An exploration of

Collaborative Materials Development

in adult numeracy teaching
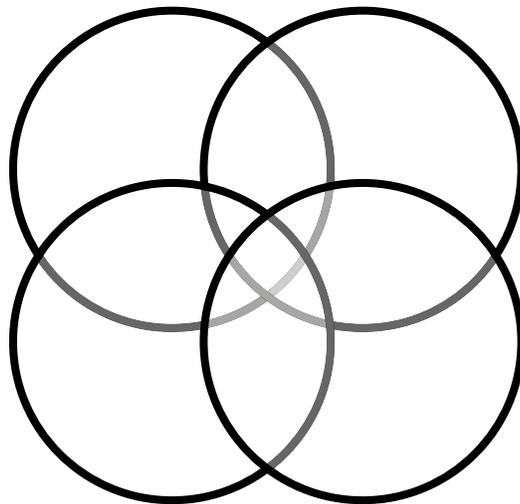
2004

Report on a project carried out at the Literacy and Basic Skills Program of the
Ottawa-Carleton District School Board

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Acknowledgements

Your Comments

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Creativity is a type of learning process where the teacher
and pupil are located in the same individual.

Arthur Koestler (1905-1983)
Hungarian-born British novelist, journalist, and critic

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Introduction

This report describes phase two of the project 'Improving Numeracy Instruction in the LBS [Literacy and Basic Skills] Program'. In phase one of the project, we surveyed practitioners and found that numeracy learning materials were much in demand and could be very powerful in the process of developing the LBS Program's capacity to deliver adult numeracy training. Practitioners need prepared materials, and they also need support in developing new ones. The process of developing new learning materials could involve practitioners in expanding their repertoires of numeracy teaching strategies and their own numeracy competence – two things they said they wanted to work on. In response to these needs, we designed a model called Collaborative Materials Development and tested it in phase two of the project, now complete. This report describes our work and our findings.

THE CMD MODEL

Our Collaborative Materials Development (CMD) model involves a 'resource teacher' in working with 'classroom teachers' to create numeracy learning materials for the classroom teachers' learners. The resource teacher is an LBS practitioner who is experienced in adult numeracy teaching, but who does not teach during the course of the project, and the classroom teachers are LBS practitioners who have less experience with adult numeracy, and are teaching classes during the course of the project. Our plan was that, to start, the resource teacher would make all the activities, and then, gradually, the classroom teachers would take over the process, having had the resource teacher's model. We aimed to make one or two units of activities for each class. All three practitioners would reflect on the process and share the results (learning materials and a process report) with the field through a presentation, a Web site, and printed materials.

This model involves several components, as portrayed in the figure below:
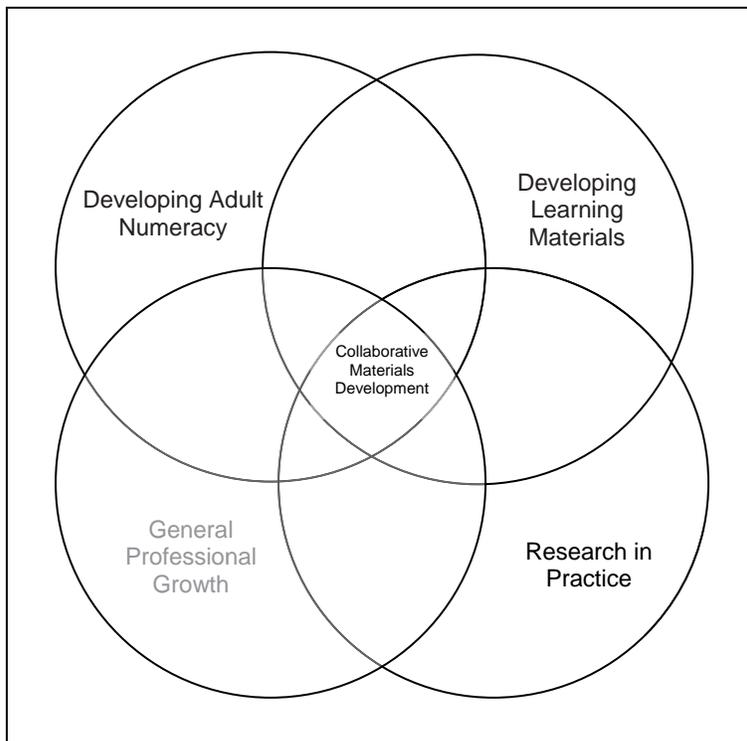
Figure 1. The components of Collaborative Materials Development

In Chapter One of this report, we describe our experiences with two of the above components: developing adult numeracy and developing learning materials. Our experiences with general professional growth follow in Chapter Two, and our experiences with research in practice are in Chapter Three. Chapter Four discusses directions that CMD could take in the future.

THE CONTEXT AND THE PEOPLE

This project was based in the LBS program of the Ottawa-Carleton District School Board, and involved that program and the LBS program of the Catholic School Board in the district. The work took place during the fall, winter and spring terms of the 2003-2004 school year. I (Lisa Hagedorn) was the resource teacher. I have several years of experience teaching adult numeracy and doing numeracy project work in LBS in Ontario. Dianne Bertrand and Bernadette Walsh were the classroom teachers. Dianne and I work in the LBS program of the Ottawa-Carleton District School Board, and Bernadette worked at the LBS program of the Ottawa-Carleton Catholic District School Board. Dianne and Bernadette are experienced LBS instructors who are beginning to explore more numeracy teaching. During this project, Dianne was teaching a lower-level class of mothers, and Bernadette was teaching a multi-level general LBS class. Bernadette didn't teach on Fridays, so that's when she tended to do her weekly five hours of project work. Dianne tended to do her five hours of weekly

project work in the evenings and on weekends. I worked sixteen hours a week on this project.

I (Lisa) wrote this report, and Bernadette and Dianne's voices are 'heard' in quotations from their written reflections.

THE ACTIVITIES

We created four theme units of learning materials for learners at Ontario LBS levels 1, 2 and 3. The four themes are:

1. Grocery Shopping Habits

2. Planning a Class Party

3. Helping Young Children with Math

4. Exploring Temperature

These learning materials are not included in this report. They may be viewed and downloaded for free from our Web page or requested in hard copy at cost from our program. At this writing, our Web page has not officially been launched. We anticipate that it will have been launched when this report is published, and that its Web address will be http://www.ocdsb.edu.on.ca/continuweb/ESL/adultn.htm. (Should this address not work, please try an internet search using the terms "Collaborative Materials Development", "adult numeracy" and "Ottawa".) To order the materials in hard copy, please see our contact information under "Your Comments" at the front of this report.

Chapter 1: Developing Adult Numeracy and Learning Materials

Developing learning materials is central to an LBS practitioner's work. Our project combined this very familiar part of an LBS practitioner's job with something most practitioners are less familiar with: developing numeracy – their own and that of the learners. We first tried to write about these two components of CMD (developing materials and developing numeracy) separately, each in its own chapter, but found that they were too intertwined. Therefore, in this chapter we describe what we did and what we learned regarding both learning materials and adult numeracy.

GETTING STARTED WITH PRACTITIONERS

Defining numeracy

To begin, we looked at the concept of numeracy and our relationships to math. To do this, we first discussed, as a definition of numeracy, the conceptual framework of the numeracy domain of the International Adult Literacy and Lifeskills Survey (Gal et al, p. 12, 1999). It follows:

Numerate behavior involves:

Managing a situation or solving a problem in a real context,
everyday life
work
societal
further learning

by responding
identifying or locating
acting upon
interpreting
communicating about

to information about mathematical ideas
quantity & number
dimension & shape
pattern and relationships
data & chance
change

that is represented in a range of ways
objects & pictures
numbers & symbols
formulae
diagrams & maps
graphs
tables
texts

and requires activation of a range of enabling knowledge, behaviors, and processes.
mathematical knowledge and understanding
mathematical problem-solving skills
literacy skills
beliefs and attitudes

Figure 2. The conceptual framework for the numeracy domain of the International Adult Literacy and Lifeskills Survey.

Our math/numeracy biographies

After this brief look at numeracy, we (the three teachers) established where we were starting from by describing our experiences of math in school, our relationships with math/numeracy now, and our expectations for the project. I feel it is important to include this here, so that readers will be familiar with our levels of expertise and experience with math/numeracy and its teaching:

Dianne wrote this of her memories of math in school:

> I don't remember anything about math in elementary school other than learning the multiplication tables in, I think, grade 2. I was very afraid of my teacher and she threatened to punish anyone, usually with a ruler on the knuckles, who didn't know the assigned table by the next day. I remember weeping and wailing as my mom practiced with me. Welcome to math.
>
> My high school math got off to a poor start. I had had a music teacher in elementary school who used to encourage us to reach the high notes by standing us on the desk and pulling our hair upwards. He later taught at the local high school. In order to avoid him, I chose home economics as an option over music. I did not know that he also taught grade nine math. Although he no longer pulled hair, he favoured the students who had chosen music. On my first math test in his class I did very well. He walked around the room handing back the papers. As he dropped my paper on my desk he said, "That's the last time you will get a mark like that." He was likely right. I took the usual high school math courses-algebra, geometry and trigonometry. I liked trigonometry the best. I have no idea why.
>
> I searched through some boxes and actually found some of my elementary and high school report cards. The math marks were sporadic. They were sometimes good and sometimes average. I think math is something I have always thought I was not, and could not be, very good at.

Bernadette wrote this:

> I don't have a lot of recollections about learning math in elementary school… I think I was confident with math.
>
> It is in high school that I hold some memories. During the first months of grade 10, I recall being worried that the grade 9 teacher hadn't taught us some concepts. I remember the grade 9 teacher focusing attention on the boys in the class. I could not relate to this teacher. The transition from my small town elementary school to a city high school was difficult. This teacher was aloof. I don't think he knew how to teach young girls math.
>
> In mid high school I didn't want to be in the enriched math class anymore. I remember going into the vice-principle's office to ask to be in the next phase down. There was one of the teacher's favourites in the vice-principle's office. He was very good at math and sciences; someone I couldn't relate to even though he was nice enough. They both tried to encourage me to stay in the enriched phase. (Now that I think of it, it was inappropriate to have had the discussion with the other student present.) After that, I didn't have as much confidence in myself learning math.
>
> I wish I had had some type of mentor or tutor at that time to help me. My mother wasn't any help. I don't recall asking my siblings, but I must have. My father tried to help me, but I think he was impatient. […]

> I was an average student, passing with a B grade, but I don't think
> there was any reason why I shouldn't have done better. Now, I regret
> not having taken a fuller range of math classes in my final years (12
> and 13). I turned more to the arts than the sciences in these years.

Bernadette wrote this about her past experiences teaching math/numeracy:

> When I started teaching ABE I focused on reading and writing skills
> because these were my strengths coming from teaching ESL. In the
> last couple of years I have tried to focus more on teaching math and
> encouraging students to do math. Their learning is still book based. I
> give them the 'Breakthrough to Math' series or 'Math for the Real
> World' and students work on chapters individually. Sometimes they
> pair up with other students who are working on the same unit. I am
> consulted when the student isn't able to follow the book's
> instructions. I have discouraged using calculators if the student says
> s/he desires to go to high school.
>
> I find the individualized book method has worked for some students.
> They have felt they've progressed and they can see their progress. At
> the same time, there are moments when I feel it would be good to
> look at math away from the books and to discuss it as part of their
> daily lives.

Both teachers reported using math/numeracy in their daily lives where necessary,
without either great difficulty or great enthusiasm.

I, Lisa, have good memories of math in elementary and high school. I remember
finishing work quickly in elementary school and doing well in an advanced math class
in high school. In CEGEP, however, I failed Calculus – I found the first class
fascinating but then skipped too many classes and did too few assignments. I've never
re-taken it, so I don't know if my failure was due to lack of effort or to the difficulty of
the material. Math was not my major in university, but I did take an undergraduate
statistics course and a graduate statistics course; I enjoyed them and did well. As part
of my B.Ed, I took one math teaching course. I taught grade five children for a year
(including math) and then began teaching general LBS. I began to focus on teaching
adult numeracy when, several years ago, our program manager decided to start a
numeracy course, and I was the most available staff member. I taught numeracy
classes for several years in the school board sector, and in the last few years I've
participated in four projects related to adult numeracy in the Ontario LBS Program. I
am not a math whiz, but I do enjoy it, and I have learned a lot from the people I have
taught.

I asked Bernadette and Dianne why they decided to participate in the project. Dianne
wrote:

> I decided to participate in this project for a number of reasons. I said
> "yes" initially without too much thought as I usually say "yes" when
> someone asks me to do something. Sometimes I regret my "yes"
> impulse. I also welcomed the opportunity to have more hours of
> work.

After I read the proposal, I wanted to participate because I have field-tested some of Lisa's work before and I knew it would be interesting.

GUILT. At the end of last year, I felt guilty when I recorded my students' lack of progress in math. We had spent the year focused on reading to young children. I knew I had not put forth as much time and effort on math as I had on reading, writing or grammar. I spend a lot of time searching for and producing new reading materials for my students and I try to give them interesting written assignments. For math, however, I fall back on the workbook and everyone very slowly plods along.

I have never been able to find interesting materials to use for math. I have tried to find life skills math activities for the students but have not been able to find worthwhile activities for students who have low math skills.

I am looking forward to seeing what weird and wonderful things Lisa thinks up. I have never had fun with math so I hope it will be fun. I hope it helps me to teach math to my students that will be useful to them in their daily life. My students have low math skills and their progress is slow, so I hope we learn some tricks to help them manage. I hope to become more enthusiastic when I think "math".

And Bernadette wrote:

I would like to improve my ability to help adult literacy learners realize how they are already using math in their daily lives. I would also like to assist them in developing further skills to be able to do what ever they want to do in life – for instance, find or keep employment, help their children with homework, improve their everyday lives in areas such as cooking, home repairs, home financing, etc.

I would like to be able to facilitate numeracy related discussions…I look forward to encouraging students to think positively about their abilities rather than focusing on negative learning experiences. From this experience, I would like to acquire some techniques to be able to bring numeracy exploration to life in the classroom. This may include cooking or home decoration or dealing with the hydro bill.

I think the varied interests and levels of abilities of adult learners in the class will be the challenge… I believe it is possible to include all students in a process of numeracy exploration, however, how the unit is developed that is crucial."

I hope to gain a greater confidence in my own ability to "do math" and a greater awareness of how math, and various forms of math are part of my daily life as well. I also look forward to the networking with and support from other practitioners that will occur during, and hopefully after this project.

Workbooks and activities

We decided to continue workbook math – not to replace it entirely with our new activities. Initially, this was because Bernadette and Dianne needed to designate math/numeracy time in their weekly schedules, and we foresaw that we would not always have activities ready for those times. We acknowledged that we were not completely overhauling numeracy teaching with this project.

Bernadette had this comment about continuing workbook math:

> I don't have a problem doing book learning. Students feel this is
> meeting their needs and that is important.

Dianne wrote:

> Right now I am doing math three times a week for about 1¼ hours
> each session. … I started with the workbooks because the students
> were very eager to begin math and the activities were not ready. I am
> OK with the decision to continue workbook math but it likely would
> have been better if we could have started everything together. They
> are now used to working on traditional workbook math 3 times a
> week. Some will likely feel that the numeracy project is taking away
> from their math work. A few do not like change of any kind.

Dianne also wrote:

> I am not looking forward to trying to get my students to embrace
> something new. From past experience, I know they are often
> reluctant to try anything different. They are quite comfortable
> working in math workbooks and may resist moving away from that.

It is interesting to now jump to one of Dianne's written reflections from the end of the project:

> I feel more effective in teaching numeracy in that I am more
> confident in using activities to teach math. Once we started the
> activities, the students saw that the activities were good for their
> children and for them as well. I would no longer be intimidated by
> some students' reluctance to deviate from the workbook.

