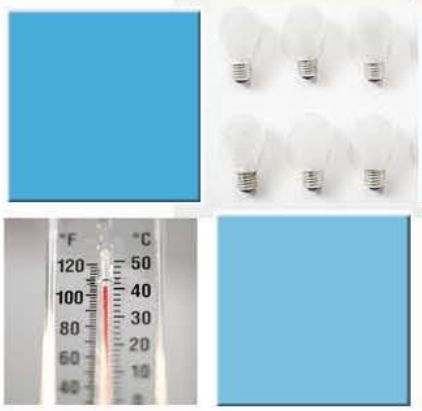

Beyond Worksheets

A social and holistic approach to numeracy

by Tom Ciancone; Flora Hood & Joy Lehmann

June 2007

MTML

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1 Introduction

1. Introduction

1.1 The Challenge

For the past several years, literacy practitioners across the province have continually requested more professional development and resources to support numeracy facilitation in their programs.

In direct response to this request, Metro Toronto Movement for Literacy (MTML) hosted the workshop, "Facilitating Numeracy: An Introduction," developed and delivered by Tom Ciancone in August 2001. It generated great interest and demand for further dialogue in developing an effective model of numeracy practice.

Once again in 2002, MTML's Education Committee and MTML membership surveys identified the need for greater guidance in numeracy practice. This was bolstered by informal discussion from literacy programs through community planning, from other networks, and from formal feedback on provincial field development priorities.

While many practitioners were aware and had access to the valuable resources already out there, they wanted more than a glimpse of a model and a list of practical teaching materials to meet the numeracy needs of their learners. What seemed to be missing was a level of comfort and ease in effectively contextualizing numeracy within literacy programming. Thus, the idea for the "Beyond Worksheets" project was sparked.

1.2 The Project

With support and funding from the National Literacy Secretariat and the Ministry of Training, Colleges and Universities, MTML selected Tom Ciancone as the project consultant and Flora Hood and Joy Lehmann as resource developers. Colleen D'Souza of Metro Toronto Movement for Literacy coordinated the project. The purpose of the project was to develop an approach for contextualizing the teaching of numeracy in adult literacy and workforce literacy environments.

We would present the approach in a comprehensive report, and workshop the approach to an informed, interested and critical environment including practitioners, curriculum developers and funding providers. The report, with accompanying workshop material, would be made available to literacy programs throughout the province.

1.3 The Process

Conducting a Field Scan

Our research for the project began by conducting a scan of the literacy field to determine what was happening in programs throughout the province. We investigated to gather information about how programs were identifying and responding to learners' numeracy needs.

Reviewing the Literature

Concurrent to the work done on the scan, we reviewed recent literature, both practical and theoretical, on literacy and numeracy teaching and learning. We were able to access and assemble much of the literature with the assistance of the AlphaPlus Centre. The staff offered help in our search and acquisition of key resources, as well as provided the project with a collection of numeracy materials. We were introduced to research in social practice theory by such reports as Supporting Learning, Supporting Change: A Research Project on Self-Management & Self-Direction (K. Grieve, 2003). We found that within the last 10 years there is research and practice documented from international sources, particularly in Australia and Europe that elaborate on numeracy as social practice. As Grieve (2003, p. 8) enthusiastically explains, "I found a whole movement of research in a wide range of fields challenging the idea that skills can be taught in isolation and easily applied to other situations. This research describes instead a social view of knowledge, literacy and learning that depends on context, meaning, and relationships." In her research, Grieve also points to holistic

approaches to learning that focus on building a strong sense of self through reflection on the self and the experience of others.

As a result of our review, this report draws information and insight primarily from three current research reports – two from Ontario and one from Australia:

- *Supporting Learning, Supporting Change: A Research Project on Self-Management & Self-Direction*, Ontario (K. Grieve, 2003)
- *Frameworks for Adult Numeracy Education: a Survey and Discussion,* Ontario (L. Hagedorn, 2003)
- *Numeracy in Practice: Effective Pedagogy in Numeracy for Unemployed Young People,* Australia (B. Johnson et al, 1997)

It also highlights two sources from Australia that exemplify our two-facetted approach of adult numeracy as social practice through holistic learning:

- *Certificates in General Education for Adults, Australia* (J. Hagston et al, 2002)
- *Rethinking Assessment: Strategies for Holistic Adult Numeracy* Assessment, Australia (B. Marr, S. Helme, D. Tout, 2003)

Formulating the Approach

Numerous discussions and brainstorming sessions provided the scaffolding to support development of our approach. The following excerpt taken from project meeting notes served as a foundation in determining the focus and goal of the approach.

> *We might envision the approach to the field as an ‚interruption' to what practitioners are presently thinking about and doing in numeracy.*
>
> *It may provide a level of discomfort that may ‚mirror' or be identified with the discomfort that learners feel in dealing with numeracy issues.*
>
> *Through the project and the approach we develop, there may be a space provided where there is an increase in the tension – to question what is happening and what could be happening in the area of numeracy.*
>
> *We are not providing a ‚quick solution' but rather [a way] to find out more about what and where the learner is and how to provide numeracy in a meaningful way.*
>
> *Our goal in developing an approach is to broaden awareness and add another assessment as key elements of the approach.*
>
> *Within the report, we would promote practitioner assessment and learner self-assessment as key elements of the approach.*
>
> *The workshop would act as the vehicle by which we share the approach and our understanding of assessment as the recognition of numeracy readiness and needs to determine and develop the next steps for numeracy support and facilitation.*

In this report, we advocate an approach that sees numeracy as social practice and adopts a holistic way of learning. This approach has been, to varying degrees, part of practice in Ontario over several decades as evidenced in reports by T. Ciancone (1988): *Adult Numeracy: Taking Mathematics from the Real World into the Classroom and Back; B. Glass (2002): Numbers Talk – A cross-sector investigation of Best Practices in LBS Numeracy;* K. Grieve (2003): *Supporting Learning, Supporting Change: Frameworks for Adult Numeracy Education: a Survey and Discussion.*

Consulting the Field

We sought feedback on this approach from the project reference group and workshop participants. We asked the reference group to provide us with their general and specific comments, suggestions for changes that would enhance the overall cohesiveness and comprehension of the report, and recommendations about program delivery flowing from the approach.

In designing the workshop, we kept in mind the goal to embed and promote the basic concepts and principles of our approach in the content and the method of facilitation. We focused on modelling an assessment technique that would help develop awareness for lower-level learners to see how they were using mathematics in everyday life experiences and situations.

Looking Ahead to Next Steps

The next steps were to see how this approach could be implemented and how it would impact the field. In the section entitled, "Adopting a Social and Holistic Approach," we outlined the implications of the approach to practitioners, as well as to curriculum developers and funders. We addressed the areas of assessment, instructional methods, curriculum, resources, program delivery and professional development. We concluded the report by recommending required changes and action to be taken in order to successfully implement this approach in the present context of numeracy delivery and practice in Ontario.

2 What are the Numeracy Needs of Adults in Literacy Programs?

2. What are the Numeracy Needs of Adults in Literacy Programs?

Adults who enrol in literacy and numeracy programs often identify one or more of these three needs:

- to learn skills they can use to feel more capable, more independent in their everyday lives, more participatory in their community;
- to acquire skills and knowledge that may enhance employment opportunities or may be required by workplace change; and
- to achieve a level of academic competence that will allow them to pursue further education or training.

Within each of these three categories – independence, employment, and further education or training – there are many variables (i.e the tasks related to independence will differ from one adult to another, and the skills and knowledge related to employment will depend upon the requirements of the workplace). These three categories do not reflect the complexity of stated needs such as, "I want to help my daughter at school" or simply "I want to learn math."

2.1 Voices from the Field

In the spring of 2004, the "Beyond Worksheets" team felt it would be helpful to informally canvas a representative group of literacy agencies in the Greater Toronto Area to find out how those agencies identified and responded to the numeracy needs of the learners in their agencies. With the help of Metro Toronto Movement for Literacy and the Ontario Literacy Coalition, we were able to expand our canvass area to include agencies throughout the entire province. Not all literacy agencies in Ontario offer numeracy, but our purpose was simply to get a snapshot of what was happening in the field at that time. We asked two open-ended questions and indicated that the responses could be as detailed or as brief as the participants wanted. We asked:

1. How do you identify learners' numeracy needs?
2. How do you address and integrate numeracy in your program?

We were pleased to receive 41 completed field scans, representing three delivery systems – community-based agencies, school boards and community colleges.

As one practitioner responded….

"I have come to see (and I suppose it is obvious) that math is useless if it can't help you solve problems. So, the emphasis for me has shifted from memorizing times tables (if you've tried for 15 years to memorize the tables, it is maybe time to let the calculator do that and let us move on to the interesting stuff of solving problems) to problem solving. I will take any numeracy scenario that walks in the door (what is the cheapest way to buy coffee at the school tuck shop – one cup at $1 a shot, or a coffee card for 30 coffees for $10) and work it out with the learners."

