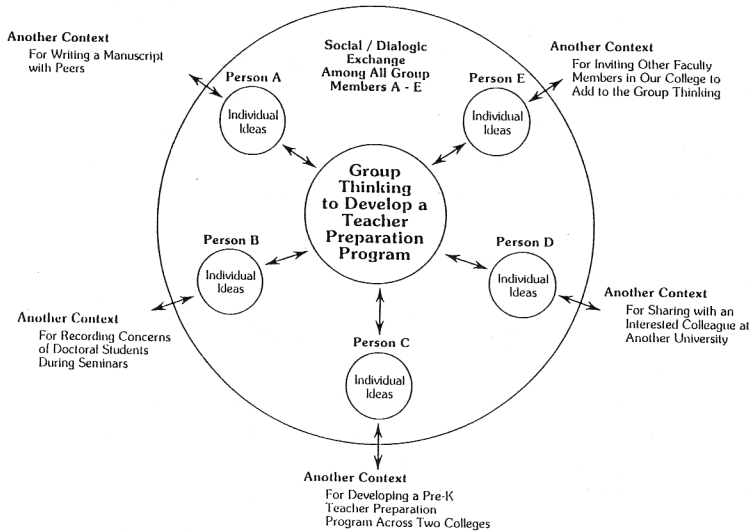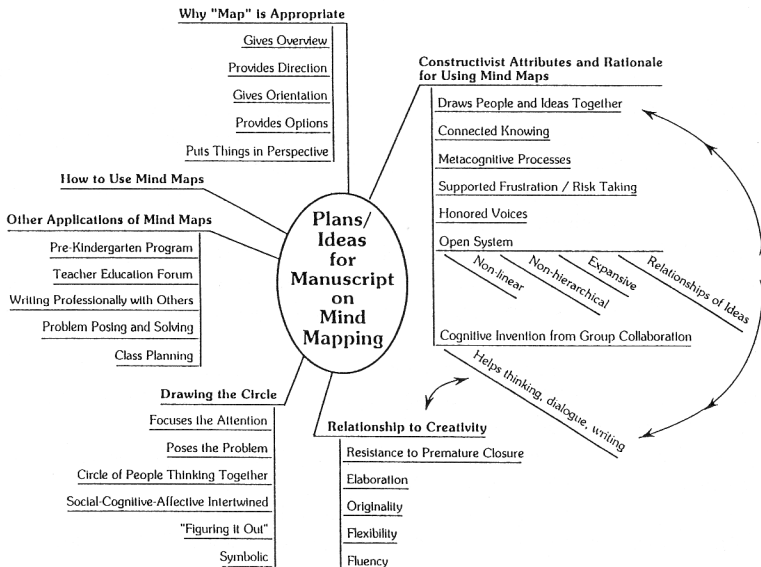
Figure 2
Contexts of Collaborative Mapping

Another Context
For Writing a Manuscript with Peers

Another Context
For Inviting Other Faculty Members in Our College to Add to the Group Thinking

Another Context
For Sharing with an Interested Colleague at Another University

Another Context
For Recording Concerns of Doctoral Students During Seminars

Another Context
For Developing a Pre-K Teacher Preparation Program Across Two Colleges

Social / Dialogic Exchange Among All Group Members A - E

Person A — Individual Ideas
Person E — Individual Ideas
Person B — Individual Ideas
Person D — Individual Ideas
Person C — Individual Ideas

Group Thinking to Develop a Teacher Preparation Program

Figure 3
Mind Map for This Manuscript

Plans/ Ideas for Manuscript on Mind Mapping

Why "Map" is Appropriate
- Gives Overview
- Provides Direction
- Gives Orientation
- Provides Options
- Puts Things in Perspective

How to Use Mind Maps

Other Applications of Mind Maps
- Pre-Kindergarten Program
- Teacher Education Forum
- Writing Professionally with Others
- Problem Posing and Solving
- Class Planning

Drawing the Circle
- Focuses the Attention
- Poses the Problem
- Circle of People Thinking Together
- Social-Cognitive-Affective Intertwined
- "Figuring it Out"
- Symbolic

Relationship to Creativity
- Resistance to Premature Closure
- Elaboration
- Originality
- Flexibility
- Fluency

Constructivist Attributes and Rationale for Using Mind Maps
- Draws People and Ideas Together
- Connected Knowing
- Metacognitive Processes
- Supported Frustration / Risk Taking
- Honored Voices
- Open System
- Non-linear
- Non-hierarchical
- Expansive
- Relationships of Ideas
- Cognitive Invention from Group Collaboration

Helps thinking, dialogue, writing

ment efforts. For example, when another group of faculty were asked to develop a pre-kindergarten teacher preparation program, mind maps were used to begin the discussion. One member came to the group with preconceived ideas of how the program should be, and was not initially open to the idea of other group members. As the mind mapping took place, there was a breakthrough that enabled her and the rest of the group to communicate more freely. Instead of defending particular positions, we were able to listen and interact more openly and collaboratively.

This paper represents a final example of the use of collaborative mind mapping for communication. Figure 3 is the mind map from which this manuscript was written.

Conclusions

Collaborative mind mapping embodies many attributes of constructivist principles, and has proven to be a highly useful tool in facilitating constructivist processes for planning a new teacher education program. Mind mapping engenders creative problem solving and group metacognitive awareness. In very practical terms, mind maps promote a smooth transition between producing ideas and writing about them. Most importantly, collaborative mind mapping enables us to develop a teacher education program in which the very processes of formulation take place in ways that are compatible with constructivist principles. Our long range goal is for coherence between the philosophical and epistemological foundations, and the structure, content, methodology, and evaluation processes of our developing program.

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