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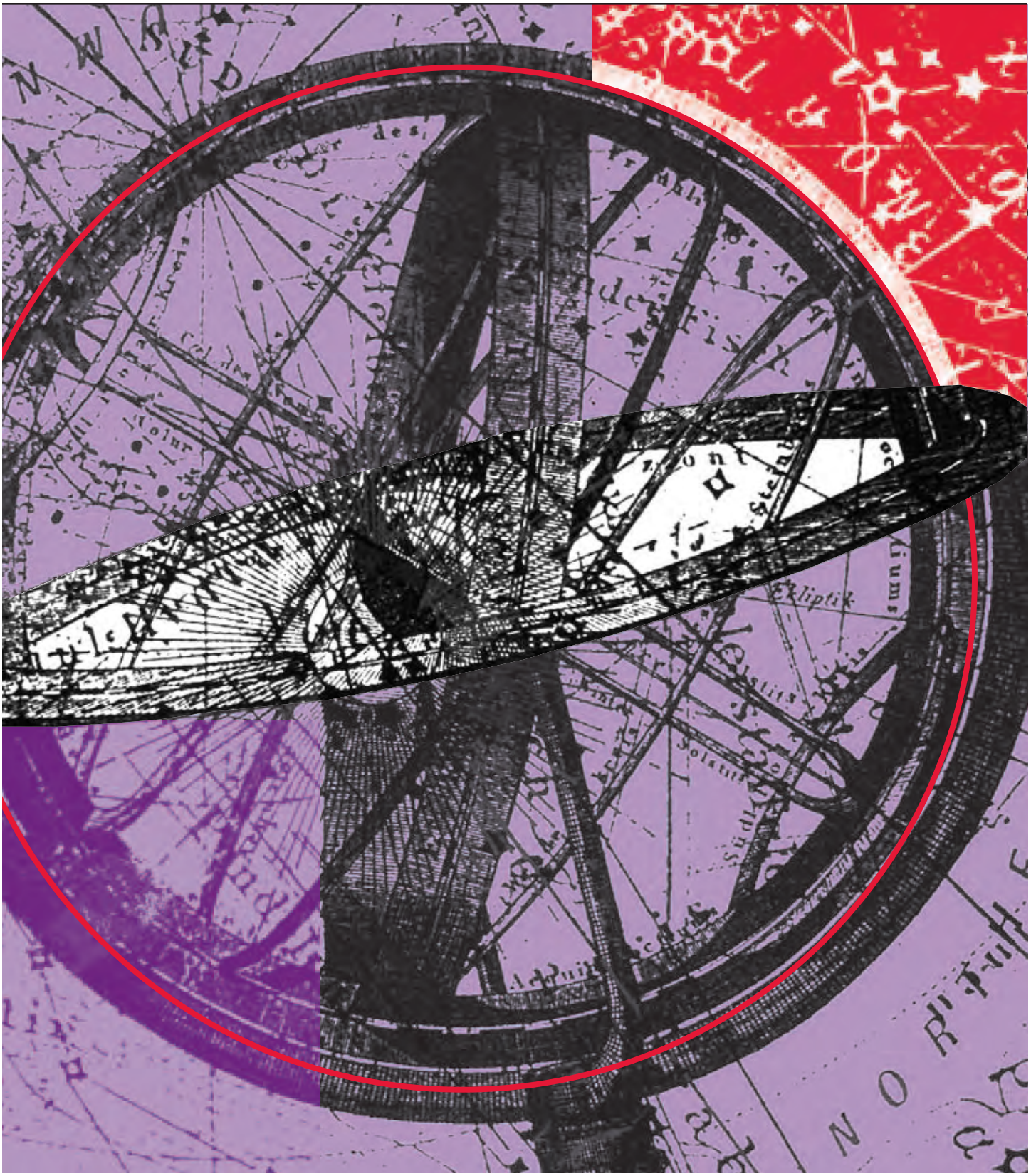

Table of Contents

The Courage To Be Constructivist Mathematics Leaders

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ABSTRACT:
In this paper, we consider The Teaching Principle outlined in The Principles and Standards for School Mathematics (NCTM, 2000) and the importance of teacher learning and continuous development in mathematics learning and pedagogy. We pose the question, "How might a professional development experience that invites teachers to become 'autonomous learners' (NCTM, 2000, p. 5) be organized?" In responding to that question, we begin, as narrative researchers, by sharing a story of collaboration in planning a summer institute about mathematics for K – 3rd grade teachers. We then unpack this story of the planning and implementation of the institute thinking about the tenets of constructivism, as outlined by Brooks and Grennon Brooks (1999), and about how these tenets contribute to the development of autonomous teacher learners.