2.2 Identifying Numeracy Needs

Regarding how practitioners identify learners' needs, we summarized the responses as follows:

- Agencies generally identify learners' numeracy needs during the initial intake process. The intake process ranges from informal (e.g. a one-to-one interview with staff in a small community-based agency), to the more formal group intake process used at the community college level.

- During the intake process, learners are asked to identify their learning goal. If the goal has a numeracy and math component, the agency will identify the numeracy and math skills embedded in that goal. An individual learner's current skills can then be assessed in the context of his/her learning goal.

- A variety of assessment methodologies is used to identify numeracy needs: discussion with learners, observation, placement inventories, Common Assessment of Basic Skills (CABS), and assessment tools developed or modified by the agency.

"In the initial interview and intake assessment, goals are discussed. If numeracy is relevant to their goal, it is included in their learning plan."

2.3 Addressing and Integrating Numeracy

With respect to how programs provide numeracy instruction, gleaned from the second question, we made the following observations:

> ***"Because we are focused on workforce and life skills (students count cash, make change, estimate amounts, etc.), they work with a tutor or in pairs and check each other's work. Individual work includes calculating purchases and cash – short or over, calculating discounts, creating invoices, counting inventory, etc.***
> ***We have a small coffee kiosk which we use as a demonstration for running a business."***

- There is little consistency in the way numeracy is delivered, except in the community college sector where math/numeracy is usually an integral part of the literacy and basic skills program.
- A variety of resources is used for instruction: textbooks, worksheets, computer software, internet sites, agency developed resources, authentic „real-life' materials, etc. Resources differ from one agency to another.
- Access to a numeracy program varies considerably. Types of delivery range from once-a-week sessions with a volunteer tutor, through to enrolment in a program that meets five days a week and which has a paid in instructor who is experienced in teaching math/numeracy.
- Classes and small groups are often multi-level and may also include individuals with identified learning disabilities.

2.4 Responding to Learners' Needs

Those of us involved in adult basic education – agencies and practitioners alike – believe in learner-centred programs based on adult education principles (some of which are outlined on pages 18 and 19 of this report). As part of these adult learning principles, it is the responsibility of the agencies and practitioners to meet the needs of the learner, in this case including their numeracy needs, at whatever level they require. However, after reviewing the responses to the field scan, we had a sense that something was missing. We came to the realization that learners' numeracy needs are often being identified and addressed in ways that reflect an agency's capacity to meet those needs. An agency's intent is to provide a supportive learning environment for adult learners to pursue numeracy goals, but the effectiveness of delivery may fall short due to limitations of the agency's resources, including the availability of staff/practitioners (experienced/inexperienced, paid/unpaid, full-time/part-time), learning materials, location, funding, etc. If any of these is weak, the agency's ability to address learners' numeracy needs will be compromised. This creates a gap between the learner and the agency. Learners who drop out of literacy and numeracy programs, or who fail to make progress, may well have fallen into such a gap. This undoubtedly contributes to the frustration that learners already experience.

If a learner needs to develop numeracy competence to achieve his/her goal, the agency can play a crucial role. Experienced practitioners know that when adults come to literacy programs for numeracy help, they often have a low opinion of their ability to „do math.' They don't value the informal math they may use on a day-to-day basis. The word „numeracy' is probably unfamiliar to them, and their expectation of what they need is likely to be based on childhood memories of school math, with textbooks, tests, wrong answers and red ink. All too often the memories are associated with feelings of anxiety, frustration and failure. Math anxiety is a well-documented barrier to learning for adults in ABE programs (S. Tobias, 1978 and C. Zaslavsky, 1994).

In contrast to the usual emphasis on hard skills, Ewing (2004) emphasizes the central role of personal growth in the learning process: "An increase in self-confidence or the growth of self awareness as a learner may not be measurable, but they are integral to literacy learning in a learner-centred system."

The most important numeracy need for adults in literacy and numeracy programs is not the obvious one of learning rules and completing worksheets. Rather, the most important need is to develop numeracy awareness and self-confidence so that the rules and the processes can be applied to solve real problems or used to inform decision-making.

In proposing an approach to numeracy that is holistic and learner-centred, we address the gap between methods of delivery and learner needs. To this end, delivery systems would require both the will and the resources to adapt programming.

2.5 Delivering the Program

A social and holistic approach to numeracy strongly supports the work of any delivery system that focuses on responding to learners' needs and helping learners work toward their goals.

In Working with Learning Outcomes (1998), the Ontario LBS program defines itself as providing "learners with the opportunity to develop and then to demonstrate the literacy [including numeracy] skills that help them attain their personal goals related to further training, employment, or independence." (p. 23) While recognizing that "it is in the learner's best interest to develop skills to a very high level of proficiency," (p. 28) the LBS program also considers "the purpose that the skills serve in the context of real-life application for the learner. It is the real-life application and the learner's specific goal that determine the level of proficiency that can or should be expected in a demonstration. The key question is: would the learner's level of

performance in a demonstration be acceptable in a real-life context, such as employment?" (p. 28)

Therefore, numeracy skills are not developed in isolation, but in the context of, and in response to the individual's social environment whether that environment is a workplace, educational setting, or daily life. To work toward these personal goals, the individual must feel confident that his/her numeracy skills have been developed to a level that he/she can demonstrate competence in that environment.

Human Resources and Skills Development Canada (HRSDC) includes Numeracy among its list of Essential Skills. Essential Skills are defined as enabling skills that:

- help people to perform the tasks required by their occupation;
- provide the foundation to learn skills that are more occupation specific;
- enhance the ability to adapt to workplace change. (Working with Learning Outcomes, p.17)

Learners with employment goals and their instructors often consult HRSDC's Occupational Profiles that indicate the numeracy tasks and the level of these tasks required by specific occupations. The Essential Skills help a learner define what numeracy is needed, why numeracy is needed, and how he/she will use numeracy, in a particular workplace context.

In looking at the occupational profiles for cabinet maker and bartender, we find that both require measurement skills in both the imperial and metric system. However, cabinet makers measure length using a tape measure, while bartenders measure drinks using jiggers. The numeracy skills required are determined not only by the occupation, but also, quite literally, by the tools of the trade and how the tradesperson handles these tools. These are skills a learner needs in order to feel confident and competent in his/her numeracy in the workplace. They are entirely contextualized.

Complete information and description of skills and profiles can be found at:
http://srv600.hrdc-drhc.gc.ca/esrp/english/general/home_e.shtml.

The LBS program strives to help a learner become an individual who is confident in his/her numeracy competence within his/her social environment. If the learner has employment goals, the HRSDC Essential Skills can help the learner identify what he/she will be able to do as a numerate individual within a particular occupational context.

3 Developing an Approach to Numeracy

3. Developing an Approach to Numeracy

3.1 Models of Learning

In 1988 in Ontario, Ciancone's proposed model for numeracy tuition, albeit involving real-life applications, was rooted in the belief that mathematics is learned mainly through conceptual structures and symbolic codes. In presenting this model, Ciancone acknowledged the "struggle" to provide instruction for adults learning mathematics in the real world. Almost two decades later, we are ready to re-think this structural/symbolic approach where context was seen as an instructional aid to learn the mathematical concepts.

Currently, adult educators are advocating models of learning based on social practice and holistic learning as valid approaches to effective learning and teaching. In this section we will survey some of those models or approaches.

Some researchers make a distinction between the autonomous model of mathematics and alternative models known as constructivist or ideological (D. Baker, 1998; Johnston et al, 1997; and M. Harris, 1991).

Autonomous Model

The autonomous model sees mathematics as a body of universally accepted skill sets and procedures devoid of context and culture. In this model, learners receive information, while teachers are the experts who transmit knowledge. It is typified by traditional school-based mathematics and adopted by certain numeracy frameworks

such as the common curriculum in the U.K. The content for adult numeracy is often a variation of the following:

- Numbers and Computation
- Measurement
- Geometry
- Data Analysis

Constructivist Model

In the constructivist model, mathematics is used in a context and mathematical knowledge is constructed by the learner. In this model, learners have the opportunity to actively participate in the learning process. The following three examples are variations of the constructivist model.

Numeracy seen as socially-constructed is proposed by Baker (1998) in an ideological model of numeracy with the following components:

- content
- context
- culture
- ideology

Taylor and Blunt (2001) change the last two components in their model of learning:

- content
- context
- community
- participation

Wenger (1998) in his intensive elaboration of "Communities of Practice" proposes a different set of four elements:

- meaning
- practice
- community
- identity

Without delving into a comparative analysis of these models, a developing consensus is apparent. These leading adult educators are advocating models of learning based on social practice as a valid approach to effective learning and teaching.