Bernadette, comparing workbook math to the activities we made, wrote:

> Doing book math can be easier on the one hand because the learner
> doesn't necessarily have to interact with others, and can work at his
> or her own pace. However, in these activities [the ones we made],
> students have the opportunity to share and learn from each other.
> This can be less threatening than talking to the teacher. Also,
> students can immediately apply this math to their daily life. They can
> see, along with the teacher, if real learning has occurred.

Later, Bernadette also found that doing our activities helped her to make more effective use of the workbooks.

It is perhaps symbolic that the original title of this section was 'Workbooks vs. Activities', and I have now changed 'vs.' to 'and'. It is not that workbooks are 'bad' and activities are 'good'. Workbooks are a tool to help a teacher manage a multi-level class, and they have face validity for learners. Hopefully, as the field develops, more good adult basic math workbooks will be published, and teachers will learn how best to use them. Also, number and symbol manipulation according to abstract concepts is a valid thing for some learners to learn; basic math and arithmetic must be considered a part of numeracy. There are many interesting ways to teach and learn it that are more effective than workbooks. For example, John Mighton's technique for tutoring children in school math (developed in Toronto and described in Mighton's book *The Myth of Ability: Nurturing mathematical talent in every child*, 2004) may be relevant.

GETTING STARTED WITH LEARNERS

The learners' first contact with the project was the class in which we told them about the project and asked for their input in choosing a theme for the learning materials we would make. I was there when each class did this.

Dianne described how she introduced the project:

> I told my class that I had volunteered to participate in a special project. I explained that there was a shortage of materials to help adults meet their math needs and that Lisa and I would be making materials and they would be testing them.
>
> The students were interested but expressed concern that they wouldn't have time to work in their math workbooks if we spent too much time on other activities. I was a little concerned about that response, as I hadn't wanted them to see the project as separate from the math program and I had hoped they would be eager to try something other than workbooks.
>
> I think it would have been helpful to have had some kind of hands on math activity so the students would have had a clearer idea of what I was talking about. The idea of the project was too vague for them. Their children are doing math programs at school that involve hands on activities. We could have drawn from that to show that there is more than one way to learn math. Maybe if we could have done a mini activity at the beginning they would have seen the value of a hands on activity. It would have given the students (and me) more of an idea of the type of learning involved and hopefully weakened their resistance to giving up workbook time. I hope I can integrate the project into the math program so they don't see it as an intrusion.

Bernadette introduced the project by asking her students to think about their experiences learning math in elementary school, and to describe their experience of math today. Several learners said they had had hard times in school math – they couldn't concentrate, remember, or get enough help. Others had positive memories.

Some had their children's school math experience to draw on as well. Bernadette wrote:

> Students also talked about the difference between how they were taught and how their children are being taught today. It seems so different.

The discussion continued, and students mentioned using math to do their finances, to budget, to pay bills, to do construction work, to compare bike travel time to bus travel time. After the discussion, I (Lisa) lead the process of choosing a theme for our numeracy activities. Bernadette comments on it below:

> I like the way this needs assessment was done. The students were asked to look at the description pages. I think the photos helped pique their imagination and memory. They could think of areas in their lives where the theme applies (i.e. paying for bills). I also like that they had to stand up, walk around and view the pictures and write their names beside ones that they are interested in. This movement helps motivate students to interact with the content and to make choices.

Generally, our start with the students was satisfactory, but we realised that we could have spent more time talking about learners' past experiences with math, common myths about math, and anxiety, and we could have done a sample activity.

CONTENT OF ACTIVITIES

As mentioned above, our first step in determining the content of our activities was to present about sixteen possible themes to the learners, and ask them to indicate which they were interested in. We considered the results of this informal survey to choose a topic for each class. For Dianne's class, we chose the theme 'Helping your young child with math'. For Bernadette's class we chose 'Saving money on groceries'.

Determining specific content for numeracy activities within the theme was much more complicated than simply choosing the theme. We had to complicate and confuse things before we could clear them up. For example, in Bernadette's class, we wanted to draw learners' attention to the unit price for groceries, so that when a personal preference or a sale did not dictate what they would buy, they could chose the least expensive item using the unit price. This 'unit price' appears on the prices tags that are on the store shelves of the larger grocery stores in Ottawa. When we actually went to grocery stores to explore it (first Lisa went before creating an activity, then Bernadette's whole class went as part of an activity), we found the following complicating details:

- One store expresses the unit price in dollars (e.g., $0.88/100g), and another gives it in cents (88¢/100g).

- For goods that the store receives already packaged, like soup or dry cereal, the unit price is usually given per 100 millilitres or 100 grams – amounts *smaller* than the size of the package. This means that for these foods, the unit price is *less* than the price of the package. But, when learners wanted to use unit price to choose among fresh cuts of meat, where it would be very helpful, they became confused, because for fresh meat the 'unit' for which unit price is given is 1 kilogram (1000 grams) – an amount that is *larger* than the size of most packages). So, in these cases, the unit price is *more* than the price of the whole package. This required extra attention from us, and derailed some learners. We hadn't anticipated that the learners would so quickly try to use the 'unit price' tool outside of the items we'd directed them to use it for.

- Cold cuts are priced per 100 grams – not per kilogram (1000 grams) as the fresh meats are.

- Another case where the 'unit' is different is for goods that are countable, like packages of toilet paper rolls. In these cases, the price is given for each item, for example, for each roll of toilet paper, rather than a certain weight or volume.

- In the produce section, when fruit and vegetables are priced by weight, the price is usually per pound (most often on bin signs the price per pound is printed in large numbers and the price per kg is in much smaller numbers). But at the cash register and on the receipt, the price is in kilograms – making it hard to determine, when you look at your receipt, if you have been charged the price you saw on the bin.

We had hoped to give the learners a powerful, generalizable tool, but found complications. We addressed this complex situation by looking only at the prices per 100 millilitres or 100 grams, and the countable items' prices. However, if we'd had more time to look into all the pricing we would have been able to help the learners much more – perhaps not by looking at more items, but by looking at different ones. Where we thought to clear things up for the learners, where we saw something teachable, looking a little further, we raised more questions than we answered, and encountered things we weren't ready to teach. So that was a topic that we thought was straightforward and teachable, but that turned out to be more complex. We learned some ways to manage this kind of situation in the future (see 'numeracy as social practice' later in this chapter).

In other cases, it was the opposite: a topic that we – in this case, I – shied away from, turned out to be teachable, relevant and interesting. I resisted doing 'budgeting' with Bernadette's students, because I thought it was too complex, too private, and because I'm not good at it in my own life. It would have meant risk-taking for me. Bernadette and her students wanted to do it, as can be seen in the following excerpt from a discussion among learners in Bernadette's class:

L1: I keep an envelope going – from when I get a check one month until I get the next one. I put all my receipts in it to do my budgeting. Normally it's way above. When the GST comes in, that's the only time I get myself something I really need for myself. Otherwise, I go without.

L2: You need to look at how much you have and go from there. First rent, then –
     [interrupted by L3]

L3: Telephone, cable.

L4: You don't need telephone and cable.

Bernadette's comment: Everyone seemed to talk at the same time. Budgeting and deciding what are necessities seemed to create a spark.

Still, I steered them toward saving money on groceries, rather than general budgeting. Now I've looked into budgeting for another reason (Bernadette's second set of activities) and I see that there is a lot we could have done. I think that we should have explored household budgeting in Bernadette's class. In future, I will be more aware of which barriers are mine and unnecessary, and which are real.

Many other topics came up, but were discarded, simply because we didn't have enough time. Through the initial survey of learner interest, and other processes of the project, we identified many more topics than we could have made activities for. For example, Bernadette wrote:

> Reflecting on the recent learning activities covered in the class, I would like to teach creating tables and graph making in the future (although the latter I don't even know how to do). I know that the computer is a great motivation for students.

Dianne:

> There are other units I would like to work on. I would like to have a unit on using the calculator for one.

Bernadette:

> I still want to develop/do activities related to number sense and talking numbers.

Also, we saw a fundamental topic that underlay several of our activities: Intervals and skip counting. Bernadette learned from Dianne's activities the term 'skip counting'. She used the term when her learners began to do the temperature activities. When they were reading the thermometer, she explained that not every degree was identified; instead, every second degree was labeled with a line, and every tenth degree was labeled with a line and a number. This idea of intervals or skip counting is turning out to be fundamental for adult measurement. We are guessing that it could usefully be a category in a matrix of adult numeracy skills and knowledge. Further collaborative materials development would probably reveal other math topics that are important, fundamental, to adult numeracy.

Some related topic areas that we only touched on this year, but that we see the value of, were anxiety, gender and socio-economic status as they relate (or don't!) to math and numeracy learning. It would be advisable to address them in an introduction for teachers themselves, and for students. Math is like a castle – there is a moat or a forest

of affective factors around it – you have to explore the forest and/or look into the moat, then clear a path through the forest or put down a draw bridge over the moat, in order to access the castle.

As well as generating topics, CMD can also explore and identify what is involved in the process of choosing good topics in numeracy. This includes consulting learners, but also thinking about what is 'teachable', what is important to learn, what takes into account the needs of all the students, and the parameters of the LBS Program. CMD can help teachers recognise numeracy-learning opportunities, and how to help their learners recognise numeracy in their lives, or where their limited numeracy restricts them, and to feel that they can expand their competence by learning more math/numeracy themselves.

MAKING TEACHING AND LEARNING MATERIALS

Once we had the theme and an idea of content, one of us would design a learning activity, and the other would give feedback. The feedback might be changing a handout, or pointing out a problem, or adding to the task, or proposing classroom management techniques to go with the activity.

The idea that materials development would evolve from 100% my work to 100% Bernadette's and Dianne's work turned out to be inappropriate. That idea assumed that I had skills and knowledge that I would model for Bernadette and Dianne, and they would gradually acquire them over two terms. This is not how it worked, and this is not the best way to do it. Instead, the materials development remained collaborative, with us sharing our particular strengths. Perhaps I did more at first, but just to give an outline – or to start the process. Then, for the most part, we went back and forth in ways unique to each pair (Bernadette and me, Dianne and me). The way I collaborated with Dianne was different from the way I collaborated with Bernadette.

Another constructive deviation from our plan was that we found ourselves significantly adapting existing materials more than we had expected to. Either we modified existing materials to be activities (when they weren't originally) or we modified activities for children to be suitable for adults.

We found that practical skills for developing materials were important to consider; practitioners have a variety of levels of word processing skills, understanding of spreadsheet software, and knowledge of clear language and design to apply in making learning materials.

Our process took more time than a practitioner usually spends creating materials (we're guessing), because our paid time allowed us to, and because we had to communicate ideas and changes to each other – this slowing down of the process is a fundamental feature of CMD. At the mid-point of the project, Dianne wrote about the process:

I feel more effective in making teaching materials, however I also
have a greater appreciation of how much time it takes to produce
good materials.

The format of our activities

In our proposal we said we would make two 'units of activities', and, for the most part,
we have. But we found that different topics can lead to different formats of learning
materials – not necessarily in the shape of typical 'units of activities'.

In Bernadette's class, we first thought to have a similar teaching/learning process for
every activity, but this turned out to be inappropriate. We tried to make it fit, but each
activity had its own structure. In Dianne's class, where we didn't try to do this, it
ended up happening; the two introductory activities were different, but the ones in
which Dianne showed the learners games they could play with their kids tended to
follow a similar process each time. Still, planning to follow a single model for the
structure of all lessons or activities is probably not suitable.

Bernadette's units are made up of only a few tasks, rather than many smaller activities.
Her tasks fit quite well into the idea of a 'rich learning task' elaborated by Gary
Flewelling of Queen's University's Faculty of Education. He defines a rich learning
task below:

> I define a learning task as 'rich' if the task gives the learner the
> opportunity to
>
> - use (and learn to use) their knowledge in an integrated, creative and
> purposeful fashion to conduct investigations, inquiries, and
> experiments and to solve problems and in so doing,
>
> - acquire knowledge with understanding, and in the process,
>
> - develop the attitudes and the habits of a life-long sense-maker.
> (2002, p. 130):

Flewellen's rich learning tasks have much in common with Marr, Helme and Tout's
(2003) 'open-ended tasks'. Tasks that have the potential to be open-ended have the
following two key characteristics:

> **Divergence of method** The task can be approached in many
> different ways, each of which may draw on different amounts, types
> and combinations of skills and knowledge.
>
> **Divergence of outcome** The task can be taken in a number of
> different directions and/or to different levels of complexity and/or
> difficulty. (p. 71)

Marr, Helme and Tout write that tasks with these two key characteristics are only
potentially open-ended because, "there is no written task that can be guaranteed to be

open-ended. Instead, the degree to which a numeracy task is open-ended depends on how it is used in the classroom, and how students respond to it."

Flewellen acknowledges this important subtlety when he warns about 'pseudo-rich learning tasks', those for which:

> The only people getting the opportunity to make sense, unfortunately, are the authors of the tasks. In setting out the tasks for the student, the authors do most of the interesting bits, the important bits, the challenging bits, the creative bits, the significant bits, the authentic bits, the bits in which the student needs to gain experience, the bits that could empower the student and allow them to make sense, the bits that would really give the student insight into the nature of the discipline and what learning is really like. The student is usually tossed some crumbs, some of the easier bits, bits that occupy the student and take them to the end of the task without real engagement, understanding or pay-off. The authors … substitute do-able anemic tasks for tasks worth doing. (p. 131)

Bernadette and I recognised this continuum from rich to anemic tasks in our work. For this reason, as we brought a real-life task into the classroom, we didn't want to tidy it so much that we killed it. To avoid this, I found that as the project progressed, we put less information on the handouts for learners, and more in the 'Notes to the Teacher'. It was more worthwhile to give learners some real life materials and a task, and let them determine the steps they would take, rather than outlining, on a handout, the steps they should take. Where we did continue to have paper handouts, they were usually used as tools in the activity or to close the activity, to record enough that there would be a reminder of the work done – there were not many instructions on them. (For more on this, please see the next section, 'teaching strategies'.)

Still more models of planning, teaching and learning activities were found to be relevant to our development of materials. For example:

- I came across, toward the end of our project, the Equipped for the Future teaching/learning cycle for adult basic education in the United States, and recognised it as a good description of our process;

- Marr, Helme and Tout's task process cycle (2003, p. 5) was suitable as a frame for some of our activities; and

- from the field of technological education, the format of 'resource tasks' and 'design and make tasks' seemed worth exploring.

All these examples suggest a variety of formats of activities. The formats we used this year are only the tip of the iceberg. We even see how CMD could generate simple, high quality, paper and pen exercises for basic math.

'Dead ends'

In Dianne's class, we first made a unit of activities for parents to do with their *young* children, because most of the children of the mothers in the class were young (two to seven years old). When that unit was finished, we started to look into activities for parents whose children were older, in grades four and five, because a few of the mothers had children in those grades, and their younger children would eventually be in those grades. The topics for the older children were very interesting, and would have involved the students in more math content learning, but Dianne's class was changed to have the purpose of preparing learners to enter training to become daycare workers, so the higher-level activities were no longer relevant. The time spent looking into ways to help older kids initially felt wasted, but then I recognized that I had learned something, that Dianne had learned something, and that there was a foundation on which to build, or a door opened. And I'm learning that simply opening a door in the field of numeracy teaching is worthwhile work; the doors are sticky.

Preparing manipulatives and real-life materials

Much is written about the value of manipulatives in math/numeracy education. The barriers to their use seem to be limited time and money, and a lack of familiarity with them.