The Principles and Standards for School Mathematics (NCTM, 2000) describe the importance of teacher learning and continuous development. The Teaching Principle states, "Teachers need to increase their knowledge about mathematics and pedagogy, learn from their students and colleagues, and engage in professional development and self-reflection" (p. 4). While many professional development activities inform teachers about mathematics or the teaching of mathematics, they may not attend to the importance of teachers learning from one another and engaging in self-reflection. In this paper, we consider the role of the mathematics leader in planning professional development experiences which honor teachers learning from one another and engaging in self-reflection. When professional development experiences invite teachers to become "autonomous learners…eager to figure things out on their own, and flexible in exploring mathematical ideas" (NCTM, 2000, p. 5) teachers enact the stance of a learner both within the professional development activity itself and within their lives in classrooms and schools. We address the question, "How might a leader organize a professional development experience that invites teachers to become 'autonomous learners' (NCTM, 2000, p. 5)?"

In a 1999 article in Educational Leadership, Brooks & Grennon Brooks wrote about teachers' courage to be constructivist in their teaching. Here, we invite mathematics leaders to be courageous and implement constructivist tenets in their planning and delivery of professional development. As narrative researchers, we start by sharing a story of collaboration in planning a summer institute about mathematics for K – 3rd grade teachers. We then unpack this story of the planning and implementation of the institute thinking about the tenets of constructivism, as outlined by Brooks and Grennon Brooks, and about how these tenets contribute to the development of autonomous teacher learners.

Story of Collaboration

In the province of Saskatchewan, Canada, until recently, there has not been a culture of measured accountability around student achievement in mathematics. As this culture shifted in the province, in response to a greater emphasis on national and international student achievement comparisons in mathematics, curriculum leaders from geographically-connected school divisions in and around Saskatoon gathered in conversation about the early identification of children experiencing delay or difficulty

with numeracy development and about enhancing teachers' numeracy and mathematics education practices within classrooms. Having switched from an earlier focus on literacy to one on numeracy, the network of curriculum leaders invited us, professors from the University of Saskatchewan, to join them in exploring professional development possibilities for early numeracy teachers.

We spent nine months in conversation with the network of leaders (called the planning team from here on in) focused on planning and implementing a meaningful summer institute about mathematics for K – 3rd grade teachers. At one meeting in March we, the two authors, proposed the following agenda for a two–day summer institute which reflected the conversation:

August 16, 2004	
8:00 – 9:00	Registration and Breakfast
9:00 – 9:20	Opening Remarks & Welcome
9:20 – 9:45	Whole Group Session: The Value of Professional Conversation
9:45 – 10:55	Professional Conversation Groups – Meeting #1
11:00 – 12:30	Key Note Talk #1
12:30 – 1:15	Lunch
1:15 – 2:00	Professional Conversation Groups – Meeting #2
2:00 – 3:30	Key Note Talk #2
3:30 – 4:15	Professional Conversation Groups – Meeting #3
4:15 – 4:45	Facilitators' Meeting

August 17, 2004	
8:00 – 9:00	Breakfast
9:00 – 10:00	Whole Group Session: Teacher Identity
10:00 – 10:15	Break
10:15 – 11:45	Key Note Talk #3
11:45 – 12:30	Lunch
12:30 – 1:30	Professional Conversation Groups – Meeting #4
1:30 – 3:00	Key Note Talk #4
3:00 – 3:30	Whole Group Session: Closure
3:30 – 4:00	Continuing the Conversation

This agenda purposefully included space for professional conversation (Glanfield, 2003) around teaching and learning mathematics. As the planning team discussed this agenda in the meeting, we talked about the abundance of professional development experiences that highlight expert knowledge and leave teachers feeling deficit in both their mathematical knowledge and their teaching practices; and we talked about the features of professional development that encourage ongoing, interactive, mathematics teacher development for teachers who are not mathematics specialists. Although the conversation made sense in the moment, for many people at the table the agenda was a step away from professional development they had typically experienced.