Numeracy as Social Practice

One may ask, "How can this apply to structured mathematics? Is this just a passing trend?" According to Johnston et al (1997), this is not the case. They document three significant studies in mathematics learning (S. Scribner, 1984; J. Lave, 1988; and T. Nunes, A. Schliemann, D. Carraher, 1993) that indicate higher success rates in contextualized situations than in school-type maths. Johnston et al (1997), based on their own study of effective pedagogy in numeracy among unemployed young people, conclude that:

> *mathematical content and techniques that people employ varies according to the situation, and that people dealing with what is apparently the same situation generate different mathematical realizations depending on the purpose and context in which the math's activity takes place. (p. 110)*

Johnston, in advocating a social practice approach to numeracy, paraphrases Hamilton (July 2000) by stating emphatically:

> *numeracy competence and needs…cannot be understood in terms of skill, but are relational concepts, defined by the social and communicative practices with which individuals engage in the various domains of their life world. [This approach] sees numeracy as historically and socially situated. (2002, p. 20)*

In her seminar on adult numeracy policy, Coben (2003) discusses constructivist and socio-cultural approaches to numeracy as having "a deep regard for the social context in which people's actions, including their mathematical actions and interpretations of information involving mathematics, have meaning." (p. 7) She goes on to challenge us to debate these various approaches, then offers this interesting observation: "In the current state of debates around adult numeracy policy we are in the critical rather than creative phase." (p.10)

Numeracy through Holistic Learning

In developing her model of "Building Self-Awareness and Self-Direction," Grieve (2003) draws clearly upon the holistic and aboriginal approaches, calling the central process „Rekindling the Spirit'.

There are four aspects of the model:

- Creating Meaning/Making Connections
- Action-Reflection
- Practical Strategies
- Reflection on Learning

This model reflects a social view of learning where she asks us to remember "the importance of context, community and relationships." (2003, p. 76)

People learn things through their senses, emotions, interactions, and many other ways in addition to rational thinking. Grieve (2003, p. 62) comments that holistic approaches recognize the importance of the spirit that "is seen broadly to include self-esteem, identity, meaning and celebration."

In aboriginal teachings, a "wholistic" approach to learning considers the human being "an entire whole – mentally, physically, spiritually and emotionally at one with the cosmos." (E. Antone, 2004, p. 1). Grieve relates that Pat Powell from the Peterborough Native Literacy program feels "that building self-esteem, self-awareness and a sense of identity are very important for being able to connect to others and for real learning to happen." (2003, p. 67)

3.2 Similar Views

There are many other ways to look at numeracy learning and practice from the perspective of assessment, making meaning, experience outside the classroom, mathematics standards, and teaching practice. The following views reinforce the notions of social practice and holistic learning as described above.

Authentic/Holistic Assessment

In the area of assessment in adult literacy, there are educators who espouse a view that sees reading as the active construction of meaning within a social context. Campbell (2004) states that a new type of assessment has emerged that "embodied the social and cultural nature of literacy, meaningful contexts, reflective practice, and diversity." It is called „Authentic Assessment'. In numeracy, the same principles hold true that assessment should be meaningful and "anchored in real-life situations and problems." (P. Campbell, p. 45)

In the recent project headed by Campbell (2006), entitled "Assessment Practices in Adult Basic Education," findings show that authentic assessment has two key strengths: (1) the tools, because

they are developed by the practitioner, can be customized to meet the needs of specific programs and students, and (2) authentic assessments, because they allow assessor and student to choose relevant test items, do not intimidate students who are returning to school.

Because traditional competency-based assessment typically focuses on narrowly defined lists of cognitive and behavioural elements, the "Holistic Adult Numeracy Assessment Project" in Australia has elaborated a holistic notion of competence in adult numeracy.

According to the project leaders, interviews with experienced adult educators revealed that:

> *Affective factors related to learners' self-image and growth in confidence played as great a role in teachers' judgements of competence, as the cognitive and skill-based elements explicitly written in accredited certificate documents. Factors such as learners' use of the knowledge outside the classroom, and their increasing independence and self-awareness were seen by teachers as indicators of real growth in numeracy competence…Emerging from the data was a model of holistic competence comprising several complementary and interconnected aspects revolving around a central change of „identity' or alteration of „self concept.'* (B. Marr, S. Helme, and D. Tout, 2003)

Making Meaning of Mathematics

A learner creates meaning by making connections between their own learning and their personal lives; this entails their own individual interests and goals and larger community concerns. In making meaning of mathematics, Johnston (1997) proposes five very specific „strands' of meaning constructed or generated through:

- rote-learning of atomized content (e.g. repeated application of multiplication tables)
- conceptual engagement - problem-solving, process and provocation (e.g. understanding the concept of „a quarter of an hour', „a quarter of a pizza', 'a quarter of the population')
- use in everyday contexts (e.g. a sales clerk making change all day)
- historical and cultural understanding of the use of specific mathematics (e.g. discussion of measurement systems and introduction to metric)
- critical engagement - by asking questions such as, "In whose interest?" and also questions about the appropriateness and limits of a mathematical application in the real situation (e.g. exploration of issues such as poverty and unemployment)

Johnston suggests that "each strand can be seen as one way of weaving meaning into a particular mathematical activity." (p. 124) The more strands that are interwoven into the fabric of an activity, the greater the understanding of relevant concepts and skills.

Funds of Knowledge

"By focusing on learners' funds of knowledge, we shift our attention towards what learners bring to our classroom when, together with them, we attempt to reconstruct their knowledge, attitudes, and understandings," says Baker (2005, p. 17). "We look at what they can do as a whole person."

Following is a list a potential funds of knowledge:

- knowledge, experiences, histories, identities and images of themselves
- attitudes, dispositions, desires, values, beliefs, and social and cultural relations
- relationships with learning, teachers, and mathematics itself
- numeracy practices beyond the classroom

Baker believes that learners' funds of knowledge become a resource in formal numeracy practice because learners have to be able to switch from informal numeracy practices outside the classroom to the rules and processes of formal numeracy practice.

The use of "funds of knowledge" in identifying goals and methods fits a holistic model of learning because the whole person is the centre of the learning process.

Mathematical Standards

In their article, "The Inclusion of Numeracy in Adult Basic Education," Tout and Schmitt (2002) produce a comprehensive review of the current state of adult numeracy and implications for research, practice and policy. In discussing the design of curriculum standards, they emphasize the importance of mathematics – that mathematics is a useful and vital tool in contemporary society and that formal mathematics is a pathway to further study.

In the U.S., the National Council of Teachers of Mathematics has published Principles and Standards for School Mathematics (NCTM, 2000), which is generally supportive of the constructivist view of learning and has influenced state standards and curriculum frameworks, instructional materials, teacher education, and classroom practice.

The standards are guided by six principles:

1. **Equity**: Excellence in mathematics education requires equity, high expectations and strong support for all students.
2. **Curriculum**: A curriculum is more than a collection of activities. It must be coherent, focused on important mathematics, and well articulated across grade levels.
3. **Teaching**: Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.
4. **Learning**: Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.
5. **Assessment**: Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.
6. **Technology**: Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances student learning.

Adult numeracy education is a field at the intersection of mathematics education and adult education. The standards set for mathematics education need to be part of adult numeracy practice. In the case of the NTCM standards, they are congruent with the social and holistic learning principles that we are advocating in this report.

An Applied Learning Approach

In his recent article, "Curriculum Frameworks and Change," Tout (2004) states that behind many of the adult and vocational frameworks are similar principles of adult and applied learning that incorporate other ideas about learning such as contextual learning, experiential learning, problem-solving approach, learning to learn, and learning styles. Some principles that he considers fundamental to these approaches include:

- Use and build on the skills of the learners; all learners bring with them knowledge and experiences to the learning situation. Engage learners in the learning process, including learning from each other.
- Accept and promote a diversity of learning styles and methods; learners learn in different ways.
- Start where learners are at; the contexts used in the teaching of the curriculum should be relevant to the interests and needs of the learner. Negotiate the curriculum.
- Build resilience, confidence and self worth; consider and support the whole person.
- Apply knowledge; connect with real life experiences and communities.
- Integrate learning; don't separate learning into a separate set

> of unconnected skills. Consider the whole task and the whole person. (p. 4)

Tout points out that the applied learning approach highlights the link between theory and application. Like Ciancone's (1988) model, the starting point is the real life context that motivates the learner to learn the skills and theory and then apply them again in the original context and/or transfer to another context.

3.3 Evidence of this Approach in the Field

From our research, what emerged as both current and justifiable was an approach to numeracy that adopts the social practice model of mathematics learning. This approach emphasizes context rather than content, processes rather than skills, change in identity not just behaviour. It is a holistic approach, giving prominence to context, meaning, relationships and identity.

Where do we find evidence of this approach in adult numeracy practice? We looked at definitions, at frameworks, and at learning and teaching practice.