As Dianne wrote:

> Working on the project has made me realize that to do a good job of teaching numeracy, you need to have a well planned unit of work with hands on materials for the students to use to explore. I think I knew this before, but I cringed at the thought of gathering materials.

We tried to be realistic about manipulatives and 'real-life' materials. If we were going to ask a teacher to make a trip to buy something, or take the time to collect something, then it should be very worthwhile – for several activities, and several days. For example, the thermometer in Bernadette's class and the beans in Dianne's class.

FIELD TESTING

We field tested each activity once. Most of this was done by Bernadette and Dianne, without me being there. I only led one activity in Dianne's class and observed one in Bernadette's class, these both near the beginning of the project. It was very worthwhile for me to have experienced one activity in each class, to meet the learners and see the teachers in their classrooms. I also visited each class several times, briefly, to pick up or drop off things.

Usually, in Dianne's class, she conducted the activity and then told me how it had gone and suggested changes she'd like to make. She said, "I never thought other field

testing comments would change the activity, but this time it really changed – you could see it. I wouldn't comment this much on regular field testing." Dianne gave her students a form to fill out to evaluate how an activity had gone with their children. We put a lot of thought into the simplicity and clarity of this form but none of the learners returned it. They preferred to report orally.

In Bernadette's class, where I didn't facilitate any activities, and observed only one, Bernadette usually wrote down how the activity went. After a few activities, she talked about them with her learners and recorded and transcribed their discussion.

We could have planned to do each activity at least twice, so students could see how we'd listened to them and made changes to that particular activity, but we didn't. It would be interesting to see how this would go. We already felt that things were going too slowly. We wanted to get to the next activity.

Below we describe what field testing taught us about our activities, about teaching and learning, and about field testing itself.

Our learning from Bernadette's first activity

Here is an example of how one activity went, and how our observations of it fed back into improving the activity. This is an activity done in Bernadette's class, in which learners surveyed each other about their grocery shopping habits and then graphed the results. We had prepared three questions about grocery shopping habits (this took some time – not all questions were interesting or 'do-able') and a worksheet on which to write the question, with a table for the respondents' names and responses. We put learners into three groups and gave each group a survey question. There were two to four people in each group. We asked them to write the survey question at the top of the worksheet, the possible responses as column headings on the table of the worksheet, and their classmates' names as row headings. We decided, without too much forethought, that the groups should split up, and every learner should ask his/her question of every other learner. This meant that learners would be asked the same question two, three or four times, but by different people. We worried that this might be strange or boring, but it wasn't. The repetition was essential. It gave learners a chance to see how different ways of being asked the same question can lead you to give a different answer. And some learners reported that after thinking about their response to the same question a few times, they were better able to answer accurately. As well as giving learners practice in answering the questions, it gave them practice in asking them. Then when surveying was done, learners who had asked the same question regrouped and compared results. This uncovered irregularities and prompted re-surveying in some cases.

Bernadette and I noted that during the activity students had to use the 'soft' skills of being organized, thorough, patient, polite, using gambits to start and end short interactions with classmates. And we and the students all learned that: (a) surveyors with the same question should write their classmates' names and the possible responses

in the same order on their worksheets, so that comparing results after surveying is easier; (b) how you ask the question can affect the answer; (c) surveyors should decide in advance if they will offer possible responses or not, and, if more than one response is possible, how many they will accept; (d) respondents should listen carefully to the question and possible responses, and take time to think about their response; and (e) it's practical to have as a possible response, "other", and if the question elicits mostly the response "other", then maybe the possible responses aren't good. These are not things that the learners should be instructed in before the activity; experiencing the need for them is part of the learners' learning process. Giving these as pre-activity instructions would change this potentially rich task into an anemic one.

Students questioned the survey questions we had provided, particularly the question about shopping schedules. The question was: 'When do you usually do your grocery shopping?' The days of the week were the possible responses. An 'other' category was added to the possible responses. People did have patterns or schedules to their shopping, but some said they shopped monthly, some said they tended to shop at the end of the week, some at the end of the day. For others it depended on which store they were being asked about. That a complex situation could not be described by one or even three survey questions was apparent. We considered dropping this question from the activity before making it available for wider use, but we decided to keep it, because it had taught us and the learners a lot. It started off being the least successful question, and ended up being the one we talked the most about and learned the most from. It's an example of field testing revealing a 'problem' that we decided not to fix. Instead, we write about it in the 'Notes to the teacher' for that activity, pointing out what can be learned from it.

Fruitful struggles and fruitless struggles

Sometimes the struggles we saw the learners having meant that we had to modify the materials or teaching strategies, but sometimes they just revealed where the learning took place in the activity – they were part of the learning process. For example, after 'struggling' through the above surveying activity, a learner said, eagerly, "Now I'm ready to do it *right*." She had taught herself how to do it by doing it. Another example is that some of Bernadette's learners said that the part of the activity where they had to make a graph was the part they found both the most frustrating and the most fun.

We have written in our 'Notes to the Teacher' how the survey might be most smoothly conducted, but also recommended that the teacher let the learners figure this out on their own. The teacher should not try to cover all bases when giving instructions to the students on 'how to do the activity'. Instead, she should support them in figuring out and refining how to complete the task, answer any questions they have, and give them the opportunity to repeat the task, applying what they learned the first time. That said, there are still times when we want the teacher to direct. For example, we recommend that the teacher determine the first few survey questions, and determine the possible responses either her/himself or with input from the learners. Fewer questions will work in a survey than one might imagine. Another example is that when learners come

together as a class to share the results for their particular survey question, they should be asked to speak from the graphs they have made rather than their worksheets/tally sheets. In the class I observed, the learners made the graphs, then put them aside and spoke from their tally sheets for the discussion. They seemed more comfortable with the numerical representation of their results than the graphical one. Or, learners could speak from the tally sheets the first few times and then make graphs and speak from them – to see the strengths of each.

Another instance of having to decide if something was a fruitful or fruitless struggle occurred when Bernadette suggested that, in the temperature activities, intervals on the graph handout be the same as on the thermometer. This initially sounded like a good, simple idea. But matching the intervals up removes a learning opportunity – that is, learners won't have to learn to switch between two scales – so we have to consider whether we want to remove that opportunity or not. Also, if learners are going to use temperatures reported in the media, then there is no thermometer for the graph interval to match. Solutions could be to create one graph for each possible interval and leave it to the teacher to decide which to use, or to not predetermine any particular interval on the graph handout.

A small example of not pre-shaping a task too much occurred when I realised that it was important to me not to put a 'Totals' row at the bottom of the survey tally sheet. Instead, I just made sure there was a large bottom margin – empty space enough for learners to write totals. I wanted learners to feel that it would be helpful or interesting to add up the responses, rather than to see some empty boxes and wonder what they were supposed to put in them.

A fruitful struggle is satisfying. Bernadette had the following exchange with her learners about the activities 'How much is 100mL?' and 'How much is 100g?':

    B: Was the activity too easy? Too hard? Just right?

    L1:   We were in a group and we got different estimates. So, we figured which one was the closest estimate and we took it from there.

    L2:   We got different measurements. And it was fun to guess it. And we were wrong, and when we were right we were all excited to have guessed it.

Still, having too many activities involving struggle – even fruitful struggle – was not good. We found that it was important to step back from the individual activities and consider how they worked together, over time. One week, Bernadette said that her activities had been too intense. There had been a field trip and some cooking. She felt that several students had burnt out and stayed home. This led me to consider the rhythm of the unit – pacing – and to aim to have some build-up activities and some cool down activities around a larger 'event'. This is time-consuming fine-tuning, but worth it.

This diplomacy of teaching – when to direct, when to step back, what to control, what to leave alone, how much of a path through an activity to clear for the learner, and when to ask him/her to bushwhack, is fundamental and fascinating. It may relate to the

concept of 'optimal frustration' found in psychology. It definitely relates to the discussion of 'rich learning tasks' and 'anemic learning tasks' earlier in this chapter, and was an important consideration throughout our entire materials development process.

What are learners doing?

Teachers formed hypotheses of learners' strategies. Here is an example of Bernadette guessing at a learner's thinking that led him/her astray:

> Another issue is to recall that when the temperature is below zero that the skip counting (by twos) starts at the zero and goes down. It does not start at the bottom ball of the thermometer and go up (if that is what they are doing).

Bernadette is hypothesising about what the learners are doing – not just repeating what they should be doing – so that she can steer them right. This is an essential part of numeracy teaching: finding out what the learner's inner processes are, right or wrong, in order to use them to learn further. Within the CMD model there is room to study this further, to explore strategies to elicit, understand and use a learner's way of doing something, whether it be unorthodox, faulty, correct, efficient or inefficient.

Responding with feeling, responding to content

As well as observing the students as they did the activities, we asked them directly what they thought of the activities. In Dianne's class, the learners would tell Dianne how trying an activity with their children had gone. For example, one learner said her son cried to play the bean game. Another learner said her child slept with the bean game under his/her pillow. Another mother said that an activity had been used as part of her child's speech therapy. Lastly, a learner reported that her child thanked her for 'buying' him such a fun game.

As you can see, feelings were reported, not just intellectual and practical things.

Dianne wrote:

> We have had fun with math which is something new. I have always had at least one student who was really keen to do workbook math, but most would rather not do math at all. Everyone has enjoyed the activities. I have been surprised by the reaction to the math activities by the children. The activities have given the families an opportunity to do something fun and educational together. [A learner's] kids picked the activities over watching TV on Wednesday. That is very nice to hear. It is good to know that what you are doing in class is affecting the students and their families in a positive way. I have gotten to know the children better through the conversation and role-playing that we do and through the moms talking more about their children.

In Bernadette's class there were several instances of learners responding with feeling to content:

- In a discussion that was aimed at evaluating the activity in which learners kept track of their grocery expenditures, a learner commented, "It makes you think too much about how much you are spending". Bernadette reported this comment and noted that the learner "looked sad".

- Asking the learners to evaluate the activities resulted mostly in a conversation about the content of the activity (e.g., grocery shopping), and less about the form of the activity and materials (e.g., graphing or tallying). In discussing the survey about grocery shopping habits, learners talked about how the survey showed that most people go grocery shopping around the end of the week, so to avoid crowded stores we should shop early in the week. They didn't say anything like, 'the tally sheet was well laid out'.

- After the activity where learners collected grocery receipts, they pointed out that someone might buy food and shoes in the same trip to Zellers one day, and have them on the same receipt, and that buying groceries is related to other purchases, so it would be better if we didn't single out groceries. Here is an excerpt from that discussion:

    B: If you were the teacher, would you change this activity? What would you change?

    L1:   I'd redo it because the first time we did it, it was kind of awkward. We do clothes and shoes next time.

    L2   Not just clothes and shoes ... gifts, photo albums. Could be anything. School supplies, Christmas supplies.

Learners evaluate the activities from a different place than educators do, so their input is invaluable.

Teachers evaluate the activities

At the end of the project, I asked Bernadette and Dianne to judge the materials. I asked if they thought they would use the activities again. Bernadette wrote:

> Yes, I believe I will use all the activities. (I wish I had tried Dianne's activities. I would like to try these as well.) Since I played a part in creating the materials, they are now a part of my personal inventory. The activities are also effective.

Dianne wrote:

> I will use the materials again. I think they are beneficial for parents to use at home with their children. I also will be able to use the activities in the day care class that I am teaching, both as math

activities in the day care and as a tool to practice communication
with young children.

and:

I can't wait to use the activities as a completed unit of work.

TEACHING STRATEGIES

We learned from our field testing that *how* the materials are used is important. Below
is what we learned in several areas.

Talking math

'Math talk' came out as a fundamental part of adult numeracy development. We can
all talk to teach, to learn, and to show that we have learned. In some situations, it is
stressful – for example, with a time limit or in front of an audience. We also
discovered that teachers need explanatory devices – ways of explaining in speech or by
demonstration – almost as much as materials, perhaps more.

At the halfway point in the project, Bernadette wrote:

Reflecting on the readings I have done over the holidays, I see that I
am "talking math" much more now. I believe that the more ease I
have talking about maths, the more ease I will have creating this
environment in the classroom.

I realize "talking maths" is difficult for me. When I am in the
classroom (such as at the board) I freeze when a student asks me a
process question and I don't know how to explain it. When this
occurs, I become afraid of encouraging conversation because I don't
know which way the conversation /problem solving will go and we
might come up with the wrong answer. Like my students, I am afraid
of being seen not to know in front of others. I want to develop an
exploratory approach so that I can learn how to do numeracy talk
with my students.

When reflecting on our presentation (for more on our presentation see Chapter Two),
Bernadette wrote:

Also, doing the workshop in March and treating it as a learning
activity as well was very helpful for me. It helped me gain
confidence in my ability to do a presentation. This is another
example of 'talking math.'

Bernadette read over her reflections at the end of the project, and had this summative
comment:

> Reading over the first reflections, the importance of communication
> struck me. In my opinion, it is 'talking math', whether individually
> (intra-personal), with family, in the community (store) or in the
> classroom (all interpersonal examples) that is the first numeracy goal
> for a literacy instructor. Increasing the adult learner's comfort level
> would increase their confidence in 'doing math'.

Bernadette's reflections invite us to take math knowledge from 'over there', in a textbook or an exercise, and bring it to life in our minds and through our conversations. Explanatory devices, activities that involve talk, and a general willingness/ease in communicating about math are effective in numeracy development. CMD supports this by increasing practitioners' numeracy knowledge and therefore their confidence (two things which then feed off each other), and by developing with and for them some tools (that is, learning activities) that they can use to stimulate talk in the classroom, as well as by creating a forum for math talk among practitioners.

Group work

Bernadette comments here on the positive effects of the group-based teaching and learning strategies introduced by our project:

> I think having a common activity to work on has been positive.
> Previously, I would have students working individually on math.
> Few students spoke with each other about what they were doing or
> asked each other for help. This has provided a common discussion
> topic allowing us all to talk math at the same time.

When to learn all together, or in small groups, or individually, is always a question in these activities.

Bernadette reflected on some specifics:

> I wish I had left the students to discuss the problem within small
> groups at this point. It would have been good to see how they solve
> the problem together. Instead, we did this as a large group exercise.

Bernadette wrote, too, about some drawbacks of group work:

> With this project I have worked with the class as a large group.
> Sometimes students enter who want to work individually. The fact
> that I strongly encourage all to be involved may be a turn off for
> some students. Also, with continuous intake, students who have not
> been involved in earlier activities may need to review them before
> tackling the new activities. However, there are many students willing
> to show their work and explain to the new student what has been
> covered so far.

Bernadette, reflecting after the project was finished, on how it had affected her teaching, wrote:

> I would prefer to continue to incorporate more "lab style" learning, as one practitioner in the final workshop called it. I feel that supporting the adult learners to explore concepts together, such as how much is 100g or to survey each other and discover similarities and differences between approaches to something like grocery shopping, is very rewarding both for the learners and myself.
>
> I also feel that this approach has spilled into my teaching of reading and writing

Recognizing the different features of the three types of groupings is useful. And using all three, one after the other, is a way of building repetition into an activity. A teacher may set up a version of an activity in each grouping type, so that learners can do essentially the same activity in three different groupings, giving them the chance to learn, practice and apply what they learn.

Other things we learned about teaching materials and strategies

- We learned to start an activity slowly, holding off on giving instructions. Learners need time to explore the materials and fiddle with them, even before starting what might be considered the 'practice' part of an activity. For example, a student was "shy to look at the thermometer" in Bernadette's class.

- We learned to move away from an activity as a self-explanatory whole-paper handout, to know when to use paper handouts and when not to, to wean ourselves off paper.

- It is useful to think of the activities/tasks as investigations, as ways of making decisions. Ask students to evaluate, choose, explain or describe, prove, not just 'find an answer'.