Shortly after the meeting we received an email from one of our colleagues on the planning team:

> I would like to share a concern I have after reflection on the weekend. I was trying to put myself in the shoes of a young mother who has paid $175.00 and arranged day care for her little ones to attend the institute. She then spends till 11:00 a.m. in children's literature and discussion groups — almost the entire morning. Will we have lost her? Do we need to get input from the keynote speaker more quickly than this?
>
> I worry that discussion groups at this stage might be a pooling of ignorance. I do not mean to sound disrespectful, but I feel that might be an appropriate way to describe what my contribution at this stage might be, without a sound philosophical basis to use for the math discussion.
>
> These are just some musings that I offer from one perspective. (email, March 16, 2004)

In response, we invited our colleague to suggest how she would rearrange the schedule to reflect her perspective expressed in the email.

Our colleague's response to our invitation was:

> Day one: Plug the keynote speaker in right after the opening remarks, and then go with the optional plan — share the value of professional conversations as well as spend time with the professional conversation groups. I think the conversations will be richer working with info from both the keynote speaker and the value of professional conversations.
>
> After lunch start with the keynote speaker — we will have been involved in professional conversations during

lunch anyway — and then perhaps move to professional conversation groups. It would be helpful to end with a half hour recap with the keynote speaker perhaps sharing some gems from the conversations he and his co-presenter have heard in the conversations.

I'm still thinking about day two, and I guess it will depend in large part on how day one evolves. (email, March 16, 2004)

Learning from one another in the exchange, we shared the following thoughts with our colleague in response to her suggestion:

As we've been thinking about this institute, we would really like to model an approach that reflects the constructivist theory of learning.

In framing our comments, we refer to a wonderful article that we read the other day, "The Courage to be Constructivist" (written by M. G. Brooks and J. Grennon Brooks, Educational Leadership, November 1999, pp. 18-24). In the article, the authors identify five central tenets of constructivism. Two of the tenets are:

1. that constructivist teachers seek and value students' points of view. Knowing what students think about concepts helps teachers formulate classroom lessons and differentiate instruction on the basis of students' needs and interests, and

2. that constructivist teachers structure lessons to challenge students' suppositions. All students, whether they are 6 or 16 or 60, come to the classroom with life experiences that shape their views about how their worlds work. When educators permit students to construct knowledge that challenges their current suppositions, learning occurs. Only through asking students what they think they know and why they think they know it are we and they able to confront their suppositions.

So, when we were discussing what the institute schedule might look like, we really wondered how we might help the keynote speaker come to know his "students" points of view. It was in this notion, that we considered the nature of the whole group sessions and then the professional conversation groups (PCG). In the first PCG experience, teachers would be sharing, essentially what they know about who they are as teachers of mathematics and their understandings of mathematical ideas. We hope, that in circulating among the professional conversation groups, the keynote speaker will come to make sense of what the teachers know and who the teachers are. We planned for the first hour or so in the groups because of the number of people in the group. For example, if there were 15 people in the group, one hour means only about 4 minutes per person to share. . . We believe this conversation and the act of writing in the journal (introduced in the whole group session) will help teachers become aware of what they know and who they are as mathematics educators at this point in time.

When the keynote speaker begins to talk then about his ideas, we are hopeful that he will be able to "challenge his students' current suppositions" so that "learning occurs" (to quote Brooks & Grennon Brooks). The movement back and forth between the keynote talks and talks with colleagues will help teachers to regularly 'reconnect' with their own thinking. (email, March 24, 2004)

From the email, we recognized there was greater dissonance with this proposed new structure for the professional development experience than we initially perceived. We returned to the next planning team meeting looking forward to further conversation about the proposed agenda. Within the team, we found a need to ask each other to say more about our beliefs about teacher learning and to go more deeply into our own thinking about valuable professional development experiences. Without consciously intending to do so in this conversation, we answered the questions for one another, "Who am I as a mathematics leader? What do I do as a mathematics leader? Why do I do what I do as a mathematics leader?" As we did this, we realized that not only was it important that we make explicit to each other our own thinking on which our proposed agenda was based, but that we make explicit to the teachers who would be participating in the summer institute why we planned the program in the way that we did. Out of this conversation we agreed on a Program Rationale that we would share in all advertisements for the summer institute, "Coming to Know: Numeracy in the Early Years:"