Definitions

There is no universally accepted definition of numeracy. However, in many definitions we see terminology that validates the social and holistic approach to numeracy. Here are some numeracy definitions excerpted from the Adult Literacy and Lifeskills Survey (ALLS) (Gal et al, 1999):

- "for effective functioning in one's group or community" (Beazley, 1984)
- "to further one's own development and of one's community" (Beazley, 1984)
- "to have sufficient confidence to make effective use …" (Cockcroft, 1982)
- "is a critical awareness which builds bridges between mathematics and the real-world, with all its diversity" (Johnston, 1994)
- "interpreting, applying and communicating mathematical information in commonly encountered situations to enable full, critical and effective participation in a wide range of life roles" (Queensland Department of Education, 1994).

In the conceptual framework of numeracy in ALLS, the authors state that:

> *Numerate behaviour is observed when people manage a*

> *situation or solve a problem in a real context; it involves responding to information about mathematical ideas that may be represented in a range of ways; it requires the activation of a range of knowledge, behaviours, and processes. (p.15)*

On the following chart, each main point of this definition is broken down to provide further elaboration.

Numerate behaviour 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 and number
dimension and shape
pattern and relationships
data and chance
change

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

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

Frameworks

In Hagedorn's (2003) comprehensive survey of numeracy frameworks, most fall into the category of autonomous models. These models consider mathematics learning as a non-contextualized set of hierarchical skills and procedures based on the traditional math strands of number, space and shape, data, measurement, and algebra. Two frameworks in Hagedorn's survey are consistent with a social and holistic approach: the CGEA framework from Australia and the NALA framework from Ireland (see 1 and 2 below).

"This report uses the term 'framework' to mean any grid that presents numeracy or math skills and knowledge, sorted into sub-topics and , usually, into levels. The frameworks in this report have a variety of structures and content, and are used in a variety of ways, to serve a variety of purposes… curricula, content and performance standards, level descriptions, assessment frameworks, and reporting systems." (Hagedorn, 2003)

1. Certificates In General Education for Adults: Numeracy and Mathematics Stream (CGEA) - Australia

The CGEA is a certificate program with Learning Outcomes organized into four categories based on different functions or purposes of using mathematics:

- **Numeracy for Practical Purposes** addresses aspects of the physical world to do with designing, making and measuring.
- **Numeracy for Interpreting Society** relates to interpreting and reflecting on numerical and graphical information of relevance to self, work or community.
- **Numeracy for Personal Organisation** focuses on the numeracy requirements for personal organisational matters involving money, time and travel.
- **Numeracy for Knowledge** deals with mathematical skills needed for further study in mathematics, or other subjects with mathematical underpinnings and/or assumptions, including problem solving, algebraic and graphical techniques.

This framework, clearly based on social practice, is not a proposed model, but a program in its third phase of development. The authors state that, through the 1990s and during the original implementation:

> *It became increasingly apparent that the aspect of presenting maths in relevant and meaningful contexts was vital to the emerging idea of numeracy as distinct from mathematics. So much so, that the purpose and use of mathematics within meaningful contexts was made the focus of the revised learning outcome. (Hagston et al, 2002)*

A significant statement that supports their theory of learning, also noted by Hagedorn (2003), is that "mathematical knowledge is not acquired by merely listening to teachers or performing abstract

repetitive tasks." It is:

> *something that learners construct through actively seeking out and making mental connections. When someone actively links aspects of his or her physical or social environment with certain numerical, spatial, and logical concepts, a feeling of „ownership' is generated. (Ellerton and Clements, p. 4; quoted in Adult, Community and Further Education Board, 2002, p. 213)*

In contrasting the CGEA with school-based curriculum frameworks, Hagedorn states:

> *When practitioners turn to such a framework to identify what their learners have learned, they don't easily find it. Though they know that what their learners have learned is valuable and holds together as a meaningful whole, it does not appear as such in a K-12 curriculum […] The numeracy and mathematics stream of the CGEA in Australia, being organized around purposes for using numeracy, reflects more directly how math skills are grouped in real-life tasks.* (2003, p. 79)

2. National Adult Literacy Agency: Assessment Framework for Numeracy (NALA) – Ireland

At the time of writing, this assessment framework is in its initial stage of development. According to its authors, it is "designed to track learner progress over time in a holistic way." (J. Merrifield and L. McSkeane, 2002; and L. Hagedorn, 2003). It is based upon four cornerstones: (1) knowledge base, (2) depth of understanding and critical awareness, (3) fluency and independence, and (4) range of application.

A holistic approach is evident in NALA's draft principles as outlined by Hagedorn (2003) and reprinted below:

1. The framework should be capable of assessing the learner's understanding, not just technical skills.
2. The approach should be informal and flexible – taking from its Latin root meaning „to sit beside'.
3. The approach should be „appreciative' rather than critical – that is, addressing existing strengths and potential, not just deficits.
4. The framework should be clear enough that learners can use it for self-assessment, as well as working with their tutors.
5. The assessment should try to reflect the wholeness of „knowing', rather than decomposing skills and knowledge.
6. It should acknowledge that knowledge and understanding are

not just cognitive but also involve feelings (about one's self and others), values and cultural understandings.

7. It should recognize that learning is a social process in which we engage with others, and that it is shaped by social relationships that can hold back or encourage learning. (J. Merrifield, U. Coleman, and O. McDonogh, 2001, p. 22)

Learning and Teaching Practices

> "If teachers could turn their „passion for skills' into a "passion for identity," then learning would be transformed." (James Gee, 2000)

There are many teaching strategies, learning materials and instructional activities that follow social practice and holistic learning principles. Below we outline two excellent resources that support and guide adult numeracy learners and facilitators to engage in activities that reflect these principles.

1. Changing the Rules: Teaching Math to Adult Learners by M.J. Schmitt and H. Jones, 1990

This training video challenges the effectiveness of traditional rules for teaching math such as reliance on tests to assess learners' skills, rote memorization of facts, text-based problem solving, and sequential linear teaching. Throughout the video, an experienced practitioner uses skilful questioning, active listening, and careful observation to guide a diverse group of 10 adult learners through a series of activities.

It demonstrates four key ideas to improve adult basic mathematics instruction. These include:

1. Using a whole-person approach to student assessment
2. Integrating concrete learning activities into classroom instruction
3. Using real-life math problems that have relevance to adults' daily lives
4. Using a spiral approach to teach math content

Holistic Assessment

The practitioner is able to informally assess the range of math needs and experience within the group by simply engaging the learners in preliminary discussion. From this discussion, she records on the board a list of everyday tasks identified by the learners as ones they encounter regularly and which require math skills. The exercise generates a comprehensive inventory of real-life tasks that the practitioner can refer to for the context in which to teach math lessons

with this group. By exploring the real-life tasks to identify the math components, the practitioner and the learners have an opportunity to reflect on the variety of methods used by the learners to compute the math needed in their everyday lives. These discussions validate the learners' individual experience, they provide the practitioner with information regarding the learners' math skills, and they help the practitioner to create a positive and relevant learning environment for all the participants.

Concrete Learning Materials

Instead of relying on rote memorization of an abstract formula, the learners participate in a "process of discovery" that demonstrates the underlying principles that support the formula. The learners can see what the formula represents as they practise concrete, hands-on activities that reinforce the concept. They gain confidence in this knowledge of the formula and are then able to relate to it when it is shown in a text-based problem.

Real-life Problem Solving

The learners create and solve math problems using information from their own real-life circumstances. They become more aware of the connections between theoretical math concepts and practical applications of these concepts, and this promotes a positive change in their self-confidence and willingness to use math.

Spiral Approach

The practitioner demonstrates how a spiral approach to teaching can give learners access to more advanced math concepts when these overlap with learners' real-life context. This acknowledges that real-life math often reflects clusters of math information and adults' need to be able to recognize and apply appropriate math strategies in order to use math confidently.