- Role playing can be an effective learning strategy in an adult numeracy class.

- Often the teaching and learning strategies we used were expanded to apply elsewhere. For example, Bernadette's first activity involved the students in surveying each other. She took that further, not just as a lesson in data management, but as an approach to teaching in other domains, to making all kinds of decisions in the classroom and to learning about each other.

- In addition to what we normally think of as math, there are 'big things' to address in adult numeracy teaching (e.g., self-esteem, math anxiety, gender myths) and there are 'small things' (e.g., particular ways of being neat and organized), as you can see in this reflection by Dianne near the end of the project:

> I would do more on self-esteem and how to promote high self-esteem in children before I started the activities and keep coming back to that to encourage the moms to make positive comments. I would likely do readings on math anxiety as well. I would also talk

to the students and elicit suggestions about where and how to store
the math activities.

DEFINING NUMERACY FURTHER

There are many conceptualisations and definitions of numeracy. Coben presents
thirteen pages of them in her 2003 review of research in adult numeracy (pp. 9-21). As
we worked, our definition of numeracy was elaborated on in the direction of two of
these many conceptualisations: a holistic view of numeracy competence, and numeracy
as social practice.

Holistic View of Numeracy Competence

The model of Holistic Adult Numeracy Competence underlying the 2003 publication,
Rethinking Assessment: Holistic Adult Numeracy Assessment (Marr, Helme, & Tout)
was considered by Bernadette in relation to her learners, and by me in relation to the
increased numeracy competence of we three practitioners. This is the model:
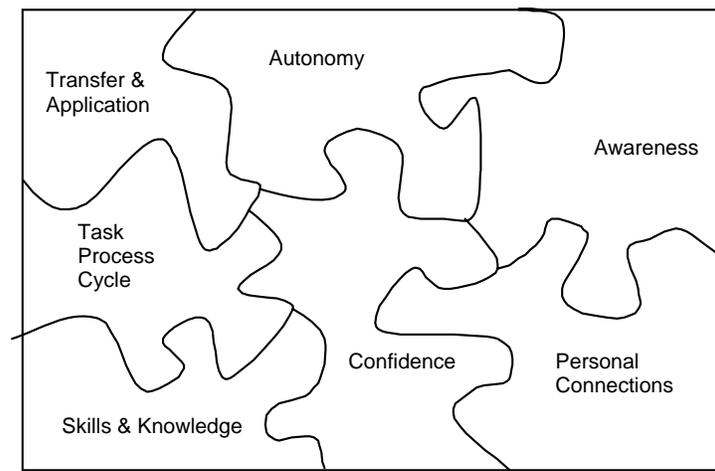
Figure 3. Marr, Helme and Tout's model of Holistic
Adult Numeracy Competence (2003).

Competence in numeracy is most often associated with competence in skills and
knowledge (the piece in the bottom, left-hand corner of the puzzle); it is sometimes
expanded to include the task process cycle (the piece in the centre of the left-hand side
of the puzzle) and may be expanded further to include transfer and application (still
further up the left-hand side of the puzzle); it is only rarely (at least in practice)
associated with the other four pieces of the puzzle (autonomy, awareness, personal
connections and confidence). As we worked on this project, we all developed our
skills and knowledge; for example, Bernadette and I developed a sense of how much 1
gram, 100 grams, 1 millilitre, and 100 millilitres were, and Dianne wrote:

> I feel more effective in the topic my students chose which was how
> to help their children with their math homework.

What was new and surprising to us was the power of our development in the areas represented by the least commonly identified puzzle pieces: autonomy, awareness, personal connections and confidence.

Before Bernadette had encountered this model, she wrote about her increased autonomy and confidence:

> I am able to involve more people in a numeracy-related activity.
> Previously, I would only provide workbooks for students, now I am
> able to create activities and materials on my own, based on the
> students' desires and prior knowledge. I was able to do this for
> communication related activities, but did not feel confident for
> numeracy related activities. Now I feel I have an approach in store
> for when I see a common need.
>
> I am more relaxed. Even if a student is working in a workbook, I am
> more able to promote a dialogue approach to learning. I will ask the
> student to go through the steps. If a student has an alternative
> approach, I will ask more questions to find out how they are arriving
> at their answer.
>
> […]
>
> In all, I feel more confident in using realia as a basis for lessons.

In the areas of awareness and personal connections, Dianne became aware of pattern as an important part of mathematics and numeracy, and made strong personal connections between that idea of patterns and her own sophisticated craft-making.

The above are brief examples of how Marr, Helme and Tout's model can be used to organize and describe how our competence increased because of this project. And the support also goes the other way: our experience in the project supports the validity of their model. In our experience, the middle and the right-hand side of Marr, Helme and Tout's model (i.e., confidence, autonomy, awareness and personal connections) must indeed be considered important components of adult numeracy competence.

Numeracy as Social Practice

Recognizing numeracy as social practice helped with many of the tangles we got into. It didn't necessarily untangle them, but it acknowledged them, explained them and helped me determine which ones we could realistically 'comb out'. Johnston explains numeracy as social practice like this:

> Rather than an immutable, discrete set of mathematical concepts and
> skills, numeracy can be seen to consist of multiple practices, shaped
> in part by broader social activities. The choice of particular
> procedures to solve a mathematical dilemma in any given situation is
> influenced by social and cultural factors in the immediate and

> broader context: by its purpose, by the roles and relationships
> between participants, by their views about maths and other values.
> (Johnston et al, 1997, quoted in Johnston, 2002, p. 20)

At first, we weren't sure what to teach within a theme, how best to match content and skills with real contexts and put them into an activity 'package'. Also, we ran into barriers because what we thought would be straightforward, wasn't. Through this, we learned a lot about the social practice of numeracy. For example:

- Dianne's learners didn't want to reveal to their children that they didn't know too much math, so we had to work around this.

- Bernadette's learners didn't want to study 'Buy now, don't pay until next year' contracts or the alternative financial institutions (e.g., Money Mart, Payday Loan). They said it was "best to just stay away from them".

- Sometimes you can't buy a larger package of something, even if it is cheaper in the long run, because you can't afford to spend that much at that particular time – that is, you can't afford to save money.

- Dianne wrote:

> Looking back at what I wrote about the parent's comments and
> excitement about doing the activities – I hope that what I remember
> from this is what is normal daily interaction with a child for me is
> not necessarily that of my students. I am likely more "teachery". For
> example, as I take my grandson up the stairs, we count the steps. I
> don't know if that is learned or natural for parents but most of my
> students do not do it. Maybe they are too busy worrying about
> providing basic needs. Although the kids' reactions, like sleeping
> with the dots under the pillow, were touching, it was also a bit sad.

I'd like to describe an interesting episode in which the social practice of numeracy 'interfered' with our teaching. It occurred in our unit on temperature. Bernadette's class put a thermometer on the windowsill, and recorded and graphed temperatures. Bernadette wrote about this one day:

> I asked students to state the temperature. -2ºC was the answer. [A
> learner] said that the forecast she'd heard on the radio that morning
> said it was -16ºC. I asked the students to look in the newspaper. -6ºC
> is what they found for the day's high. We readjusted the
> thermometer to be out of the sunlight, and it lowered to -4ºC;
> however, the students still did not want to change the temperature
> from what they had first read.
>
> […]
>
> [A learner] looked up the temperature in *theweathernetwork.com* and
> found the temperature to be -11ºC.

That's five different temperatures, none of them 'wrong'. There were five potential answers to the question, 'What is the temperature today?'. They varied according to

the source, the purpose of the measurement, the time of the measurement, and whether they were predictions or actual measurements. The weather forecaster's predicted high and low are useful in the morning when you're deciding what to wear to work or school. The thermometer outside the window is important if you're going outside right where the thermometer is. Knowing the temperature is for all kinds of reasons. What are the learners' reasons? As well, other questions may be asked. Having a thermometer (or two) outside the classroom window may be appropriate to answer the questions: What is usually the hottest time of day? What is usually the coldest time of day? What is the difference in temperature between a shady spot and a sunny spot? For this last question it would be good to have one thermometer in the sun and one in the shade, and to graph them at the same times, hourly rather than daily. It is understandable that a teacher stumbling upon this situation in class would consider the variation a 'problem', but the fact that we encountered it in the context of CMD meant that we could recognize the variation as richness that, with the right preparation and materials, learners can engage with and learn from.

Another instance of the social practice of numeracy changing our teaching occurred when we were working on unit price for grocery shopping with Bernadette's learners. Our activities focused on the grocery items that we thought learners would buy often (e.g., canned soup, pasta, toilet paper), and that nicely demonstrated the idea of unit price. This was a good start, but we found that learners very quickly moved from these items to the unit prices of items that we hadn't prepared to look at, for example, meat and milk. These were items that they really wanted help choosing among. The meat counter at the grocery store was a place where the variety in cut and size of meat made choosing difficult, and unit price could really help. Differences in the way unit price is used for these products, as compared to the ones we'd already looked at (see 'Content of Activities' earlier in this chapter), meant that more teacher support was required here, and initially we weren't prepared to give it – we didn't have clear explanations ready. Also, we saw other slightly different ways that unit price was used for still other items, and felt overwhelmed by the need to explain them all. The topic seemed to have exploded. But, if we'd paid attention to what the learners were telling us – that they could really use unit price for certain items – then the topic would have been manageable. We needn't explain everything. Instead, perhaps we could have started this unit by asking learners what kinds of grocery items they have trouble choosing among, and then looking at ways to help make those choices (and one of the ways could be to look at the items' unit prices); this would give purpose and boundaries to our look at unit price. Both this way of doing the activity and they way we actually did it require the teacher to be ready to translate back and forth between a complex real life situation and more limited classroom activities, and to know a lot more about unit price than she will perhaps use with her learners. She doesn't know what parts of unit price will be most useful to these learners until she gets into it with them. If a practitioner is doing this unit as part of CMD, then she has support and time to explore all that might be useful, but if she is trying this out without support, then the social practice of unit price might be overwhelming. Giving practitioners techniques for moving from complex 'real life' to classroom learning would be very valuable (for example, determine with learners a specific problem or question that you will answer, related to

the topic you're studying, and it will guide you through the larger topic), and is something that CMD can do.

Without prompting from me, Bernadette and Dianne expressed interest in knowing more about their learners' social practice of numeracy. Bernadette wrote:

> I would like to know what students do when they come across math related problems in their daily life. Do they let others solve the problems? Do they try to solve the problems in their own way? I would like to have a series of questions related to math in daily life that I could ask the students. This way I could see how they apply math concepts in their daily lives.

Dianne wrote:

> Ideally, I'd like to follow them for a day to find out what they can and can't do.

In general, we found that the idea of numeracy as a social practice was central when we were adapting real-life numeracy tasks to function as numeracy learning tasks in the classroom, and when we wanted to know what kinds of numeracy skills learners already had.

ASSESSMENT OF STUDENTS' LEARNING

We have focused on assessment of common learner interests (in choosing the themes) and on formative assessment during and right after each activity (as described in the 'Notes to the Teacher' that accompany each activity).

Initial assessment

Experienced numeracy practitioners in a study by Marr, Helme and Tout (2003, p. 68), reported the following about using paper and pencil tests as tools in initial assessment:

> Numeracy teachers felt that, as well as being a very unsuitable introduction to the nature of the future numeracy classes, this was not a realistic assessment of students' numeracy abilities.

We agreed, but the teachers felt that something beyond a survey of interest in certain themes was necessary, so they each did reluctantly use a paper and pencil test.

Bernadette wrote:

> I used the "Math for the Real Word" (New Readers Press) pre-test to assess the level of the learners. […] The test has two sections. The first section assesses recognizing numbers, rounding, comparing, adding, subtracting, multiplying and dividing (some with decimals). The second test assesses adding and subtracting with decimals,

adding hours and minutes, fractions and percents. Students who were able to complete the first section, then go on to do the second section.

Unfortunately, some students did not understand the concept of the test as an assessment tool, even though I explained that this test would help me know what to teach. I heard "Did I fail?" or "Could you explain to me how to do this?" When I answered that all would be explained, but not at that moment, some students were confused. Others did understand the concept of an assessment tool.

Dianne wrote:

I gave each student a short basic skills test to try to get some idea of where to start in the workbook. I am not happy with this method because:

- It makes some students nervous

- It doesn't give me any idea of how they manage mathematically in their daily life

- Unless you are helping your child with homework, topics such as long division are not used every day anyway.

I do not know how else to assess their math/numeracy abilities. I have tried quizzing them as to what math they use every day. Most tell me they have no problems managing. Ideally, I'd like to follow them for a day to find out what they can and can't do.

Both teachers would have preferred a better method, better tools, and a few weeks, in order to determine learners' levels and needs.

Formative assessment

In the 'Notes to the Teacher' for each activity, we have a section on formative assessment. This section includes what to look for in learners' performances, and how to give feedback so that they engage with the material as fully as possible and learn the most they can. This is the area of assessment that we have most fully addressed.

Ontario LBS learning outcomes

Our activities integrate, with numeracy, skills and knowledge from Ontario's LBS component learning outcomes of Communication (i.e., read with understanding for various purposes, write clearly to express ideas, and speak and listen effectively), and Self-Management and Self-Direction. Though we present our activities as numeracy activities, most of them are equally speaking and listening activities, and several are reading activities. The component learning outcome least often addressed is 'write clearly to express ideas' – though it is still present in several of the activities, and we frequently mention methods for increasing the written component of an activity.

Bernadette wrote:

> I'm learning that a variety of LBS outcomes are included in
> numeracy work. There are writing outcomes as students write
> reflections on numeracy related experiences in their lives. There are
> reading outcomes as students read about situations, such as Canadian
> trends in purchasing food. There are self management and self
> direction outcomes related to how students approach the subject area
> and their confidence building practices.
>
> I also learned that there are other outcomes, which are not explicitly
> written in the LBS documents. Skip counting, as Bill referred to it,
> isn't mentioned in the outcomes. He said that this is related to
> recognizing number patterns (Use Number Sense and Computation
> level 1).

As Bernadette noted, important skills and knowledge used in our activities aren't listed in the success markers of the LBS matrix of learning outcomes. Were CMD to continue, it could contribute to further development of the LBS matrix of learning outcomes.

As well as bridging LBS domains, our activities bridge LBS levels. Learners at levels one to four may undertake our activities and have satisfying learning experiences, though the work they do will be to different degrees of sophistication. And, with the repetition that is built into each activity, learners have the opportunity to complete them with more and more sophistication. In the case of these activities, it is more useful to give the learner's performance a level than to give the activity a level.

Summative Assessment

At the midpoint in our project, our advisor, Bill Day, commented that our materials would benefit from having more summative assessment materials with them. We agreed, but have been unable to provide summative assessment materials, due to time constraints. We recognize this absence as a weakness of our product this year. We would have liked to create demonstrations for each unit, but we haven't. We are left with the hope that teachers' own ideas for demonstrations will be stimulated by seeing learners do the activities (and that the notes to the teacher will them help in doing this), and the knowledge that the activities will generate concrete artifacts of the learning process that will be helpful in portfolio assessment.

PRESENTING THE ACTIVITIES TO FUTURE USERS

The notes I wrote to Bernadette and Dianne, to accompany and explain a new activity, evolved into the more formal 'Notes to the Teacher' that now go with each activity. Our advisors confirmed the importance of this kind of support for learning materials. In the notes, we wanted both to present practical, concrete information about how an

activity might be carried out, and to look deeper into the content – to 'milk' the activity for all it could teach us about numeracy and the learners' skills and knowledge. To bring the activity to life in the mind of someone who was reading the notes and deciding whether or not to try the activity, we realised it was important to emphasize what the students do – how they contribute to the activity – and not just what the teacher should do.