Program Rationale

This two-day institute has been purposefully structured to promote and support teacher knowledge. We strongly believe teachers are holders and constructors of

knowledge and come to this institute knowing much about early numeracy and about teaching mathematics to young children. We want this time to be an opportunity for educators to:

- reflect on their beliefs and practices,
- puzzle over those aspects of mathematics teaching which cause them tension or uncertainty,
- affirm and extend their understanding within a knowledge community of fellow educators,
- develop a support network,
- consider their identities as mathematics teachers.

We will strive to honor constructivist principles of learning which are foundational in the design of classroom experiences for children — principles such as beginning with what the learner knows, honoring the learner's lived experiences, connecting what is known with what is unknown, promoting active engagement — in the structure of this two day institute for educators.

As the planning team collectively reflected on our Program Rationale, we recognized that we wanted to be courageous and embrace the constructivist principles of learning in our summer institute. As mathematics leaders we realized that we constantly expect teachers to embrace and enact constructivist principles of learning in their classrooms and yet we do not see these very same principles embraced in mathematics teacher professional development.

While the Program Rationale and proposed agenda made sound philosophical and pedagogical sense to the planning team as a collective, we were all aware of the tension and unease that some individual team members felt. Not only did team members have to trust constructivist principles of learning, we also had to trust that teachers would see value in this professional development experience. Thinking about our colleague's wonders and concerns, the planning team had to further trust that we would not "lose teachers," that teachers would have knowledge to share, that they would come to the institute with questions arising from their own practice, and that they would feel comfortable posing their questions. This was a courageous moment for the planning team as we stepped away from what we'd known as mathematics professional development into something many of us had not yet experienced. Once the team made the decision to go ahead, we carefully planned the activities for the institute, in alignment with the Program Rationale, to promote and support teacher learning. Following, we describe the types of activities that the planning team used to enact the program rationale for the summer institute.

Types of Institute Activities

Whole Group Sessions. The whole group sessions were a place in which all participants came together in one large professional community. They were a place in which personal reflection and professional conversations were framed and initiated, using children's literature and metaphor(s) from that literature.

As an example, on the first morning, after introducing the value of professional conversation (Glanfield, 2003), we read the story, *Wilfrid Gordon MacDonald Partridge* (Fox, 1984), to the large group. In this story, a young boy named Wilfrid Gordon lives next door to an "old people's home." He is friends with all of the people who live there but his favorite person is Miss Nancy Alison Delacourt Cooper because she has four names just as he does. One day he hears his parents saying that Miss Nancy has lost her memory. This prompts Wilfrid Gordon to set out to discover what a memory is. In asking his elderly neighbors what a memory is, Wilfrid learns much about memories. A memory is "something warm," "something from long ago," "something that makes you cry," "something that makes you laugh," "something as precious as gold" (unpaginated). With these ideas in mind, he then puts together a basket of his most precious treasures and presents them to Miss Nancy. As she explores each of Wilfrid's items, Miss Nancy recalls a corresponding memory of her own. With Wilfrid Gordon's help, Miss Nancy's memory is found!

In response to the story, we invited participants to recall corresponding memories of their own relating to numeracy teaching and learning — possibly a 'warm' memory of a child's learning or growth, or of their own; a 'long ago' memory of their beliefs and practices when they began teaching numeracy; a sad memory of a challenge or difficulty they experienced in their teaching or with a child's learning; a happy memory of a success or discovery they had made, or observed a child making; a memory they cherish from their lives as numeracy teachers which is as 'precious as gold' to them. We gave them time within the whole group setting to individually reflect and then depict their memory(ies), in their institute journals, through words, pictures, symbols, or schema. The memories they pulled forward then served as an entry point to their first

professional conversation group and their conversation about their knowledge as mathematics educators.