Furthermore, the authors identify the following nine factors that need to be considered during the assessment process and when creating an individual's learning plan:

- Emotions and attitudes towards math
- Short and long-term goals
- Everyday math experiences
- Computational problem solving processes
- Math skill level
- Reading level
- Cultural background
- Learning pace and style

- Perceptual disabilities and strengths

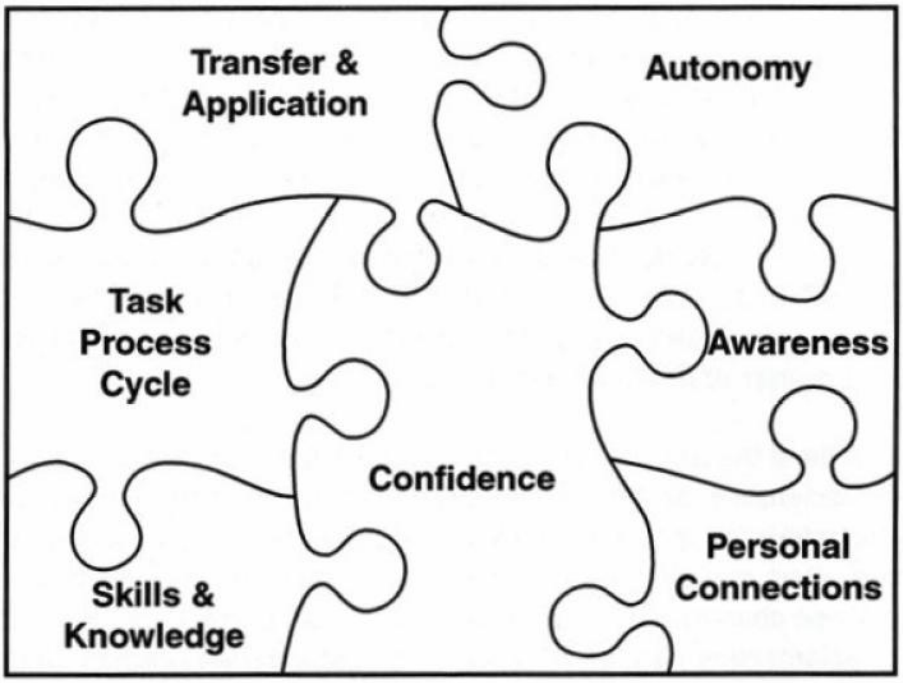
The video, *Changing the Rules: Teaching Math to Adult Learners* is distributed with a 16-page viewer's guide that provides additional material to build on the approach modelled.

2. Rethinking Assessment: Strategies for holistic adult numeracy assessment by B. Marr, S. Helme and D. Tout, 2003

This resource provides both a model and a set of instructional tasks and materials developed from listening to the voices of teachers from a diverse range of programs across Australia. The conclusions of these teachers had little to do with simply the acquisition of mathematical skills, but rather what they termed "holistic competence." This notion has as its core a change of "identity" or alteration of "self-concept."

This model offers an innovative and comprehensive approach to numeracy learning. The components of holistic competence, both cognitive and affective, are presented as a jigsaw to portray their interlocking and essential nature.

Model of Holistic Numeracy Competence



The conviction of the teachers is that competence is more than mere completion of assessment tasks. They stressed the importance of recognizing and highlighting all components of holistic competence illustrated in the model. (p. 4)

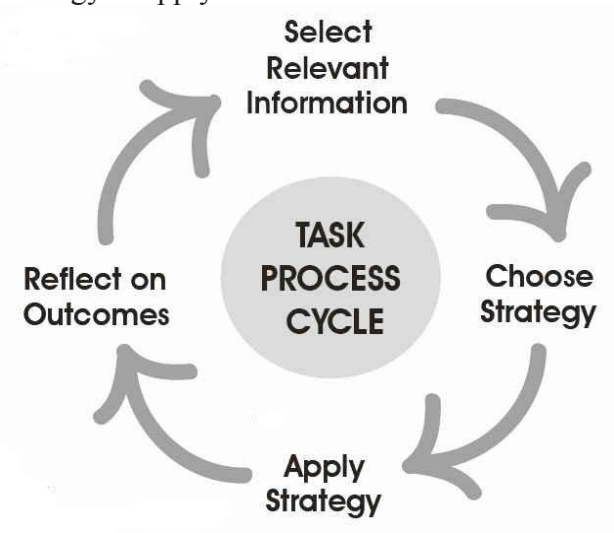
As one practitioner stated:
"I value mathematical thinking more highly than being able to do accurate tasks all the time…I have students who just do sums…reams of sums where all the problem solving has been done…they never start to think about where those numbers have come from. As opposed to students who really [learn] to get in behind and try to understand the processes." **(p. 6)**

The cognitive aspects of competence illustrated in the model are identified as:

- **Using skills and knowledge.** The key elements of this competence are repeated demonstration, understanding of concepts, and integration of different aspects of numeracy.
- **Using the Task Process Cycle.** Students demonstrate their competence through completing whole tasks following a four-phase cycle, instead of simply demonstrating isolated math skills.
- **Transfer and application of skills and knowledge.** Students are able to use what they have learned in diverse situations.

Phase 1 and 2: Select relevant information and choose strategy. Before using the mathematical skills, students need to be able to select the information they will need and decide on the appropriate strategy to apply.

"Practitioners discussed reflective thinking, or consciousness of the process, as an integral part of the cycle: Metacognition. Thinking about thinking." **(p. 6)**



Phase 3 and 4: Apply strategy and reflect on outcomes. After they have performed the mathematical operations, students need to reflect

on the meaning of the result, decide how reasonable this seems for the particular circumstance and consider its likely implications. (p. 5)

The affective aspects of competence:

- **Confidence**. Shifts in a student's confidence or self-esteem as a numerate person.
- **Personal connections**. The ability to relate their learning to their personal lives and make connections with what they do outside.
- **Awareness of themselves as learners**. The importance of having awareness of your learning style as well as what you have learned.
- **Growth of autonomy as a learner**. Taking control of your own learning, have opinions and take risks.

In examining this model of holistic competence, what struck us most was the central role of confidence. "Confidence" is the largest jigsaw piece centred in the model where it interfaces with all the other pieces. Throughout their discussions, the project participants emphasized change of identity or self-concept in the numeracy learner to be at the core of the holistic notion of competence. In recognizing this, we have embraced the essence of this notion as a basic premise in the social and holistic approach that we are proposing in this document.

4 A Social and Holistic Approach to Numeracy: Propositions & Perspectives

4. A Social and Holistic Approach to Numeracy: Propositions & Perspectives

From the outset, we believed the ultimate learning outcome is a person's individual development and empowerment with the possibility of participating actively in their wider community. We believed that we could best achieve this through numeracy provision that is both context-based and learner-centred. We gathered information from the field in Ontario and studied research and practice from abroad. In a short time span, we only scratched the surface of this area of numeracy practice. What we have, however, is significant information to substantiate our original premise. When we thought of summarizing our findings, it seemed mundane to produce a linear list of characteristics of a context-based learner-centred approach. This was especially difficult, because we came to realize that a "social practice" approach is much larger than "context-based" and a "holistic" approach is larger than "learner-centred."

What appears here is not a new model of numeracy practice, but a proposition with three perspectives: (1) concise statements, (2) a schema of learning, and (3) goals and methods. It's a place to hang our hat, a reference point for further development. We all have different learning styles; no one perspective may capture the essence of the approach more clearly than another.

Although all our findings contribute to these three perspectives, we have relied on the following three sources for the formulation and vocabulary:

- *Numeracy in Practice: Effective Pedagogy in Numeracy for Unemployed Young People,* Australia (B. Johnson et al, 1997)

- *Supporting Learning, Supporting Change: A Research Project on Self-Management & Self-Direction*, Ontario (K. Grieve, 2003)
- *Rethinking Assessment: Strategies for Holistic Adult Numeracy Assessment*, Australia (B. Marr, S. Helme, and D. Tout, 2003)

Proposition:

Numeracy learning and teaching can best be provided through a social and holistic approach. This is based on the principle that the learner is a whole person and that mathematics is a human construction.

Perspective 1: Concise Statements

The approach we are proposing has two main intertwined concepts: numeracy as social practice, and numeracy through holistic learning. For clarity, we put forward two concise statements of what these concepts mean to us:

- **Numeracy as Social Practice** asserts that the mathematical content and techniques that people employ vary according to the situation, and that people generate mathematical problems, skills or procedures depending on the purpose and context in which the numeracy takes place.

- **Numeracy through Holistic Learning** takes into account the whole person involving the mind, body and spirit interacting with the world around and connecting to a larger whole. It is learning that is both active and reflective. A numeracy learner will move towards a greater sense of confidence and self-awareness in using mathematics, creating meaning in daily activities, reflecting on the learning, and making personal connections throughout the process.

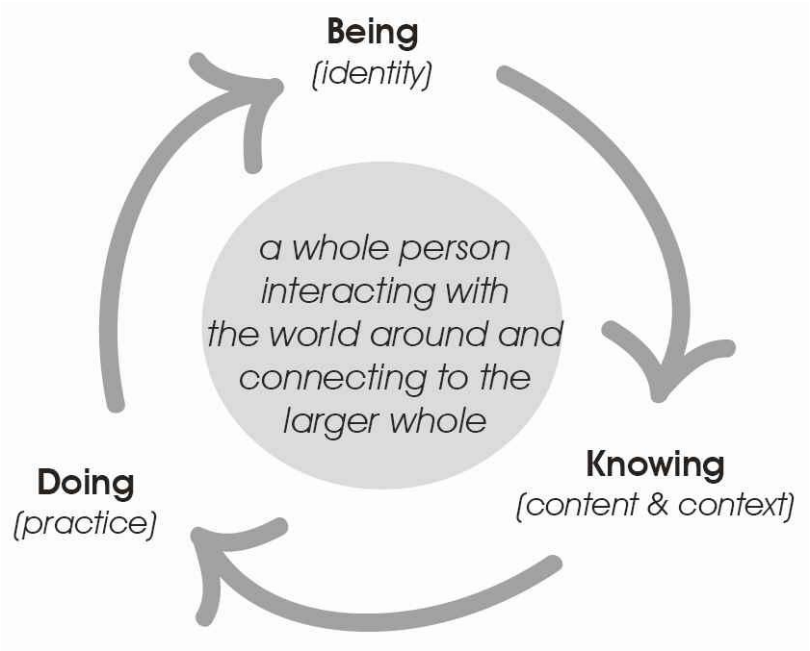
These are not meant to be definitions, but an attempt to highlight the basic components of our proposed approach.