In reviewing the notes to the teacher, I had in mind the tone of many Australian learning materials that I've come across. They are professional, and yet one senses real people behind them. They are clear and useful, friendly, not always slick. They convey a sense of collegiality. I hope our notes speak to practitioners in this voice too.

Though the materials on temperature are now accompanied by notes to the teacher, these notes are much less directive than other activities' notes, and, originally, they didn't exist. The temperature materials were an experiment in giving learning materials to teachers without also giving ideas for how to use them. In our case, Bernadette took the materials and began using them right away, though, in hindsight, she wished she'd thought it through more. Dianne thought she would try to use some of them, but didn't, because her class was too disrupted. I would conclude, perhaps obviously, that learning materials without supportive notes are better than no learning materials, but that learning materials with supportive notes are even better. And, what is best, according to practitioners who attended a presentation of our materials, is the chance to assume the role of the learner and try out the activity, led by someone who knows it well.

Our activities and notes are available for purchase at cost from our program, and we also present them as downloadable PDF documents on a Web page. (At this writing, the page has not officially been launched. We anticipate that its Web address will be http://www.ocdsb.edu.on.ca/continuweb/ESL/adultn.htm, but that may have to change. If that does not work, then an internet search using the terms 'adult numeracy', 'Collaborative Materials Development' and, perhaps, 'Ottawa' will find the page.) This report, too, will be available on our Web page, and it can be a further support for practitioners who are using our learning materials.

Chapter 2: General Professional Development

The CMD model created a climate that was conducive to general professional growth for practitioners, that is, growth that falls outside of materials development and numeracy teaching.

A CLIMATE FOR GROWTH

Corcoran, in his report to the United States National Governor's Association (1995), writes that effective professional development is embedded in teacher work, recognizes teachers as professionals and adult learners, provides opportunities for reflection and coaching, and is collaborative. All of these are features of CMD. The professional development in CMD is embedded in teacher work (developing and using learning materials), and we feel that it recognizes the teachers as professionals. Bernadette and Dianne had the following responses to the question, 'Do you feel that you are respected as a professional in this project, that your competence as a teacher is recognized?'

Dianne wrote:

> I feel that I am respected as a professional in this project. Lisa is always willing to listen to ideas and incorporate them into the activities.

Bernadette wrote:

> The coordinator of the LBS Program, the administrator and the Continuing and Community Education principal were all happy to

> see that I was involved in this project. Co-workers showed interest
> too by attending the presentation in March and by requesting to
> borrow materials. I believe this interest conveys respect for what
> I've tried to achieve – an increased competence in teaching
> numeracy.

It was also important to me to work with, rather than against or in spite of, the teachers' teaching responsibilities. I asked them, 'Do you feel that the practical requirements of your teaching responsibilities are recognized in this project?'

Dianne responded:

> The practical requirements of my teaching responsibilities have been
> recognized by Lisa. Lisa has re-arranged her schedule to fit my
> teaching times.

Bernadette responded with a simple, "Yes."

CMD indeed provides opportunities for reflection and coaching (Corcoran's third feature). This happened in all our communication: in our meetings, in our e-mails and phone conversations about activities, and in our written reflections. This opportunity helps the teachers, and contributes to the knowledge base of the Literacy and Basic Skills field. This is because, as well as fostering a climate in which professional growth can occur, CMD also creates an opportunity to record how it occurs. We can document the impact of our project work on our daily practice, and thereby learn more about how change, professional growth, and policy implementation occur. For example, Bernadette, Dianne and I have learned to appreciate the time that goes into developing good learning materials, and we've experienced the benefits of pausing to answer nagging questions about content or teaching (for example, "Why does the idea of patterns keep coming up?").

The fourth and final item in Corcoran's description of effective professional development, that it be collaborative, is central to our work, and merits its own section in this report.

Collaboration

People involved in our project would agree with Corcoran that collaboration contributes to the effectiveness of professional development. Here is what Bernadette, Dianne, and our advisor, Maria Moriarty, have written about it:

Bernadette wrote:

> I really like the fact that we are three practitioners working together
> (with you as mentor/practitioner/researcher). This is something I've
> dreamed about.

Maria wrote:

The collaborative aspect of this work, the opportunity for LBS instructors to have support in materials creation, and ready access to an expert resource teacher is likely to be attractive to instructors who are often short of time and often have difficulties in finding practical resources and in adapting existing resources to the needs of their students.

Bernadette also wrote:

The strengths of this kind of professional development are the opportunities to share experiences, work collaboratively, and learn from each other. Recently I woke up one morning thinking that literacy practitioners need learning circles to do their job. There are so many facets to our work – we are working with many people who have suffered many disadvantages in life. Doing math can even trigger memories of abuse for some. (It may be writing for someone else.) For me, having a supportive network is essential on a variety of levels – to gain ideas for approaches to content, to gain ideas on how to support learners individually and when they work in groups, etc.

At the end of the project, she wrote:

Knowing that there was someone there to ask questions to, to double check results or even the content or approach to a lesson helped me relax and gain confidence. I knew my role and my tasks. I was able to do far more than I would have been able to do alone.

I will remember the students' interest and collaborative spirit as well as they attempted the tasks assigned. I will especially remember their interest and learning while taking and analysing surveys, as well as comparing approaches or results when taking measurements or temperatures.

Dianne wrote:

The strength of this kind of professional development is that I was able to give feedback from doing the activities and get almost instant results or answers. I felt that my input made a difference. I have field-tested work from other projects but never knew if suggested changes were made. The one to one interaction was great.

The collaboration within the CMD model provides support for practitioners in taking risks and innovating – partly because the resource teacher's visits to the classroom are a signal to learners that something out of the ordinary is going on – an experiment – and that it might be different from what they may think of as school work. It shows that their teacher is taking the risk of learning, and that we're all learning together.

Bernadette wrote:

As I have mentioned before, I have wanted the opportunity to explore ideas and reflections on teaching more with my colleagues. This project was an answer to prayer.

Exposure

We experienced a minor tension between private and public. This report and doing activities with learners make our work public. Were there any things we did that we did not want made public? What was private? What might we avoid doing if we thought it might be made public? For example, what were we comfortable writing in our math biographies? Who would read them? I had the experience of uneasily telling members of the Numeracy Work Group of Ontario about some of my own learning in this project – learning about math, about teaching, about working collaboratively with colleagues, that I had at first hesitated to talk about, because it could be seen to reveal what I hadn't known or been able to do before – and being encouraged by the work group's supportive interest. I had felt I had to talk about it in that forum because I was essentially asking Bernadette and Dianne to do the same with me. Also, Bernadette and Dianne had my promise that any time our work was made public (at Numeracy Work Group meetings, at our presentation to practitioners, in this report), they would have the chance to remove any part of it. Having this veto power and trust made meaningful work possible.

I asked Bernadette and Dianne, at the end of the project, if they would have preferred to do professional development more privately – not involving their learners so much, and not with colleagues. Dianne wrote:

> I wasn't uncomfortable with either my learners or with you. I think it
> is good for the learners to see teachers learning too.

Also related to exposure, Dianne read *Dancing in the Dark* (Niks et al, 2003) in the middle of the project, and initially thought the researcher/practitioners revealed too much about their struggles to carry out research, but, at the same time, was glad to hear it. I had the same experience (for more on this, see Chapter Three).

It seems that though we felt somewhat exposed, it did not end up being a problem. On the contrary, it was a relief, and eventually it strengthened us.

Seeing further

As well as feeling seen, we did a lot of seeing. We saw each other's programs, we met practitioners from our region at our presentation (described later in this chapter), we met people from outside Ottawa at the advisory meetings, and we read about practice and research elsewhere in Canada and in other countries. Also, in the future, we hope to hear responses to this report.

It was great that Bernadette and Dianne were from different programs. This meant that we were exposed to different administrators' styles, different teaching hours, different classes offered, and differently-laid-out training plans (among other things) which were refreshing. As well, it was interesting to note the similarities. We wondered if even more exchange between the classroom teachers would have been good: reading each

other's written reflections, sharing materials more, visiting each others' classrooms more, perhaps.

The presentation we gave allowed us to see a little further a field, with practitioners from our area, whom we had never met, attending it.

The advisory committee meeting took us to an even higher lookout. Dianne wrote this about the first meeting of the advisory committee meeting:

> The meeting gave me an appreciation of the research side of adult education. Although I have read articles before, I really didn't have much idea of the kind of research being done or how much is being done. Listening to the advisors talk made me feel part of something important. I felt very good about the project by the end of the meeting.

Bernadette saw what each person could bring to the meeting of our advisors:

> I enjoyed meeting with all of them. Maria brought information about the materials that are available and what is lacking in the literacy field here in Ontario and nationally. Bill brought an expertise in teaching maths. He was encouraging and gave added information. … Trudy brought her knowledge as an administrator and how this project fits into the larger field – LBS requirements and various organizational needs.

This 'seeing' of the larger field can affect how one sees oneself. Bernadette wrote:

> I feel that I am now considered someone (practitioner) that does numeracy teaching. I know we all do it, but I hadn't really framed an image of myself in that way.

She also wrote:

> I think the whole project is affecting my work. I think this meeting [the first advisory meeting], and the subsequent readings you have provided, helped me see that what we are doing is something that is needed. Collaborative materials development, collaborative research, research in practice, and inclusion of adult learners in the process are all aspects of current literacy trends.

Finally, the readings we did – from British Columbia, England, Australia, and an international collaboration – brought us our longest view.

GROWTH WITHIN THE ROLE OF RESOURCE TEACHER

Defining the role

When we got underway, I needed a title, so I chose 'resource teacher' because it seemed practical, neutral and possibly accurate. I chose it over 'researcher', 'mentor', 'expert', and 'advisor'.

At first, my work felt like teaching, but different in some ways. Then I realised that what I had thought were the differences were simply an expansion of how to teach, and, specifically, how to teach adults – how to be an adult educator. I will be a slightly different adult educator now. This parallel between my relationship to Bernadette and Dianne, and Bernadette and Dianne's relationships to their learners was picked up by Bernadette and Dianne, as can be seen in the following two examples. Some things I did with them, Bernadette and Dianne used with their learners, as Bernadette did when she used my questions from the first written reflection to introduce the project to her learners. A second example is when Dianne wrote:

> I imagine that my students feel much the same as I did at the beginning of the project. They look at the teacher as the expert and are sometimes hesitant to express their opinions or draw on their own knowledge. They likely look to me for solutions in the same way I looked to Lisa.

Acting as the resource teacher in this project required me to bring together skills I had from teaching, from doing an MEd, from giving presentations, and from my personal life. Where I had to do something new, I followed the examples of people I knew in my professional life and my personal life. I also consulted colleagues and went to the public library.

At one point early in the project, I felt that my role was like having clients, determining their needs and keeping them happy, serving them; I felt that I was in customer service, like a real estate agent or an advertising account manager. I had to be scrappy. I had to learn what Bernadette and Dianne's styles were. I had to be a nimble communicator.

Also, I needed a lot of people skills beyond the ones I've used as a teacher and workshop facilitator over the past twelve years in literacy. I needed to balance 'Telling instructors what to do' with 'Asking instructors what I can do for them and their learners'. I had to figure out how to encourage, through my manner and our work plan, openness and directness in reflections; a key to this was to guarantee that Bernadette and Dianne had veto power over what would be shared.

As Maria Moriarty noted:

> The major challenge to this model I think is around establishing and maintaining good communication between the instructors and the resource teacher.

[and]

> Here are some of the qualifications/qualities that I think an effective resource teacher would need to have:
>   - substantial subject knowledge
>   - experience in materials development
>   - superior communication skills – both verbal and written
>   - people skills – the job would require ongoing discussion/negotiation with instructors
>   - teaching experience in adult basic education
>   - understanding of the principles of adult learning
>   - understanding of the LBS framework

Maria has described the role very well.

Planned vs. spontaneous

I often had to ask myself, "What should I/we plan in advance, and what should I/we determine as we go?" This was relevant in the following parts of our work:

Making Materials – Guessing how much time each teacher's tasks (mine as well as Bernadette's and Dianne's) would take was tricky. A task might take one teacher a long time, and another teacher less time. We didn't track exactly how much time we took to do each task. Also, some weeks a teacher had no time for the project, or there was nothing to do, and other weeks there was a lot to do. It was important to be flexible, yet responsible, and to keep discussing tasks and deadlines.

Reflecting – I thought at first that we would reflect every week, or after every activity, but we didn't. Instead, I chose when we would do a written reflection based on when I wanted to know what Bernadette and Dianne thought of something we'd done, or to capture their experiences. At those moments, I e-mailed them some prompts to guide their reflecting. After a while, it became obvious when we should do a written reflection; we just knew that we had something to say. Also, Bernadette, of her own record, wrote several classroom reflections on specific activities. Reflecting became almost a drive or a reflex.

Reading – I provided readings at the beginning, halfway through the project, and when a topic came up. This combination of pre-planned and spontaneous reading seemed to work well.

Holding Meetings – We had to decide when to hold meetings, how to manage them, how to record what happened in the meetings and how to follow-up on what we said we'd do. These are skills that will have become automatic for many adults in the world of work at similar points in their careers as we were at, but, I venture to say, are not central to the work of an LBS instructor, and so may not be automatic for them. I once tried having an agenda that I passed out, but it really wasn't necessary. I needed just a plan for me, with room for others' ideas. We each took our own notes during

meetings, instead of one person taking minutes, knowing better after a few meetings what we needed to note in writing, and what we didn't.

Capturing what happens

I saw in action the difference between speaking (conversations at meetings and over the telephone) and writing (e-mails, written reflections and field notes). I feel it now, when all the talking and doing is finished, and I am combing through the written artifacts as I write this report. Conversation is alive but it evaporates. Writing is more time consuming, and in some ways more restricted/ive, but it lasts.

When to be a presence and when to withdraw

I always faced the question of whether I should be a presence or whether I should withdraw. Should I go into the classrooms? Should Bernadette and Dianne meet without me? Should Bernadette and Dianne do the presentation without me? How much direction should I give in the written reflection prompts? Looking back, I see that my answers to all of these questions were to be a presence: I went into the classrooms; Bernadette and Dianne didn't meet without me (except for a few times when I was late for meetings); Bernadette and Dianne didn't do the presentation without me; I gave prompts for written reflections. Here, we see again how the collaboration stayed strong throughout the project, or, how the collaboration required a leader to stimulate and coordinate it.

OUR PRESENTATION

We gave a 2-hour workshop at the end of our project, and learned quite a bit. I had imagined that each teacher would do a separate presentation to a group of her choice, perhaps her immediate colleagues, or a group of practitioners outside the city, but Bernadette and Dianne preferred to work together and not to travel. Bernadette spoke with the executive director of our literacy coalition who then managed the event planning. I originally stepped aside, said, 'you two do it alone'. They agreed, but then we decided I would join in, perhaps because some leadership was needed, and it was hard at that point for one of them to begin leading the other.

I had experience in giving presentations – though without formal training (I had facilitated two workshops approximately six times each in different Ontario cities, and given approximately ten other presentations on numeracy and plain language to various groups). Bernadette had some experience:

> Besides the practice for my adult education diploma, and TESL certificate program, I had presented at TESL Ontario on assessment using the Canadian Language Benchmarks.

Dianne wrote this about her experience before the presentation:

> I had not had very much experience speaking in front of colleagues.
> I gave a farewell speech a couple of years ago for a colleague in
> front of a large number of staff at a year end celebration. I also did a
> presentation in front of about 20 people when I was involved in a
> small company producing literacy kits for children.