There were many reasons the planning team chose children's literature as a way to frame the professional conversations. Literacy had been a central focus in each of the school divisions for a significant period of time and we knew teachers had strong knowledge, skills, and confidence in regard to literacy practices. We also knew these teachers, typically, did not have the same confidence in their mathematics knowledge and teaching practices. As expressed in the Program Rationale, the planning team wanted to start with something familiar, something teachers knew, connecting what was known with what was unknown (or, perhaps, less comfortable).

Further, reading a story together creates an experience that everyone then shares. It provides something that each individual at the institute has in common; something that each individual can reflect upon, make connections to, work outward from. Literature appeals to people on an affective level as it evokes an emotion; it creates an opening — a desire to know — which the intellect can then fulfill. Literature is rich with metaphor. It gives people a new way of perceiving or thinking about something because it reframes it. Thinking about 'a numeracy teaching life' as 'a memory basket' — a collection of memories that are current and long ago, that evoke laughter and tears, that are precious for what they teach us — teachers move away from seeing themselves in singularity to seeing themselves in their multiplicity and their complexity. Teachers move away from thinking of themselves as good or bad, knowing or unknowing, experienced or inexperienced, to seeing themselves as individuals who are "shaping a professional identity" (Connelly & Clandinin, 1999) from the many educative moments of their lives. In carefully selecting children's literature for the whole group sessions, the planning team believed we would bring the conversations easily and naturally to teacher knowledge, to identity, to community, and to reflection and wonder.

Wilfrid Gordon MacDonald Partridge and the metaphor of a memory basket continued to be woven into professional conversation throughout the first day. We opened day two with a whole group session as well, this time using the story Mirror (Day & Darling, 1997) to deepen our thinking and our conversation around teacher identity. The metaphor of a mirror helped teachers to think about how who they are as early numearcy teachers and learners is mirrored back to them by the children in their classrooms, the children's parents, and their colleagues. It also helped teachers to think about what they mirror to others about who they are as teachers and learners of early numeracy. The questions the team addressed in our planning sessions, "Who am I as a mathematics leader? What do I do as a mathematics leader? and Why do I do what I do as a mathematics leader?", were reframed as, "Who am I as an early numeracy teacher? What do I do as an early numeracy teacher? and Why do I do what I do as an early numeracy teacher?" and were explored explicitly with teacher participants. We ended day two, and the summer institute, with a final whole group session and a story entitled, I Wish I Were a Butterfly (Howe, 1987), another selection about identity; one which reminded us to celebrate the gifts we have as early numeracy teachers and to consider how we will share those gifts with our students and within our professional communities.

Professional Conversation Groups. Conversation within the professional conversation groups flowed naturally out of the whole group sessions. They were a place in which teachers could tell stories of their experiences as numeracy teachers and explore their own unfolding knowledge. "If one's knowledge is to be useful, one must feel free to examine it, to acknowledge one's confusions, and to appreciate one's own ways of seeing, of exploring, and of working through to a more satisfactory level" (Duckworth, 1997, p. 3). We wanted these spaces to be a place for teachers to talk about what they had figured out in their teaching and to puzzle over the questions that persisted for them. We wanted them to be a place where teachers could learn from one another.

The team planned a facilitation guide for the professional conversations and we arranged to have a facilitator, a curriculum leader, within each group of approximately ten teachers. Because many of the teacher participants did not know one another, we wanted to have a way to begin the professional conversations and an individual who could facilitate introductions and the development of a sense of community within the group.

As an example, in the first professional conversation group after sharing the story *Wilfrid Gordon MacDonald Partridge* as a whole group, teachers introduced themselves, responding to the questions, "Who am I?, What do I teach?, and What brought me to this summer institute?" Facilitators provided space to talk about and clarify the

purpose of the professional conversations. Teachers then partnered with someone in the group they didn't know and shared the memories that had been evoked for them in the whole group session. Following this, teachers individually made note of the things they felt they knew about early numeracy teaching and the things they were wondering about and hoping to know more about by the end of the institute. Together as a group, teachers shared and discussed their knowledge and their hopes for expanding that knowledge. Facilitators charted key points from the conversation so that this information could guide the keynote talks and professional conversations to follow.