Perspective 2: A Schema of Learning

Often learning is analyzed according to three domains:

1. Cognitive (knowing) – learning through acquiring knowledge
2. Active (doing) – learning through performing tasks
3. Affective (feeling) – learning through feeling or emotions

We borrowed from this analysis, with some variation. From the holistic learning principles, what is at the core of learning is the search for identity. So we chose "Being" as one of our domains, which includes the affective aspect. Each domain is elaborated into three components drawn from the main concepts of social practice and holistic learning as in the two statements above. There is no absolute reason why components are placed as such. For example, "reflecting on learning" could be part of "knowing," while "creating meaning in daily life" could be part of "doing." "Context" applies to both "doing" and "knowing." There will be natural overlapping.



Being (identity)

- becoming self-aware in using mathematics
- gaining confidence as a "numerate" person
- making personal connections throughout the learning process

Doing (practice)

- choosing relevant information
- applying appropriate skills and strategies
- reflecting on the learning and the results

Knowing (content & context)

- generating mathematical problems, skills or procedures
- employing mathematical content and techniques that
    - vary according to the situation
    - depend on the purpose and context in which the numeracy takes place
- creating meaning in daily activity

Superimposed on the three domains, we have associated four terms that are central to our approach: identity, content, context and practice. All this intertwining is made clear by our choice of using a circle with no beginning or end to contain all these aspects of learning. Aboriginal holistic principles also influenced us to use the circle, which is central to aboriginal ways of understanding the world.

The central principle of our approach occupies the core of the schema:

> **A learner is a whole person – mind, body and spirit – interacting with the world around and connecting to a larger whole.**

We must keep this principle in mind at all times to avoid making learning a checklist of component skills. Learning is an interactive and interconnected process involving being, doing and knowing.

Perspective 3: Goals and Methods

Another crucial way to understand the social and holistic approach to numeracy learning advocated here is to focus on the educational goals and methods of numeracy practice. A very succinct statement follows.

***Goal*:** The primary educational goal is a "shift in identity" towards a numerate individual – a person who makes meaning of the world through mathematics.

***Method*:** The method entails generating mathematical content and procedures through acting and reflecting in real world contexts.

The goal must be a shift in identity, not the acquisition of skills. The methodology must be to generate mathematics in context, not to apply abstract formulas and procedures.

If a shift in identity is the clear goal for a learner in a numeracy program, then the learner and facilitator will work together to generate the suitable mathematics in order to achieve this.

They will identify the relevant information, apply the appropriate mathematical skills and procedures, practise the skills, and reflect on the learning. Together they will create meaning from the mathematics they are using and how it relates to their daily life. In the end and along the way, they will gauge how they are doing relative to their goals of increased confidence, self-awareness, and personal connection – in short, a shift in identity.

5 Modelling Numeracy as Social Practice through Holistic Learning

5. Modelling Numeracy as Social Practice through Holistic Learning

What does this social and holistic approach look like in practice? How does a numeracy learner achieve this shift in identity? It is not possible to demonstrate this in one example, but we will at least touch upon one aspect of our approach – learner assessment. Although our approach is adaptable for ongoing assessment, we suggest it has particular effectiveness when used at the initial assessment stage through a guided conversation that we call the "blank page assessment."

5.1 Blank Page Assessment

The "blank page assessment" is essentially a process that acknowledges a learner's skills, knowledge, responsibilities and independent life experience. It situates a learner in the present and makes no assumptions about his/her competencies. It reframes the relationship between a program and a learner to establish a context of shared responsibility for future progress; it engages the learner as a partner in the learning environment. A "blank page assessment" also provides a context where anxiety associated with previous school experience can be acknowledged but not reinforced.

During a "blank page assessment," an open-ended conversation takes place between a learner and a practitioner who is comfortable with this process. This assessment technique encourages practitioners to visualize math contexts and problems by carefully listening to the learner describe how he/she encounters math in everyday situations.

During the conversation, the practitioner uses a blank sheet of paper to make notes as the learner reflects on the skills and knowledge used in his/her everyday life context. The practitioner may guide the conversation by asking questions that allow the learner to expand upon examples of actual scenarios from his/her experience. It is essential that the practitioner is able to recognize, separate and link basic math concepts in a variety of contexts. As the learner discusses or demonstrates some of the situations that create difficulty and success, an experienced practitioner can identify some of the gaps and strengths in the learner's knowledge. From this information, a starting point for learning can be established. The practitioner can then select or create appropriate activities that teach what is needed for this learner to move ahead.

By listening to the learner's "story" and by reflecting it back to the learner through the prism of the practitioner's knowledge, the practitioner will gain an understanding of relevant and meaningful context for the learner. The learner can see that his/her whole person is reflected in the process and will be encouraged to reflect on his/her self-awareness as a numerate person. This insight can initiate a subtle shift in the learner's identity.

5.2 The Workshops

In February 2005, the team planned and facilitated two three-hour workshops in Toronto to present the approach to the literacy field and receive a sampling of practitioner feedback. We also presented an abridged version of the workshop in Melbourne, Australia in July 2005 at Connecting Voices: practitioners, researchers & learners in adult mathematics and numeracy, the 12th annual conference of Adults Learning Mathematics. The workshop goal, objectives, activities and materials are outlined in Appendix B.

We carefully designed the content and method of delivery based on the idea of modelling a "blank page assessment" that would promote and reflect the social and holistic approach to numeracy practice. This assessment technique encouraged practitioners to rely on their own capabilities, experience and expertise to create math contexts and problems by carefully listening to the learner. By listening to and later writing down the learner's "story," the practitioner would gain an understanding of where the learner was coming from and an awareness of relevant and meaningful context for the learner.

In the workshop, there was one "interviewer" and one "learner," while the other participants observed the interaction. To evaluate the "blank page assessment" technique and, at the same time, highlight the social and holistic approach to numeracy, we created a "reflection circle" (Appendix B, p. 66) that was adapted from our

schema with the three domains – being, doing and knowing. The observers recorded their observations by "mapping" them onto the circle. For example, when the learner mentioned "confidence in estimating," it was placed in the circle near "Being"; similarly, "being able to measure" was placed near "Knowing." In a sense this was an assessment tool within an assessment tool. We used the "blank page assessment" to assess the learner and the "reflection circle" to evaluate the "learning." In each case, the tool considered the whole person and was socially-constructed.

Participants shared their own math incidents or "stories" that were used as modelling examples. They were able to see how to navigate through a "blank page assessment" and to draw out potential numeracy needs from the stories they heard. They were asked to reflect upon the assessment process and suggest ideas about what might happen next to meet the identified needs. In smaller groups, participants had a chance to practice the assessment technique and were able to keep in mind concepts of the approach when discussing the process they had experienced.

We were able to capture immediate feedback from three workshop participants:

I was given the responsibility of coming up with a numeracy assessment package to be used in our programs, and in doing so I came up with a bunch of exercises and worksheets to assess certain skills. So the first thing that really stood out for me was the „blank page assessment'. At the session I attended, Flora modeled this with one of the attendees. I was able to see how this gentle guided conversation allowed the real numeracy needs of the learner to emerge and gave the practitioner valuable information on what and how to teach and what resources to use. I like this approach because it attends to the particular needs in the learner's lives and does not try to fit the learner into some predetermined structure. As much as we espouse „learner-centredness' there is still not enough attention given to the whole learner. Numeracy is indeed social practice, so finding out the contexts within which learners need to apply numeracy skills is crucial.

I think this approach allows the practitioner to focus more quickly on the learner's more immediate numeracy goals. As it is now in our program, we take learners through a numeracy assessment process that tries to assess their mastery of a multitude of concepts and skills without too much consideration of how relevant they are in the learners' lives. After this workshop, I will certainly spend more time on the „blank page assessment'. I also liked the emphasis on building up learners' confidence. I believe this is an important aspect of competence in math/numeracy.

". . . the first thing that really stood out for me was the „blank page assessment."

"The Beyond Worksheets approach has challenged me to think about numeracy as a reflective action."