We met to lay out a presentation outline and divide the time and topics among ourselves. Then we developed our parts separately and met for two rehearsals – one of them videotaped. I welcomed the opportunity to consult books on public speaking and giving presentations and workshops. I learned and passed on some practical tips (for example, write out what you will say, double spaced, 14-point font, number the pages, have a lively opening to engage, think of it as a conversation in which you need to pause to give the listeners time to respond in their heads to what you're saying).

I will let Bernadette and Dianne speak (write) for themselves about their experiences giving the presentation, below.

I asked Bernadette and Dianne, "Before we gave the workshop, which parts of doing it did you feel confident about, and which did you feel would be a challenge?"

Bernadette wrote:

> I worried that I wouldn't be able to finish a thought, that I'd forget
> something important because of nervousness. I tend to rush when I
> get nervous. I have to remind myself to slow down. I also become
> shy, and worry about the audience's perceptions and so may not
> enter into a dialogue with the audience.

Dianne wrote:

> The challenging part was getting up and speaking. I felt confident
> that our materials would impress the audience.

I also asked, "What do you think about how we prepared to give the workshop? For example, what did you think about how much time we took to prepare, how we decided what to do in the workshop, how often we met, what kind of support we gave each other, how you prepared your bit, how we rehearsed? Is there anything you think you needn't have done to prepare, or something you would like to have done?"

Bernadette said:

> I felt that it was well done. I liked how you took time to revise the
> procedure as we went along. I think you constantly consulted us,
> which I appreciated.
>
> Having two dry runs was good. I believe the three of us met often
> enough, however I feel I should have practiced on my own more
> before the first dry run. (I tend to want to cover too much in too short
> a time.)

On the other hand, possibly a third dry run would have helped us get a better feel for the timing of the workshop.

I also like how you gave us suggestions for giving a talk. I reviewed the suggestions, put the font at a larger size and lengthened the spacing between lines. I practiced a few times to allow for pausing and intonation for emphasis.

Dianne said:

We did a good job preparing for the presentation, due to Lisa's organization. I wouldn't change anything. By having planned rehearsals I did a lot of practicing and editing so I would be ready for the rehearsals. The rehearsals helped me to make revisions and I appreciated the comments from Bernadette and Lisa. I think Bernadette and I needed Lisa's gentle prodding to get going.

I asked, "What did you take away from seeing yourself on video tape?"

Bernadette said:

This was a positive, and not a threatening experience. It gave me ideas on how to position myself, what type of movement to promote or avoid (which way to look or walk), and how to emphasize parts of the talk.

However, I believe it would have been more effective for me, had I fully prepared for that session (instead of just winging it).

Dianne protested the idea of doing it, then agreed to it, and after wrote:

Seeing myself on video was interesting. It made me want to practice more.

I asked, "What did you think, or feel, or notice, while we were giving the workshop? For example: How did you think we were doing? What vibes were you getting from the participants? Were you nervous, excited, un-inspired, pleased, proud, embarrassed, etc.? Did anything that happened strike you as particularly interesting?"

Bernadette wrote:

I enjoyed giving the workshop, and I believe the participants enjoyed it as well. I felt the numbers were just right for this first workshop.

The workshop was jam-packed with information. I think you, Lisa, gave a good opening. Also, the surveying exercise went well. I heard participants discussing with each other possible adaptations to the exercise. Their questions and comments showed that they were thinking about their own experiences and how their students would react. I appreciated the comment from [a participant], who said she liked the experiment-type format, we used. She felt this promoted dialogue and true learning amongst students.

Dianne's presentation went well. Participants could see the carry over into their own programs. I wondered if Bill's suggestions could have been explained (about how the card could be adapted for addition, subtraction, and multiplication exercises).

I feel that I should not have attempted to explain the "How many drinks?" exercise as there wasn't enough time. The class surveying was my demonstration of an activity.

Dianne:

I was nervous and excited while giving the presentation. I felt proud of the materials.

I asked, "Your classroom teaching and giving this workshop are similar in that both involve leading, explaining to, and listening to adults – but how are the two situations different?"

Dianne:

Classroom teaching and giving a workshop feel very different. I am not sure I can explain why. My class is likely a more easy to please audience. I have been to workshops that I felt were a waste of my time. I didn't want my audience to feel like that, particularly after giving up their free time to come. People have a lot of expectations when they go to a workshop. They want to learn something, be entertained, and get materials that they can use. A workshop feels more like a performance than classroom teaching does. Although workshops are interactive, the interaction is very planned. Often in classroom teaching, if someone suggests something interesting, we take a different path than the one I had planned. With the workshop, we try to keep everyone on track. (Maybe a workshop is just really well planned teaching.)

Bernadette:

A workshop is a one-time event so it is important that participants get immediately the information they need, have the opportunity to practice, ask questions, and network with other colleagues.

In the classroom, students could get the information in one session, and practice it in the next. There is more time to explore content.

…

As much as instructors, students enjoy checking out each other's perceptions and sharing their own. The needs are similar, but I feel, the classroom is not as time-constrained as a workshop.

I asked, "Was there anything you experienced/learned from giving this workshop that you will apply in your regular teaching or in giving future workshops?"

Dianne:

My teaching would be better if I introduced new material or units of work with all the preparation and props that go into a presentation. We spent a lot of time though thinking about the various parts of the presentation to ensure an interesting introduction and flow. This year I have invited several speakers to my class. They have all given mini "workshops" which my class seemed to enjoy.

Bernadette:

I am more aware of the need to go over content beforehand, and allow for dry runs. I am also more aware of the need to keep it simple, and not to present too much content at one time. Participants need time to explore the content and come up with their own solutions. They will retain more and learn more in this manner.

And, in a later reflection, Bernadette wrote:

I also think having had the opportunity to do a presentation with Lisa and Dianne has helped me gain confidence in delivering PD to colleagues. I have avoided the opportunity to give workshops, thinking that I had nothing unique to share that would benefit my colleagues. Even though my segment was too long for the time allotted, I appreciated the opportunity to practice it a couple of times, and to take the time to write up the whole script. I learned both from Dianne and Lisa during this exercise.

I asked, "After having given this workshop, are you more or less keen or confident about giving workshops to colleagues?"

Dianne said,

I feel a little more confident about giving a presentation but no more eager to do one.

Bernadette said,

Yes, I feel more confident. This is the first time I treated a workshop as a learning experience – slowly going through each step – practicing often, reviewing how the talk and content is presented (i.e. overhead, posters, displays), videotaping it, and constantly revising the content. […] This was very helpful.

I think I'll try to incorporate these practices when I do workshops to colleagues in the future.

I felt that the presentation went well, and I think the participants' evaluations support this feeling. They were asked to rate the presentation on a scale from 1 (lowest) to 5 (highest): Five of the seven gave it a 5, the remaining two gave it a 4. Some comments were, "Hands on adults stuff great. LBS appropriate and applicable", "I love hands-on. This keeps it fresh so I can use immediately", and "I enjoyed it and it is really good to see people developing resources that are practical and useful and fun for students and facilitators (teachers). Also good to see the commitment of instructors to this topic".

MISCELLANEOUS PROFESSIONAL GROWTH

We learned several other things, too:

- Dianne learned how visual she is – she says she had no idea before.

- Dianne saw the need for and the benefits of role playing – not something one generally associates with numeracy and math.

- Dianne said she would next time be more organized about e-mails, and perhaps print them out more often.

- Bernadette wrote:

> I like to rush in, I need to take time to think through the process (do the activity) before giving it over to students.

- Dianne learned that not all parents speak to their children in "a way that educates them":

> My teaching has changed in that doing the activities made me realize how much practice and skill it takes to talk to children in a way that educates them as well. It was not easy for many students. I now try to not assume that my students know how to do this.

Chapter 3: Research in Practice

Though our project proposed to engage practitioners in 'action research', we find now that the paradigm of 'research in practice' is more suitable. Because our use of the research in practice paradigm came only partway through the project, it is not used to frame our entire report – only this chapter. I have questions about how to apply the paradigm to our work, but it was not in the project plan or budget to consult with an expert. Therefore, this chapter may be taken as my side of a conversation with an absent university-based researcher. I hope this chapter will help university-based researchers see where they are needed in this kind of endeavor, and how we might work together.

ARE WE DOING RESEARCH IN PRACTICE?

I asked myself this question often and, at about the mid-point of the project, concluded that, yes, we were doing research in practice. It is interesting to note that I had to think about it a lot. Now, looking back, I am sure that we were doing research in practice, but all of us, in our own ways, had to push hard for quite some time to access the idea of research – it wasn't an open door. We faced the sticking point that Horsman and Norton describe in this quotation: "Although plans to encourage practitioner research are often met with interest, few practitioners regard themselves as people who carry out research" (1999, p. 2).

Here is Dianne, reflecting on reading the first two issues of *Literacies* (the Canadian journal *Literacies: Researching practice, practising research*) during the Christmas holiday:

> Reading the articles made me realize how little I know about the
> research community. Because colleagues have been involved in
> research projects, I did know that practitioners occasionally do
> research. I have glanced through articles but, like the author of
> Practitioners Making Time to Read and Write, I never found time to

really reflect on them. Practical, everyday teaching problems take up my day and often preparing for class takes up a lot of extra time. When I "research", it is to find teaching materials that I can use in the classroom. No one I work with has ever said, "You should really read this" so I am assuming my co-workers are not reading research material either. Even our PD days typically focus on outcomes rather than research.

I am not sure if we are doing research in practice or practising research. I feel like I am researching when I scour the internet for ideas. When I am making and testing the materials, I feel like a teacher, not a researcher.

Most of the readings, I found interesting. I was especially interested in the articles on literacy practitioners who are doing research.

Bernadette also reflected after reading the first two volumes of *Literacies*:

I enjoyed reading through the articles you mentioned in these two publications, plus a few more that caught my eye. The area of research in practice interests me. Often, as a literacy practitioner, I feel overwhelmed by the various issues involved in the adult literacy classroom. There are life and family issues that people bring to class whether past or present. There are learning issues, whether through interruptions with schooling, learning disabilities or second language confusions. There are also economic realities. Research in practice is a way of actively learning from what I'm experiencing daily – to take the time to see what is in front of me, and to truly assist the adults in the programs to achieve their goals.

In "Making Connections" Literacies 1, page 3-4, Richard Darville says, "It is research when teachers experiment with learning materials, with the phrasing of explanations, or with learner involvement in program organization, and make findings about what works. It is research when practitioners carry on discussion and debate, seeking to share and to clarify their understandings, or to pose and address problems."

I would agree, and add that research happens when learners are involved with the development of learning materials.

I like how Margaret Herrington kept referring back to and including the adult learners in her article "Literacies?" (Literacies 2 p.35-39). She mentions listening to learners about what they have to say about processes and outcomes, recording what they say, reflecting and analysing, discussing the analysis with students and speaking and writing with students about the new knowledge.

If the above are the first steps towards research in practice, then we are doing it. Research is happening when we conduct surveys: when the practitioners survey the adult learners, and when the adult learners survey each other. Surveying also nicely falls under the LBS Numeracy Outcomes for "Data Management and Probability."

For myself, I felt pretty sure that we were doing research in practice when I read the passage by Richard Darville that Bernadette quoted above, as well as the two descriptions of research in practice below, which clearly match our work.

The first is a definition from Horsman and Norton (1999):

> We use the term research in practice to include a range of ways that practitioners might engage in research, but also to explicitly identify reading and reflection as important ways for practitioners to engage with research. Research in practice includes:
> - reading and responding to research
> - reflecting on practice in light of research
> - applying research findings to practice
> - doing research about practice
>
> We think it is particularly important to include reading and reflecting as part of research in practice. (p. 2)

The second description is from Quigley and Norton (2002):

> Reasons for supporting research in practice
> - improving practice / encouraging critical reflection
> - responding to state / regional needs
> - hearing practitioners' and learners' voices
> - linking/rethinking research and practice
> - creating new knowledge
> - creating visible research culture
> - encouraging practitioner research
> - informing and challenging policy
> - providing professional development (p. 3)

Finally, at an advisory committee meeting, our advisor Maria Moriarty (who is a member of the steering and editorial committees of *Literacies*, and who therefore knows research in practice when she sees it) told us, "This is real research in practice."

WHAT IS OUR RESEARCH DESIGN?

I didn't specify a research design in the project proposal, beyond saying that we would test the CMD model to assess its feasibility and value. I hadn't anticipated how strong and varied the research elements of this work were. I didn't propose to involve university-based researchers, even simply as advisors. I thought this project existed outside of 'real' research. I wasn't well-acquainted with research in practice at the time. Now it is the idea of research in practice that requires or invites me to formalise this work a little more. Perhaps I may say that we used an emergent design, a post hoc design. There are so many approaches to research that name, to some extent, what we've done. For example, qualitative observational research, narrative inquiry, ethnography, grounded theory, descriptive inductive research. Which one would have been best? None of them? Is it relevant to apply one of these approaches within

research in practice? Our research design is still emerging as I write, as you can see in the following sections about who the researcher(s) was (were), what the research question(s) was (were), and what the data, methodology and findings were. Without a more expert research advisor, I felt it was more honest, and perhaps useful at this point, to leave things open than to adopt one specific research design – to ask questions rather than state 'the way it is'.

Another debate regarding research design occurred while I read the 2003 research report *Dancing in the Dark* (Niks et al); I struggled to decide whether or not our project could be considered collaborative research. I flip-flopped from 'yes' to 'no' and back again many times. Then I settled on 'no', for this reason: Collaborative research meant sharing control, tasks and decision-making in the *research* process (Niks et al, p. 73). We did share control, tasks, and decision-making, but not in the overall *research* process, rather, in the *materials development* process. So I concluded that we were doing collaborative *materials development* rather than collaborative *research*. Which didn't mean that we weren't doing research – we were doing research, it just wasn't collaborative. It was more concurrent, or parallel. I was researching the CMD model, and Bernadette and Dianne were researching numeracy teaching by experimenting with activities and by reflecting and reading. This report is my analysis of my data, and I wish we had planned for Bernadette and Dianne to write reports analysing their data (i.e., their written reflections, their notes and their memories of how the activities went, what the learners did). Even now, though, I can switch back to thinking that we *were* doing collaborative research – or wondering why I need to decide one way or the other. Here too, a university-based advisor would be helpful.

The struggle to fit into a research mold may be thought by some to be deadening to lively enquiry in the field. I don't think so. I think this project has done the divergent work of seeing all that is there, the potential of the CMD model, and now, were it to be repeated, there is an opportunity for some convergent, focused work, perhaps according to a particular research design, or several concurrently, within this model.

WHO IS THE RESEARCHER, OR WHO ARE THE RESEARCHERS?

I entered the project thinking I was a researcher, and I leave the project questioning that. Bernadette and Dianne entered the project thinking they were not researchers, and leave it more ready to think they are or can be.

Am I a researcher? I have taken courses in educational research as part of a masters degree; I have designed and carried out two other joint provincially and nationally funded projects; I designed this project. Yet, I found my research knowledge and skills lacking in this project. Does CMD just need a resource teacher with more research training, or does it need the researcher to be a separate person from the resource teacher? If the CMD model were to be used again, would someone like me be the resource teacher, or would the resource teacher be more of a researcher, or would a

university-based researcher be added? At this point, I think that adding another person, a university-based researcher, would be best.

A university-based researcher would have helped in the following situation: I've been at times uncomfortable writing this report, saying things *about* Bernadette and Dianne, instead of *to* them or *with* them. Having my voice in the body of the report and theirs in quotations makes them subjects rather than co-researchers. Our relationship during the materials development was different than it is as I write this. As well, I naturally write '*we* thought this', '*we* decided that', when, if I really think about it, actually '*I* thought this' and '*I* decided that'. [After reading a draft of this report, Bernadette wrote: "It's OK by me to say 'we' – I find you're restating what we did accurately."] After I replaced 'we' with 'I' where necessary, I felt uncomfortable – there seemed to be too much of me in the report, acting on them. I would be more comfortable shielding myself behind more 'we's or perhaps more passive sentences, or being talked about, along with Bernadette and Dianne, by a fourth person. Or is the personal voice in this report a strength?