The planning team encouraged facilitators to see the facilitation guide as exactly that — just a guide — and to let their group of participants shape the way the conversation unfolded or the direction it took. The facilitators used their teaching knowledge and skills in enacting principles of learning within their group such as beginning with what the learners know, honoring the learners' lived experiences, connecting what is known with what is unknown, and promoting active engagement. The purpose of the professional conversation groups was always to have teachers exploring their own 'coming to know.'

Keynote Talks. During our planning sessions, the team talked a lot about the positioning of a keynote speaker within the summer institute. We did not want the institute to be a professional development experience in which a keynote speaker was seen to be the holder of knowledge and teachers the receptacles of that knowledge. The team did not want this to be a professional development experience where teachers listened and processed passively while a speaker talked. We invited a speaker who would join us as a member of our professional community, who would disrupt our ways of thinking about mathematics and mathematics teaching and learning, who would stimulate questions and wonders, and who would challenge us to see new possibilities. In the invitation the team extended to the keynote speaker we shared our intentions, the program rationale, and the plans for the two days.

The day before the institute started, a portion of the team met with the keynote speaker and shared the children's literature that had been selected and the facilitation guide for the professional conversation groups. Together we talked about how the speaker would move in and out of the professional conversation groups throughout the institute to get to know the teachers and to get a sense of their teacher knowledge and their wonders. We agreed that charted information from the professional conversation groups would be brought into the keynote talks and shared with the whole group to give the speaker a sense of where to begin and where to focus the talk.

Keynote talks were a second type of whole group session that shaped the professional conversations that followed them. After each talk, teachers had the opportunity to go back into their professional conversation group to discuss thoughts that were emerging for them, connections they were making, questions that were arising, and common understandings they were developing. There was a reciprocal sense-making as teachers moved between whole group sessions and professional conversations with each space influencing the other.

Continuing the Conversation. This element of the program provided an opportunity for all the teachers from each school division to gather together to discuss how they might continue their conversation about numeracy teaching and learning throughout the rest of their school year. It was a place to determine how they could continue to support one another's learning. While the institute was a stimulus, the planning team knew the important work was going to happen in classrooms as new ideas were enacted with children.

Unpacking this Story of Collaboration

In reflecting on the program format for the summer institute, *Coming to Know: Numeracy in the Early Years*, we believe there are a couple of elements that were particularly significant in distinguishing this summer institute from other professional development experiences. There was a balance between time spent by teachers in professional conversations and time spent with a speaker in whole group talks. Approximately half of the participants' time was spent engaged in professional conversation, in the large community or within their smaller groups, while the other half was spent in whole group talks with the keynote speaker or engaged with children's literature. Further, the first whole group talk with the keynote speaker did not occur until late morning on the first day of the institute, rather than being first on the agenda of the institute. This scheduling speaks to Brooks & Grennon Brooks (1999) five tenets of constructivism:

> …first, constructivist teachers seek and value students' points of view…second, constructivist teachers struc-

> ture lessons to challenge students' suppositions…third, constructivist teachers recognize that students must attach relevance to the curriculum…fourth, constructivist teachers structure lessons around big ideas, not small bits of information…finally, constructivist teachers assess student learning in the context of daily classroom investigations, not as separate events. (p. 21)

In our unpacking, we have substituted the phrase "constructivist leaders" for the phrase "constructivist teachers" in each of the tenets.

Constructivist Leaders Seek and Value Teachers' Points of View

Within the program of this summer institute, the professional conversation groups provided the space for teachers' points of view to be expressed. This is not typical in most professional development experiences. Generally, there is no planned space for teachers to describe their lived experiences nor is there generally space to connect teachers' lived experiences and their points of view with the content of the keynote presentations. Teachers who participated in the summer institute saw that their points of view were valued when the keynote talks and subsequent professional conversations were built upon what they, in their first professional conversation, said they knew and what they said they wanted to know about early numeracy teaching.