I really liked the „blank page' numeracy assessment interview that Flora used. It gave me a better picture of how someone uses numbers and number concepts to get through their life, rather that what math skills they have (or don't have). For example, asking someone how they figured out how much paint to buy when they didn't measure the room told me that the person uses estimation skills, and how confident they are in their skills. The interviewee was able to go to the paint store and figure out how much paint to buy, and ended up with enough – if I remember correctly. This assessment technique really addresses numeracy a social practice, taking the whole person into account.

One thing that struck me during the workshop was the way that I teach numeracy training to new tutors. When I teach them how to teach reading and writing I emphasize the pre-, during, and post-reading/writing activities that we, as competent readers, do unconsciously. I emphasize all the things the learner brings to the text, how to teach the learner to interact with the text as they read. Yet I don't think about that when I'm teaching numeracy! It's just math – I teach the formulae and the learner practices the skill. The Beyond Worksheets approach has challenged me to think about numeracy as a reflective action.

I was struck by the way that we use numeracy skills to make meaning of our world. It is more than just mathematics, it involves ideas of space and time and distance – things that adults think about and are familiar with.

"The workshop helped me to understand at a deeper level how this shift can play out in practice."

I just wanted to thank you for the great workshop last night. I think you did a great job presenting an important shift in thinking about numeracy work. The workshop helped me to understand at a deeper level how this shift can play out in practice. As I said last night, the „blank' sheet interview idea is brilliant in its simplicity and in its effectiveness in focusing attention on the person. This is such an important shift. In the past, when I told people about Tom's approach to numeracy people would sometimes say, „Yeah, yeah, we all give the students practical stuff', and that would sometimes be the end of the conversation. What I should have said then and now know how to say was/is, „Yeah, but are you taking the while person into account?', this focus on the whole person has now been articulated really well and put into a framework that makes us much more conscious of where we should be going with numeracy work. You've turned the tables with this framework. I used to think that numeracy work should be more informed by the way we approach literacy work. What I think is going to happen now is that your numeracy framework's going to help inform literacy work.

6 Adopting a Social and Holistic Approach

6. Adopting a Social and Holistic Approach

When we first set out, this project was aimed at practitioners but later expanded to include program providers, government and policy makers. This is a very wide net to cast. In this next section, we will try to address our views in two directions. We will consider the implications of adopting this approach to practitioners in the field and to policy makers and curriculum developers. Finally, we will reflect upon the challenges that this approach might raise to address workplace skills and academic competence within the development of numeracy practice.

6.1 What are the implications of a social and holistic approach to numeracy practitioners?

Goals

If the goals of a learning program are to be social and holistic, they will start with the learner as a whole person situated in his/her community. This is where concepts like "funds of knowledge" come into play, because they focus the attention of the practitioner to what the learner brings from outside the classroom. In following this approach, the main goal is a shift in identity for the learner. From our schema, the goals are derived from the "Being" domain. The goals would entail becoming self-aware in using mathematics, gaining confidence as a "numerate" person, and making personal connections throughout the learning process.

If we begin with those "large" goals, they filter down to more precise goals in a specific learning plan. For example, in our workshop, one participant brought to us the specific need to buy the correct amount of paint to cover a room. The person did not measure the room, but

used estimation skills instead. In this case, her learning goal was to have the confidence in her estimation skills to buy the paint. She was aware of what math skills she was using (even those she was not using). She was also making connections between the concrete task of buying the paint and the skills she needed to follow through. In the end, there was a shift in her confidence and in her "numerate" identity.

If a learner had merely the task-specific goal of buying the correct amount of paint and the practitioner did not take into account the whole person, they may have gone through the exercise of learning how to measure and doing exact calculations. However, if the learner had not made a shift in confidence, the next instance of having to buy paint would be as daunting as the first time.

Assessment

To do authentic assessment, the learners and practitioners together will "create" or "choose" the assessment tools in keeping with the goals of the learning program.

In modelling the social and holistic approach in our workshops (p.32-34), we used a "blank page assessment," where the technique is an open-ended interview. The purpose of this technique is for the practitioner to learn about the whole person, to discover the "funds of knowledge" that the learner brings to the classroom. This is suitable for a practitioner who is experienced in adult education principles and in generating meaning from mathematics. In any numeracy program, a practitioner would need to use a variety of assessment mechanisms– diaries, observations, folios, written tasks, open-ended tasks, etc.

Earlier in our report, we referred to a resource that validates our practice supporting a social and holistic approach. (p. 25-27): *Rethinking Assessment: Strategies for holistic adult numeracy assessment* by B. Marr, S. Helme and D. Tout (2003). The book contains an extensive overview of various assessment strategies based on the practitioners' experience. Their strategies for assessment include:

- Keeping track of student progress
- Bringing reality to assessment
- Using interviews in initial assessment
- Using open-ended assessment tasks
- Negotiating assessment
- Focusing on student success
- Focusing on awareness of learning
- Focusing on student autonomy

In discussing learning difficulties, the authors deal with issues such as interrupted attendance, fragmented learning, and lack of a set structure. A key concept underlying their model is "negotiated assessment" where the learner and facilitator work together to devise an appropriate assessment task that interests the learner while also meeting relevant assessment criteria.

In trying to determine the difference between an assessment task and a learning task, their conclusion was that "any task that requires students to apply skills in a realistic situation, or demonstrate their conceptual understanding, has the potential to be an assessment task." (p. 16)

While citing "Rethinking Assessment" as an invaluable resource, it is not the authors' collection of assessment tools and strategies that is the most important. These merely flow from their approach of "holistic adult numeracy assessment." What is important is "what" they assess. Much of this is captured in our schema of learning. However, as we see in the jigsaw on page 26, "what" they assess includes the seven components:

- Confidence
- Skills and Knowledge
- Task Process Cycle
- Transfer and Application
- Autonomy
- Awareness
- Personal Connections

A numeracy program would do well to consider all these in developing assessment tools. We would go further in recommending that every literacy and numeracy program purchase a copy of the book.

Instructional Methods

If we look at the "Doing" and "Knowing" domains in our schema, we get a glimpse of what methods a practitioner may be using:

- choosing relevant information
- applying appropriate skills and strategies
- reflecting on the learning and the results
- generating mathematical problems, skills or procedure
- employing mathematical content and techniques that:
    - vary according to the situation
    - depend on the purpose and context in which the numeracy takes place
- creating meaning in daily activity

However, from the perspective of an outside observer, some of these activities look no different than in a program that does not subscribe to social and holistic learning. The key to this approach are the verbs: choosing, reflecting, generating mathematics, creating meaning – all depending on the context of the learner. It is a fluid and cyclical process that does not depend on set rules and procedures.

The two terms that are perhaps most perplexing to the practitioner who has not yet encountered them are *generating mathematics* and *creating meaning of mathematics*.

Generating mathematics means that the learner and practitioner themselves discuss the context in which they need mathematics, and then choose the procedures and skills they determine necessary to achieve their goals. In the example above, of the person needing to purchase paint, the "learner" chose to estimate rather than calculate. In a learning environment, the learner and practitioner would generate further problems that reinforce the skill of estimating – the learner's goal being confidence in her ability to do this in her real life context. A traditional approach, on the other hand, would have relied on textbook procedures on calculating volumes with ready-made problems to reinforce the procedures. In the ideal learning situation, where time is available, the learner and practitioner would consider alternative strategies and procedures. Consequently, they could develop a repertoire of skills and strategies and an ability to choose appropriately among them.

Making meaning of mathematics, in the simplest terms, means making it relevant to the learner's real life context. In the same example above, because the skill of estimating is applied in the learner's daily life, it has meaning. If she had chosen to calculate volumes, that too could have meaning if the learner actually used it in her purchase of paint. In other words, mathematics skills are not taught and learned as abstract and free of context. For greater understanding of these concepts, we refer you back to pages 17-19 that outline Johnston„s strands of meaning constructed or generated in five specific ways and Tout's applied learning approach.

Rather than leave you with generalities, the following is a non-exhaustive list of specific techniques, strategies and activities that a practitioner might use while adopting a social and holistic approach to numeracy. They are gleaned from many sources including D. Tout (2004), D. Tout and M.J. Schmitt (2002); D.A. Grouws and K.J. Cebulla (2000); L. Ginsburg and I. Gal (1996); and D. Buerk, (1994):

- Start with the knowledge and interests of the learners, including the mathematical methods they already use and know.