In one of her reflections, Bernadette says that we're all doing research: me, Bernadette, Dianne, and the learners in Bernadette's and Dianne's classes. Perhaps, who is considered a researcher and who or what is considered a subject depends on what the research question is, and who reports the results.

WHAT IS THE RESEARCH QUESTION?

An overarching research question comes from the first part of the title of this project, which is 'Improving Numeracy Instruction in the LBS Program' and which leads to the question,

> Does CMD improve numeracy instruction in the LBS Program?

Three more research questions were in my mind as I worked on the project:

> What can we learn together about how to develop adult numeracy –
> our own numeracy and that of learners?

> What can we learn together about the process of developing learning
> materials in LBS?

> Does the CMD model develop worthwhile knowledge and effective
> practice, and how might it be modified to do this better?

Research questions came up in Dianne and Bernadette's work. In Dianne's work there were several questions, among them:

> How are patterns relevant to adult numeracy?

> How can role playing help in an adult numeracy classroom?

How does the research process go?

In Bernadette's work some of the questions were:

How is talk relevant to adult numeracy teaching, and how can it be improved?

How might group work go in an adult numeracy classroom?

If the learners were considered researchers, what would their research question(s) be? Perhaps:

How can I explain to my teacher what and how I want to learn in math/numeracy?

Several research questions were being (informally) addressed at the same time. Were we to do this again, we might capture more of this in research reports not just from the person in my position, or a university-based researcher, but also from the classroom teachers and the learners. As well, a university-based researcher could help us to identify and focus on specific questions.

WHAT ARE OUR DATA AND METHODOLOGY?

Our data are Bernadette's and Dianne's written reflections, my field notes, our e-mails, learners' comments, our learning materials, and our advisors' comments. They were generated by the processes of making learning materials, writing reflections on our work and reading, which, together with the analysis that went into writing this report, make up our methodology.

The first part of our methodology – making learning materials – is described in Chapter One of this report. The remaining three parts of our methodology (reflecting, reading, analysing) are described below.

Reflecting

My reflections were recorded by hand in several notebooks that make up what I call in this report my 'field notes'. At first this was just my 'to do' list, then I used it to record ideas I had and things I observed and learned, so I began calling it 'notes to myself', and, finally, after reading about research, I called it 'field notes'.

Classroom teachers' reflections were written in response to me sending them prompts (questions) by e-mail, after significant episodes in the project. Bernadette and Dianne typed their responses into word processing documents, and e-mailed them back to me within one or two weeks. I always hesitated to prompt when it was time to reflect; I felt that it made a difference if a comment the classroom teacher made was something they decided to talk about or if it was in response to a question I asked. Did I draw

their attention to something, or did something attract their attention on its own? Though I always said at the beginning of a request for a written reflection that they could ignore the prompts if they wanted to, and at the end of the prompts that they could write on more if they wanted to, I don't think they ever did this. (However, Bernadette, without prompts from me, reflected in writing on all her activities.) I think that reflecting in response to prompts generated more feedback than reflecting without prompts would have. It is a way of 'making the familiar strange', of drawing teachers' attention to things they usually don't have time to dwell on. I hold up a mirror (the prompts), and the teachers describe what they see in it.

We all felt, at times, like Deborah Morgan, who wrote:

> Slowing down long enough to reflect on my practice was sometimes tedious, frustrating and even personally painful work. However, it was also exciting, eye-opening and worth the effort. (2000, n.p.)

This echoes a statement from Sheila Stewart, in Volume 1 of *Literacies*:

> What an irony that as literacy practitioners we can become alienated from the power of our own reading and writing. [new paragraph] Research can help us tell our side of the story. (2003, p. 22)

Here is Bernadette, about the effort it takes to reflect in writing:

> I was reminded of how reflecting on lessons took time, but how it helped me be aware of all that was happening during a math activity (the content of the lesson, the need for or lack of props/teaching aids, the prior learning of students, the motivation for learning that particular day, and interpersonal dynamics, etc.)

Reflection can also simply be an aid to memory; Bernadette, when asked if this project had given her any insight into her students' experiences of learning, wrote:

> By continually reflecting on what was happening in class, I believe I recalled more what was happening – interpersonal dynamics, the need for more instruction, or the need to break content down into smaller steps.

Near the end of the project, Dianne wrote:

> I see the value of reflecting on my teaching more than I did before I worked on the project. Again, reflection is more valuable when you are going to repeat the lesson to a different group of students and make improvements to the lesson. Reflecting, especially on problems, is also more rewarding when there is someone who can help solve the problems, reading the reflections.

Most classroom teachers wouldn't reflect to this extent on their own, because it requires time, and it benefits from having an audience and a chance of having an effect or getting answers.

Once we recognized the value of including reflection with our practice, we still had to consciously balance the two. If we weren't careful, one or the other would take over. When we took our work to others, we had to decide how much time to give each aspect of our work. Our first advisory committee meeting focused more on the materials (our product/practice) than the CMD model or research in practice (our process/reflection). Dianne wrote:

> […] no one asked either Bernadette or I about the professional development part of the project. They focused mostly on the activities, perhaps though because we were presenting the activities.

On the other hand, the second advisory committee meeting didn't involve looking at the activities (product/practice) at all – it was focused on the CMD model (process/reflection).

Then, in our presentation to practitioners, the focus was more on our activities than on the CMD model. Participants were not very engaged during the short time we had allotted to presenting and discussing the CMD model. Perhaps this was partly because it came at the end of the presentation. The participants were very hands-on, to the point of wanting to experience each activity themselves – not to experience only a few and be given the materials for the others.

Reading

We read articles and parts of books about numeracy and math. At two points (the beginning of the project and over the Christmas holiday) I gave readings to Bernadette and Dianne that were related to numeracy, teaching adults, and research. On several occasions, I found readings for Bernadette and Dianne on topics that had arisen.

Bernadette, after reading about adult numeracy in England, commented that she could see that some features of her learners were the same as those of learners in England, and that some of her concerns were shared by practitioners there:

> I found this NIACE Response to the Post-14 Math Inquiry very informative. The description of adults in British programs and the list of aspects that affect adults' learning are the same as with my program.

That reading, combined with one on IALS in *Literacies* also led her to consider a fundamentally different approach to numeracy – one opposed to the common 'deficiency model':

> The article is also helping me look in a new light at the issues I learned about at the conference I went to in June 2002 in Montreal [Math for Learning, Math for Life]. In Canada, money has been spent to document the numeracy skills embedded in particular jobs (for example through the BC Skills Project). While this is important, I wonder if funding has been given to research numeracy skills embedded in the activities involved in the every day lives of adult

learners. By having their experience reflected back to them within the context of math skills, adult learners would discover that they are numerate. Possibly many would find that they are more numerate than they considered, and so encourage them to master new math concepts.

In reading the Literacies articles, I learned that the IALS results do not always confer with what adults feel they are able to do. The results show that 40% of adults in Canada have literacy needs, and yet many of these same adults report to have sufficient literacy abilities. The NIACE article mentions that the deficiency model is not the way to go. Focusing on strengths helps adults move forward. I think this is very true.

Dianne's response had some similar comments:

I was most interested in math anxiety and dyscalculia. The English learners and their problems sound much the same as our learners. The report mentioned the need to develop and share learning materials. We certainly share that need.

In addition to this general reading that both practitioners did, each of them did particular readings on topics that came up. Here is Dianne describing reading about patterns:

I had asked Lisa about patterns in math. The question came from the lesson Lisa prepared on How Parents Can Help Their Children With Math. I asked Lisa to explain the question relating to patterns. I had also found lots of activities about patterns but didn't know why patterns are important other than for things like skip counting. She did some research about patterns and discovered a section in the Math Gene [*The Math Gene: How mathematical thinking evolved and why numbers are like gossip* by Keith Devlin, 2001]. She suggested I read parts of the book. I discovered that patterns are very important. I read more than requested because I found it very interesting particularly the links with language and mathematical ability. The studies on babies and inborn mathematical ability were also interesting.

[…]

I think teachers of adult numeracy should know why patterns are important. It would be useful also to have examples of patterns in math.

The opportunity to follow up a teacher's casual query with some reading that explores the topic further is very valuable.

Another reading that I brought out in response to Dianne's thoughts was *Dancing in the Dark* by Marina Niks, Darcy Allen, Paula Davies, Dee McRae and Kate Nonesuch in British Columbia (2003). It describes a collaborative LBS research project that had two research questions: (1) How do adults with little formal education learn? and (2) How do practitioners do collaborative research? A colleague had given it to me after

hearing about the CMD project, and I thought it would be interesting for Dianne to read, after she expressed concerns about how our work was going. She read it and recommended it to Bernadette.

At first, it was Niks et al's second research question (How do practitioners do collaborative research?) that was most interesting to Dianne. She wrote:

> I'm on page 21 and my thought is Thank God other people have problems and feel frustrated working on a research project. I don't feel quite so badly that my students haven't tested as many activities as I had thought they would. I have been discouraged by their poor attendance.
>
> Also:
>
> Similarities with our project
>
> - difficulties with students. The researchers had a difficult time finding and keeping participants. In total 25 people were involved. My diminishing class and sporadic attendance dampened my enthusiasm and kept me from testing activities.
>
> -difficulty carving out extra hours each week for the research project
>
> -gaps - times when no work was done on the research project
>
> -both led by a qualified researcher
>
> -interference from personal life
>
> The section on collaborative research was helpful to me. As some one participating in a research project for the first time, it is reassuring to know that others face the same obstacles and frustrations.

At the end of the project, it seemed to be Niks et al's first research question (How do adults with little formal education learn?) that was most memorable for Dianne:

> Looking back at the reflections, the one that makes me think the most is the one on Dancing in the Dark. Although the results from that study seem so obvious, I think that sometimes we forget that our learners do need to ask for information more than the average person. It reminds me of the importance of creating an environment that is "ask" friendly.

I, too, engaged with this report. And I, too, at first found the findings from their second research question much more interesting than the findings from their first question, only later to realise the significance of the findings from their first question. I've put several quotations from *Dancing in the Dark* and my comments on them, in the table below. We've stepped onto the dark dance floor, and are having a little conversation with dancers already there.

Quotation from *Dancing in the Dark*	**My comment**
1. During the first team meeting, we discussed the various expectations related to roles and ways of work that each team member was bringing to the project. Rather than assuming that responsibilities and relationships would somehow just evolve, Marina brought these issues to the team for our first discussion. We talked about the team environment we wanted to generate. A sense of trust, where we could share our feelings without "walking on egg shells," being able to speak openly without having to worry being politically correct, and a sense that we would be heard were all important. We agreed we would work on the assumption that we all liked each other and did not intend to hurt each other. We wanted to be able to deal with conflict openly rather than working around or avoiding uncomfortable situations. (p. 77)	We didn't talk about this explicitly, though I did think about it. I thought, after we were underway, that it would be good to have something like a statement of principles for our working relationships – not because anything had gone wrong, but to put the teachers at ease. To say that everyone would be respected and heard, and that one's development was more important than achieving a particular 'level', that learners were our focus, that each person's time would be respected, that work would be done to negotiated deadlines, and modifications would be worked out, etc.
2. We found it extremely challenging to find a separate time to focus on our research tasks during our working day. Only one researcher was able to take one course off during one term and use that time to do her reading, data collection and initial analysis. The other researchers could not divide their workload in such a way and ended up working after work and during holidays. (p. 85)	We tried to be careful that our workload was not overwhelming. Teachers who had full time teaching loads were not invited to participate. Still, Bernadette was teaching more than we had known when we invited her into the project, and she took on other project work during the year. It really is up to each practitioner to decide the workload that is reasonable for her. Administrators can help by allowing a practitioner to teach fewer hours while working on research, and then resuming former hours when the research is over. The schedule of project work was irregular, which was sometimes good and sometimes not.
3. Not having special office space and a clearly defined role as a researcher in our organization were added challenges. (p. 85)	We did not miss having special office space at our organizations. We each had a computer set up at home for our independent work, and we always found a good place to have our meetings. It was good to meet in different places – Bernadette and Dianne saw each other's classrooms and administrative offices.
4. By having practitioners involved, the knowledge produced is grounded in practice and can be passed on to other practitioners with an immediacy rarely found in other research projects. (p. 85)	This is certainly true of our products. Learning materials are very immediate, and the way we created ours is grounded in practice.

	Quotation from *Dancing in the Dark*	**My comment**
5.	We communicated almost daily via emails, every two months through conferences calls. Too sporadically we met face-to-face. We found these meetings to be the richest and most useful way of working together. (p. 85)	We, too, found meeting face-to-face to be very valuable. It was efficient and we learned more.
6.	Research takes time, and collaborative research takes even longer because relationships, as well as meaning, have to be negotiated. (p. 85)	We thought we could make more materials than we have made. But the collaborative and reflective processes slowed us down. We couldn't just churn out activities. They wouldn't have been as good, or as share-able, or as explained as they are, and we would not have learned as much as we did. We were negotiating relationships and meaning all the time.
7.	Having practitioners participate in research activities benefits the individuals involved but it also enriches the programs and organizations they belong to. (p. 86)	Our work did this by involving students and by facilitating a workshop for other practitioners. Dianne continues to work at the OCDSB, while Bernadette has taken a leave to do a Masters degree in adult education. It remains to be seen if this report and our Web site enriches people and practice beyond our project.
8.	It is the responsibility of the instructors and administrators in the program to find a suitable way of accommodating the research activities of the practitioners. Program administrators should become involved in facilitating the research pursuits of the instructors and support them with finding substitutes, navigating the organizational bureaucracy, and creating a private environment for practitioners to work on their research. (p. 86)	Yes, the administrators' role is important. For us, it was in identifying potential participants, in arranging release time twice, in providing meeting space, in managing the budget of our project, in providing office materials and in managing our contracts. Administrators from each program involved sat on the advisory committee. The local coalition did the event planning for our presentation – providing a space, refreshments and publicity, and managing the registration process.

	Quotation from *Dancing in the Dark*	**My comment**
9.	Practitioners will find that they are more engaged with the research if the focus of the research is one closely related to their daily practice. We therefore recommend that practitioners choose a question they feel passionate about, a focus that is useful and meaningful to them. (p. 86)	I'm not sure that Bernadette or Dianne felt passionate about teaching numeracy (see quotations from their first reflections in Chapter One), but they did want to teach it more, and teach it better. And, making teaching materials and helping learners learn is the core of what they do, so this part of the project is useful and meaningful. So, perhaps there wasn't any passion at the beginning – only usefulness and meaningfulness – but some may have been kindled by the end [Bernadette agrees].
10.	"We feel having someone who is knowledgeable in research methodologies and is willing to work with a team in shaping the process so that it follows rigorous research criteria but at the same time is able to be flexible and willing to challenge traditional academic requirements is definitely an asset in collaborative practitioner research. (p. 86)	I am only moderately knowledgeable in research methodologies; I am willing to work with a team in shaping a process that is rigorous yet flexible. More of this would have been helpful.