Constructivist Leaders Structure Activities to Challenge Teachers' Suppositions

Teachers' questions and ponderings, expressed in the professional conversation groups, framed the keynote talks. The keynote speaker focused his presentations around what the teachers knew and, through his interactions with teachers in his talks, he asked teachers to question what they knew and how they knew it. For example, one of the mathematical topics that teachers raised in their professional conversations was that of children being explicitly taught the procedure to add or subtract. The keynote speaker indicated that, in his classroom, he would have children working in small groups to solve problems around addition and subtraction. By having the children share their solutions to the problems, all children in the class would come to know there are multiple ways in which one can add or subtract. This notion of multiple procedures challenged many teachers' suppositions about teaching the "correct way" to add or subtract. In this way, through his continued interactions with teachers, the keynote speaker challenged many suppositions about early numeracy and what it means to teach and learn mathematics in the institute.

Constructivist Leaders Recognize that Teachers Must Attach Relevance to the Curriculum

Following each keynote talk teachers participated in a professional conversation group in which they were able to talk about what they had heard in the keynote talk, how what they heard in the talk could translate into their practices, and what questions continued to persist for them. For example, teachers talked about how they might structure their classrooms in order to encourage the type of problem solving that would encourage each child, or group of children, to develop their own solutions. Teachers also talked about the types of questions that they would have to learn how to ask in order to invite children to share their solutions. In addition, teachers talked about focusing their teaching around number sense, the sense of "ten-ness," and the importance of spatial visualization for young mathematics learners. These conversations lead to further questions around student assessment, talking with parents, and reporting student learning. In this moving back and forth between keynote talks and professional conversations, teachers were attaching relevance to the curriculum of the institute and the curriculum being lived in their own classrooms with children. In other words, teachers were beginning to re-imagine their early numeracy classrooms in light of the sense they were making from having their long-standing suppositions challenged and in light of the way they were now looking to big mathematical ideas instead of the multitude of mathematics objectives cited in the mandated curriculum.

Constructivist Leaders Structure Professional Development Around Big Ideas

The rich metaphors (the memory basket, the mirror, and the butterfly) depicted in the selected children's literature reflect the big idea around which the institute was organized, that of early numeracy teacher identity. Flowing from our numerous conversations as a planning team, we recognized that the summer institute was not just about teachers knowing mathematics or the pedagogy of mathematics but that it was also about who they saw themselves as being as teachers of mathematics – and as teachers outside of mathematics, about the complexity of their particular classrooms and the communities in which they teach, and about the impact and complicity of their teacher judgment in each and every decision and action they take (Davis,

Sumara, & Luce-Kapler, 2000). As teachers embraced the multiple metaphors, they were given an opportunity to move away from seeing themselves in singularity as early numeracy teachers following a prescribed curriculum to seeing themselves with multiple identities in that role – as teachers, as learners, as curriculum-makers, as supporters, as risk-takers, as knowing, as wondering. They were given the opportunity to reflect on these multiple identities as situated within the complexity of their classrooms, and they were invited to make, with an ownership for their complicity, teacher judgments and decisions within their early numeracy classrooms.

As a planning team, we believed that teachers participating in the summer institute, through reflecting on their lived experiences and laying those experiences alongside those of other teachers and of the keynote speaker, would come to see themselves as individuals who are "shaping a professional identity" (Connelly & Clandinin, 1999) — individuals with a strong sense of who they currently are as early numeracy teachers, of what they do and of the suppositions underlying what they do, of what is yet possible for them and of new suppositions to consider, and of who they want to become as early numeracy teachers.

Constructivist Leaders Assess Teacher Learning

Mathematics leaders on the planning team were the facilitators of the professional conversation groups. Through their participation as facilitators in the institute they came to see the importance of assessing teacher learning in the context of teachers' daily unfolding practice. Throughout the two days in the professional conversation groups, the leaders observed that as teachers shared who they were and who they were becoming, thoughts about implications for practice, and emerging wonders, the leaders could think about the assessment of teacher learning as "enlarging the space of the possible" (Sumara & Davis, 1997, p. 303). That is, the mathematics leaders saw themselves as assessing teacher learning by listening to teachers' stories about the implementation of new practices and about how teachers were making sense of the multiple identities they now recognized they were living out. The leaders took on a role, similar to that of the keynote speaker at our institute, to find out what teachers within their school divisions knew, what suppositions they were acting on, and to consider ways in which to challenge, or affirm, teachers' suppositions. The leaders took responsibility, beginning with "Continuing the Conversation" at the institute, to structure further activities to keep professional conversation an integral part of the life of a classroom teacher engaged in "daily classroom investigations" (Brooks & Grennon Brooks, 1999, p. 21).