Analysing

Most of the analysis within our methodology took place in the writing of this report (though analysis was done elsewhere, too). I could have used the advice and guidance of an academic researcher in this process. I felt I should be able to write the report easily – it would have elements of a narrative, a description and an academic essay – all of which I thought I had time to write adequately. But this combination results in a different beast, and I had not recognized how much analysis would be possible or necessary. I typed into a word processing document interesting parts of my field notes, Bernadette's and Dianne's reflections, quotations from readings, and our advisors' comments, and grouped them into themes. This felt like data management – each datum being a paragraph – to the point that I briefly considered putting them in a database to manipulate them that way. I had to see what they amounted to, where they would lead me. I sorted them into four chapters, printed them out, spread the pages of each chapter on a large desk, and then moved things around, re-titled sections, wrote to introduce ideas, to explain, to make explicit what was implied in a quotation, to come to some conclusions, to give background, to elaborate, to expand. Then I made these changes on the computer, printed out the new version, and did more re-arranging and re-writing. Is this a valid way of writing a research report? An advisor would have been helpful. I feel as if I've taken the analysis to a certain point, and that further analysis should be done – that, at times, our findings/learnings/experiences are a little

'undigested', and the tone of writing is uneven. This is indicative of our position on the borderline between practice and research, and of the exploratory nature of the project.

WHAT ARE OUR FINDINGS?

The answer to this depends on which research question one is interested in. Our findings, or our answers to our research questions, are scattered throughout this report. They are, in a way, summarized in the next and final chapter, 'Future Directions'.

Chapter 4: Future Directions

In the preceding chapters, we have described how CMD is a constructive process that develops worthwhile knowledge and effective practice which can increase the capacity of the Ontario LBS Program to deliver numeracy training to learners and can contribute to field development in general. In this chapter, we describe how CMD might be modified, and how and why it could be expanded, to continue this valuable work in the future.

MODIFYING THE CMD MODEL

Roles

We recommend that people be involved in CMD in the following roles:

Role	Tasks and Time Commitment	Who would fill this role?
Resource teacher(s)	The resource teacher should retain all the responsibilities that I had in this trial, with the difference that some of the research should be done or guided by a university-based advisor. The resource teacher could work full time, instead of the 16 hours per week that I worked for this project. Then he or she could support more teachers – though supporting much more than four at a time would require reducing everyone's expectations of the number of activities they were going to make and the amount of support they were going to get – as well as the amount of reflection and research that could be carried out.	There could be one or more resource teachers. There are several LBS practitioners currently in the field who, after some training, would be qualified to act as resource teachers.

Role	Tasks and Time Commitment	Who would fill this role?
Classroom teachers	Each classroom teacher would, as they have done in this trial, develop materials, reflect in writing, read, and give a local presentation; they would also carry out a mini-research project and give one more presentation (this second presentation would be to a larger audience). The classroom teachers in this project reported that 5 hours per week of paid time (at their hourly teaching rate) was appropriate. Teachers need to manage their own hours – not necessarily working a set number of hours every week, but using the number of weekly hours, multiplied by the number of weeks in the project to determine the total time that they should expect to devote to project work, and keeping track of what they actually work, so they know where they stand. Also, this weekly number gives the resource teacher a guide for how much work he or she can give to the classroom teachers.	Our advisor, Trudy Lothian pointed out that practitioners are at different stages in their professional lives, and this work will suit some stages more than others. I think this is true, and still that the model can adapt to practitioners at different stages to a certain extent. Dianne recommended that practitioners not have anything else intensely creative going on in their jobs when they participated in this project. The paid time to think, write and read about their practice would be attractive to many practitioners, and the commitment would be reasonable – about seven months.
Learners	The learners involved still would not experience the activities as a coherent unit; they would, instead, be considered part of the development team, and would therefore, like the practitioners involved, slow down their work to reflect on their experience. Their reflections would be more often captured by the classroom teachers, and their ideas would form a larger, more explicit, part of the project's products than they have in this trial. The hours spent on the project would vary from class to class, depending on how much time that class or learner decided to devote to numeracy.	The learners would be those taught by the classroom teachers. Learners whose goals do not require numeracy would not participate. Where a class is organized along an independent study model, a teacher may decide to focus only on some learners.
University-based research advisor(s)	He or she would meet monthly with teachers, and be available for e-mail exchanges to guide and answer questions about the research process. Should such a research advisor not be available, CMD may still be productively conducted.	This person would come from the education, social studies or mathematics department of an Ontario university.

Role	Tasks and Time Commitment	Who would fill this role?
Advisory committee members	Advisors may be from a variety of LBS organizations. It would be helpful to involve a staff member of the LBS section of MTCU. Committee members may meet once or twice per project, and should be available for e-mail exchanges.	These can be people who have experience with numeracy, learning materials, adult learning, field development, and/or who have knowledge of the broader LBS field.
Administrators	Administrators from the managing organization should help with contracting, budget management and communication with funders, among other things. He/She/They would meet with the resource teacher and/or researcher when necessary.	See 'Administration, funding and ownership" later in this chapter.

Products

Learning materials and a process report would remain the principle products of CMD, and, added to them, would be classroom teachers' mini-research reports, learners' reflections, a second presentation, and several short documents presenting numeracy teaching tips and information. These short documents would be aimed at practitioners and would, for example, describe useful explanatory devices, or answer common questions – the documents would capture and present our learning about numeracy teaching in a shorter format than a process report or the notes to the teacher for a particular learning activity.

The Web site

The processes and products of CMD would best be presented on their own Web site (separate from the Web site of a particular LBS program), with a memorable domain name.

A new name

To reflect our discovery of the model's strong elements beyond materials development, the model could be given a more suitable name; perhaps, 'Learning, Teaching, and Researching Adult Numeracy' or 'Strategies and Materials for Developing Adult Numeracy: Research and Practice'.

EXPANDING CMD

CMD at a distance

Our face-to-face meetings were very productive, and it was very valuable for me to meet the learners and see the teachers in their classrooms, but we wondered if CMD could be done at a distance. Our advisor Bill Day wrote:

> From my experiences in Northern Ontario, classroom teachers would be very interested in Collaborative Materials Development. Many LBS Instructors do not have a background in teaching numeracy and are very receptive to PD or materials development in this area. The main problems I see are geography and communication. We have a huge area up here and coordinating Collaborative work would be difficult. This could be overcome by working with the Literacy Networks and through distance delivery.

Maria Moriarty wrote:

> I think that doing this kind of professional development by e-mail is certainly do-able, but may be quite challenging – requiring commitment on both sides to make it work […]

I think CMD at a distance would be different, but definitely fruitful. One or two face-to-face meetings over the course of the work would be helpful. This would require an increased travel budget.

CMD in other areas of the LBS Program

When asked whether she thought this model suited only numeracy, or if it could be used for other areas of the LBS Program as well, Maria Moriarty wrote:

> Initially my response […] was no […] . But… I think it could be effective in the development of writing skills and based on my reading of the OLC's report Taking the Temperature, the survey of field capacity to deliver workforce literacy, I think that there is potential there too – programs and practitioners clearly express the need for practical resources and cite the lack of time for development as a major barrier in developing capacity to deliver effective workforce literacy.

I would add that all of our activities already involve other areas of the LBS Program, in that they include skills in reading, listening and speaking, and self-management and self-development, as much as skills in math.

CMD as a longer-term initiative

The CMD reported on here was a short-term project. We think that CMD has potential as a longer-term initiative. It is a strong candidate to be one of the vehicles through which the field responds to the recent interest in improving numeracy training in the LBS Program.

If CMD were to be part of a longer-term numeracy initiative, the following would happen:

- The CMD Web site and presentations would grow and become known as sources of helpful numeracy materials, including learning materials, teaching tips, background information about adult numeracy and math, and research reports.

- CMD would explore and document how numeracy competence grows, how learning materials are developed, and how professional learning occurs, thereby building the field's knowledge base in these areas.

- CMD would elucidate important adult numeracy topics and skills that could contribute to informing and strengthening Ontario's matrix of numeracy learning outcomes.

- CMD would directly engage practitioners in growing as reflective, pro-active practitioners, interested in research and confident in their ability to teach and learn numeracy.

Administration, funding and ownership of expanded CMD

CMD falls under the LBS function of service development. The work reported on here was a short-term project, carried out by a delivery agency with funding from the research and development part of LBS service development. If CMD were conducted as part of a longer-term initiative, and over a larger geographical area, it still could be managed by a delivery agency, or it could also be managed by a support agency (i.e., umbrella organisation, regional network, sectoral body or service organisation), because it fits within the core services they provide. Still, we at the Ottawa-Carleton District School Board would be very interested in managing or playing a large role in future CMD, and feel that we have the expertise to do so; we also feel that we work very cost-effectively.

Whichever body were to manage ongoing CMD, the following items would have to be paid for: resource teacher and classroom teachers' time, classroom teacher replacement cost (one or two half days per term), honoraria for university-based researcher and advisory group members, Web services, some atypical classroom supplies, travel costs and long distance telephone charges, meeting facilities and refreshments, and administration. There may or may not be costs associated with office space, equipment and supplies.

On the subject of ownership, Maria Moriarty wrote:

> I think the challenge might be around getting agreements as to
> quality standards – who "owns" the activities etc. I think it would be
> necessary to set out clear terms of use, protocol etc. to address these
> challenges.

There is much to be determined in the areas of administration, funding and ownership.

RATIONALE FOR LONGER-TERM CMD

CMD fits within the guidelines of the LBS Program, as stated in *Literacy and Basic Skills (LBS) Program: Guidelines* (Literacy Ontario, October 2000). CMD supports seven of the nine LBS Program Principles (from chpt. 1, p. 3, in bold italics below), as described below.

CMD is *flexible* in that it can adapt to produce whatever learning materials and research reports are of interest to the people involved in the project at that particular time. The areas of exploration are determined by the needs of the learners and practitioners involved.

CMD is *learner-centred* in that learners determine the numeracy topics studied, and in that their experiences with the learning materials feed quickly back into revisions or deeper understanding of the materials in particular and adult numeracy learning in general. Learners are usually pleased to contribute to the project, and appreciate the extra time spent listening to them. Also, with learning materials that fit so well to their needs, they experience successes in learning that they might not otherwise experience. For example, Dianne wrote:

> I think that what I will remember most from the project are the
> positive comments my students had after introducing the activities to
> their children. They were pleased to be able to do something
> educational and fun. I had had limited success with encouraging
> parents to read to their children because of the difficult vocabulary in
> many children's books. However, the parents were able to explain
> the math activities and do them together.

Dianne and Bernadette were always thinking specifically about their learners – right from the beginning, and right to the end. This keeps the work grounded. If our first principle is – to take from medicine – 'to do no harm', then we think we have been able to uphold it. Dianne wrote:

> I don't think that there have been any negative results in the
> classroom.

CMD is not something that leaves the learners feeling 'used'.

CMD is ***based on adult education principles***. These principles are applied in the classroom teachers' work with their learners, are upheld in the notes that accompany the learning materials that will be used by many practitioners, and are followed by the resource teacher in working with the classroom teachers.

CMD is ***community-based*** in that practitioners from different programs may work together and share the results of their work with, first, their local community (through a presentation) and, then, a larger community (through another presentation and a Web site).

CMD is ***linked to the broader education and training system*** in that in meeting learners' needs, it looks to the K-12 system, the apprenticeship system, college programs (outside of college LBS), and other training opportunities, to identify the themes and goals of its learning materials and research.

CMD is ***results-based*** in that its work can be evaluated against demonstrable performance indicators and by all those involved.

CMD is ***accountable*** in that it includes mechanisms to record and present evidence showing that those involved accomplished what they committed to do.

As well as fitting with the above principles of the LBS Program, CMD fits with priorities in LBS research and development that have been identified by the LBS Program and several other bodies. Some of these are described below.

- The action plan within the Ontario Literacy Research Strategy (Literacy Ontario, August 2000) identifies its intention to "encourage practitioners to acquire critical reflection skills and apply research in practice."

- Campbell's 2004 review of Canadian research in literacy in the last ten years includes the following recommendation: "The field of literacy needs more projects that focus on praxis, a cyclical process of learning that unifies theory and practice." (p. 6).

- Quigley and Norton (2002) note that:

  > Adult literacy research in practice is not a new concept in Canada. Literacy educators have engaged in research since the contemporary literacy field started to evolve. However, systematic efforts to encourage and support literacy research in practice in Canada are relatively recent.

- Horsman and Norton, (1999, p. 17) write:

  > Frequently, practitioner research is praised as being valuable for the practitioner engaged in the research process but the products are criticized as being of less interest for others.

> We think that CMD overcomes this difficulty through the practicality of its learning materials and the availability of its products (that is, on a Web site, through a presentation and in hard copy). As well, other practitioner-researchers' products will get more attention, as *Dancing in the Dark* did this year, because CMD practitioners have the time and context for engaging with them and building on them.

We generated many research questions that we wanted to investigate. As described in Chapter One, both teachers wanted to know how their students used math in their everyday lives. This is one area ripe for research. As described in Chapter Three, all participants could be said to be investigating research questions. Also, I asked Bernadette and Dianne, 'Has your work on this project brought up any ideas or questions that you would like to explore further? Bernadette wrote:

> I'd like to make the time to write reflections from class activity, create questions and then observe for responses. Observing other classes would be helpful too. I still want to develop/do activities related to number sense and talking numbers.

CMD rouses the researcher and the reflective practitioner in all who participate.

CLOSING

As we work to further develop LBS adult numeracy training, and to judge the merit of CMD as part of that work, we can learn from the work and ideas of other jurisdictions. For example, the state of field development described below (referring to elementary math in an American state) is in several ways similar to that of adult numeracy in Ontario LBS programs:

> The new visions for mathematics teaching and learning are certainly exciting, but also are challenging in that, as yet, few well-developed examples of reformed practice have been disseminated and discussed. It is as though we are working toward a vision which isn't quite visible, and which is being invented and refined along the way. This situation requires a new kind of tolerance for ambiguity. It will be difficult to be sure, as we move in these directions, how it is all working. The risk-taking and experimentation that is central to these changes will be rewarding as well as unsettling; thus the need for strong collegial support, for discussion, and for opportunities for reflection and revision. Because there is no one right way for doing this, a multiplicity of approaches and efforts need to be undertaken, shared, evaluated, and revised. (from an addendum to New Hampshire's K-3 Math Curriculum, last revised in 2000 (retrieved July 8, 2004 from http://www.plymouth.edu/psc/math/ curricula/k3cmplex.html))

CMD works well under these conditions. It can work toward the "vision which isn't quite visible", provide some "well-developed examples of reformed practice", and fill

the need for "strong collegial support, for discussion, and for opportunities for reflection and revision" as practitioners engage in "risk-taking and experimentation". CMD also works to move us from these conditions to more stable ground.

Another jurisdiction whose reflections and experiences we can learn from is Australia, a leader in adult numeracy teaching. In a 2002 paper called *Numeracy in the making: Twenty years of Australian adult numeracy*, Johnston writes, "A knowledge base of mathematical knowledge, pedagogical theory and contextualised practice is the foundation of the development of adult numeracy in Australia." CMD can be a significant part of establishing this base for Ontario. Johnston also writes that Australia's international reputation as a leader in adult numeracy is founded on "two strands – the understanding of what numeracy is, and the careful, imaginative and informed development of teaching practice and resources" (p. 2). CMD clearly works in these two areas.

As well, Johnston reports that she and other researchers see several worthwhile models of professional development for adult numeracy practitioners:

> (a) conference sessions and workshops,

> (b) short-term in-service programs,

> (c) long-term in-service programs,

> (d) postgraduate study,

> (e) teaching materials, and

> (f) research.

CMD includes elements of all but one of these models. As it stands, it is not a form of post-graduate study (but it could quite easily be modified to include this), but it does include conference sessions and workshops, it can be either a short-term or long-term in-service program, it involves teaching materials, and it is a forum for research.

Having considered the results of our work this year, and looked briefly at international developments, we believe that CMD can contribute significantly to the future development of adult numeracy training in Ontario's LBS Program. We feel lucky to have had the chance to do this work, and we hope it is of use to the field.

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