In interacting with one another, with their colleagues and with the children in their classrooms, we believe teachers consciously generate new interpretations of curriculum and new practices, and link curriculum and practice together in new ways. It is through being engaged with these interactions and through listening to teachers' stories of these interactions that mathematics leaders are able to assess teacher learning and to determine how to provide continuous professional development for teachers that will increase their knowledge about mathematics and pedagogy, enable them to learn from their students and colleagues, and promote self-reflection and ownership for learning.

Conclusion

The Professional Standards for Teaching Mathematics suggest that teachers should be given the opportunity to "examine and revise their assumptions about the nature of mathematics, how it should be taught, and how students learn mathematics; reflect on learning and teaching individually and with colleagues; and participate actively in the professional community of mathematics educators" (NCTM, 1991, p. 160, 168). Like Clark and Florio-Ruane, we believe "the time has come for a radical shift in thought and action in support of sustainable teacher learning and teacher research. This shift is needed to engage teachers as reasoning and responsible professionals in the process of refining their knowledge" (2001, p. 6). This shift for us requires a shift to tenets of constructivism enacted within professional development experiences.

This summer institute, *Coming to Know: Numeracy in the Early Years,* was a courageous attempt by mathematics leaders to embrace NCTM's (1991, 2000) teaching and learning principles by creating a professional development experience which provided a space for teachers to share and explain their thinking about teaching mathematics in the early years in authentic conversation (Clark, 2001). "[This] reconstitution of experience through personal narrative allow[ed] for safe exploration of uncharted territory and imagining the possible" (Clark & Florio-Ruane, 2001, p. 12). This institute began a process of continuous professional development; a process continuing to be lived in teachers' daily classroom work and in their ongoing conversations with colleagues about the "possible."

To create a professional development experience for teachers that positioned teachers as autonomous learners in "control of their own learning" (NCTM, 2000, p. 5), we, too, as mathematics leaders had to reconstitute our own sense of what it means to live out leadership in ways that reflect the tenets of constructivism (Brooks & Grennon Brooks, 1999), to explore uncharted territory in professional development experiences, and to imagine what is possible for continuous teacher learning within a community of mathematics educators.

References

Brooks, M.G. & Grennon Brooks, J. (1999, November). The courage to be constructivist. *Educational Leadership,* 57(3), 18-24.

Clark, C. M. (2001). Good conversation. In C. M. Clark (Ed.), *Talking shop: Authentic conversation and teacher learning (pp. 172-182). New York: Teachers College Press.*

Clark, C. M. & Florio-Ruane, S. (2001). Conversation as support for teaching in new ways. In C. M. Clark (Ed.), *Talking shop: Authentic conversation and teacher learning* (pp. 1-15). New York: Teachers College Press.

Connelly, F.M. & Clandinin, D.J. (1999). *Shaping a professional identity: Stories of educational practice.* New York: Teachers College Press.

Davis, B. & Sumara, D. J. (1997). Cognition, complexity, and teacher education. *Harvard Educational Review*, 67(1), 105-125.

Davis, B., Sumara, D.J., & Luce-Kapler, R. (2000). *Engaging minds: Learning and teaching in a complex world.* Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Day, A. & Darling, C. (1997). *Mirror.* New York: Farrar.Straus.Giroux.

Duckworth, E. (1997). *Teacher to teacher: Learning from each other.* New York: Teachers College Press.

Fox, M. (1984). *Wilfrid Gordon MacDonald Partridge.* London, England: Penguin Books.

Glanfield, F. (2003). Mathematics teacher understanding as an emergent phenomenon. Unpublished doctoral dissertation, University of Alberta: Edmonton, Alberta.

Howe, J. (1987). *I wish I were a butterfly.* Orlando, FL: Harcourt Brace Jovanovich, Publishers.

National Council of Teachers of Mathematics. (1991). Professional standards for teaching mathematics. Reston, VA: Author.

National Council of Teachers of Mathematics. (2000). Principles and standards for school mathematics. Reston, VA: Author.