- Address and evaluate attitudes and beliefs regarding both learning math and using math.
- Teach in a context that is of interest to the learner – start with a context and move into skills/theory.
- Use a cooperative approach to working – work in groups, on projects, investigations and tasks, etc.
- Connect to the outside world – including people who know and use different mathematics.
- Build self-esteem and confidence in mathematics – encourage success, and fun too!
- Integrate across into other curriculum areas and skills. Work on common themes.
- Engage learners in problem-solving via investigations or projects involving "real life" mathematics.
- Try to experience the problem, relate it to the personal world, clarify language, create context, and remove ambiguity.
- Look at limitations of any particular solution and describe conflicts that remain.
- Be tolerant in attitude towards rules and more willing to make exceptions.
- Encourage questions that are critical of the use of specific mathematics.
- Search for differences among theories and patterns that are similar.
- Encourage reflective and personal thinking.
- Help learners make meaning – share mental images that the problem brings to mind.
- Help learners see multiple methods and approaches.
- Develop realistic tasks or investigations that are of interest to learners.
- Engage learners in whole group, small group, and individual work – this is also how the math skills are taught and practised.
- Focus facilitation on the meaningful development of important mathematical ideas.
- Discuss historical and cultural understanding of the use of mathematics.
- While solving problems, introduce and reinforce new concepts and skills.
- Encourage learners to discover and invent new knowledge and have an opportunity to practice what they have learned.
- Encourage learner solution methods and learner interaction.
- Incorporate learners' intuitive solution methods, especially combined with opportunities for learner interaction and discussion.
- Encourage learners to become problem-solvers in a wide variety of situations and to view mathematics as a discipline in

which thinking is important.

- View computation as a tool for problem-solving, not as an end in itself.
- Encourage the development and practice of estimation skills.
- Provide opportunities to explore mathematical understanding with concrete and visual representations and hands-on activities.

When we initially talked about our personal goals for the "Beyond Worksheets" project, we wanted to create an "interruption" for numeracy practitioners. So if you are currently a practitioner, we hope that you have felt the interruption. If these methods fit into what you already do, or at least believe in, then carry on. If you don't feel convinced, then try whatever fits your level of comfort. In order to really go forward using a social and holistic approach, we need adequate resources and support from the providers and funders of adult basic education.

6.2 What are the implications of a social and holistic approach to curriculum developers and funders of numeracy programs?

In the previous sections, we present an approach inviting practitioners to critically reflect upon their current numeracy practice. But in reality, we have posed yet another challenge for practitioners to find the time and to create the space for reflection, given their experience adapting to changes in the past decade.

To support practitioners in adopting a social and holistic approach to numeracy practice, there is a need for innovative curriculum, learning materials development, flexible program delivery, and professional development that includes opportunity for reflection and discussion with colleagues.

Innovative Curriculum

In his excellent article titled, "Curriculum Frameworks and Change," Tout (2004) argues the need for an innovative curriculum for adult numeracy that provides a framework "based on an explicitly stated and theoretically based view of what mathematics education is about" (p. 10). This would be structured differently than traditional mathematic frameworks. He makes his case on the fact that the majority of numeracy facilitators are influenced by their own schooling in traditional "transmission style" approach to teaching – the expectations of students, colleagues, superiors and institutionalized curriculum, and their level of consciousness and ability to reflect on their own practice.

It is worth quoting what Tout believes are the functions and purposes of a curriculum. For him, an innovative curriculum framework should:

- Provide an overall description and structure for mathematics education.
- Provide a public face of mathematics education.
- Give guidance and general directions to teachers, including giving a flavour and emphasis (it should have a philosophy behind it).
- Give students credit for work and skills across a range of levels.
- Not prescribe contexts – but give guidelines and structures with suggestions, and therefore allows local contexts and applications to be used.
- Be flexible! Allows teachers to input and negotiate with their students and the school community and also the wider community. (p. 9)

We concur wholly with Tout's call for innovative curriculum. In fact, if policy makers and curriculum developers see merit in the social and holistic approach to numeracy that we advocate in this report, then there is a clear need for a curriculum framework to support the approach.

Tout, Marr and other numeracy educators in Australia have the experience of developing and working with the numeracy and mathematics framework (p.21-22) of the CGEA – a nationally accredited competency-based curriculum. Aside from its solid theoretical foundation, the CGEA's numeracy strand is based on an applied approach to learning and teaching with the underlying premise that numeracy is about making meaning of mathematics. What makes this curriculum framework stand the test of effectiveness and relevance is that every five years there is a process of evaluation and revision based on feedback from the field. The current edition is its third.

If policy-makers and curriculum developers in Ontario are ready to embark on an innovative curriculum, the Australian CGEA model would be a good starting point.

Learning Materials

If adult numeracy practitioners are following a social and holistic approach, they will need to develop materials where the content and procedures are relevant to the context of the learner. In an ideal world, every learning situation will require its own unique learning material. And that is exactly what a facilitator and learner will do to

create meaning for themselves in mathematics. If they are generating their own mathematics, they will develop their own materials. From our workshop example, the "learner" who wanted to be confident in purchasing the necessary paint for her room will need to develop, along with her tutor/instructor, procedures and activities to learn and practice the skills that they identify as essential.

On the other hand, a practitioner and learner cannot realistically be developing brand new materials every day. That has been the great burden on practitioners who follow an emergent curriculum based on learner needs. So we also need prepared materials that can be relevant to specific learning situations.

One of the most innovative ways to develop materials is described by Hagedorn (2004) in her report, "An Exploration of Collaborative Materials Development in Adult Numeracy Teaching." In her model, two practitioners worked with an experienced numeracy practitioner to develop materials for their own learners. They created new materials, but also adapted existing ones – always based on their learners' needs. One general conclusion was: "We found that the idea of numeracy as social practice was central when we were adapting real-life numeracy tasks to function as learning tasks in the classroom, and when we wanted to know what kinds of numeracy skills learners already had." (p. 31) In the end, they created four learning modules: (1) Grocery Shopping Habits, (2) Planning a Class Party, (3) Helping Your Children with Math, and (4) Exploring Temperature.

Another project using a similar approach was done by Ciancone and Jay (1991) in "Planning Numeracy Lessons for an ESL-Literacy Classroom: A beginning." This project also involved two literacy practitioners and a numeracy resource facilitator.

The success of this collaborative materials development approach was due to the fact that it was rooted in the social practice of the learner, while the facilitators reflected continually on their own teaching practice. But it was also successful because time and financial resources were devoted to the project. Facilitators, in the normal course of teaching, do not have the time and resources to create and develop learning materials. They can barely cope with doing their daily lesson plan along with assessment and long-term goals. Therefore, funders must provide the financial resources for materials development – not on a project basis – but as an integral part of program delivery.

Program Delivery

In our schema of learning proposed above, there are three domains – being, knowing and doing –with the learner as a whole person

interacting with the world around. This conception of learning implies the need for a flexible delivery of learning and teaching environments. If the learner is treated as a whole person, the scheduling and location of the learning program must suit their needs, as well as the curriculum and learning materials. With respect to scheduling, there should be a variety of times available – morning, afternoon and evening, weekend, full-time and part-time. With respect to location, there should be a variety ranging from community centres to neighbourhood schools and colleges to workplace settings.

A range of delivery models should also be available – classes, small groups, one-to-one, linked-skills, ESL-numeracy, family math, preparation for employment, workplace, and union-based. In our social and holistic approach, social interaction would be a central component of any program.

In short, any program delivery model needs to be accessible and flexible.

Workplace Numeracy

We would like to highlight numeracy in the workplace as a delivery model because, while the need is great, the programming is sparse. Due to technological change and globalization, there has been much restructuring in the workplace and increased demands on workers to upgrade their skills – especially mathematics and computer skills. Much like our three-domain schema of numeracy learning, Wegede (2000) claims there are three different levels at which to consider mathematics in the workplace: skills, understanding, and identity. Current workplace training focuses mainly on the level of skills. However, there is also a need to develop more general mathematics understanding that is not solely concerned with a job-related task, but that enhances the worker's knowledge in the whole working environment and life outside as well.

Coinciding with our social and holistic approach to numeracy is a worker-centred educational process, proposed by Connon-Unda (2001), that:

- is participatory, inclusive and deeply democratic in both its aims and objectives;
- acknowledges and builds on the experiences and skills of workers;
- involves hearts as well as minds;
- promotes solidarity and respect among workers;
- enhances workers' capacities for critical reflection and action;
- links education with action in the world in a project of social transformation.

For a successful workplace numeracy program, the design must consider the worker as a whole person, with needs inside and outside the workplace. Accordingly, the curriculum will derive from mathematics generated by the worker in his/her diverse contexts.

Professional Development

For adult numeracy in Ontario, there is a clear need for more instructional support and professional development. Practitioners come to adult literacy with varied experience and are prepared in adult learning methodology to varying degrees. Unfortunately, when it comes to adult numeracy, most lack the pedagogical and content knowledge (conceptual understanding as well as procedures) needed to teach adult mathematics.

As we have seen throughout this report, effective numeracy practice requires that the practitioner be confident and self-aware with respect to the use of instructional techniques, materials, assessment tools, curriculum frameworks, as well as mathematical content and methods. In order to support the knowledge and practice in these areas, we need a variety of professional development and training programs.

Considering our social and holistic approach to learning, professional development programs should reflect this in both content and process. These programs should provide participants with opportunities to reflect not only on their current practice, but also their belief system that motivates their practice.

We look again to Australian educators for leadership in professional development of adult numeracy facilitators. They have created two innovative programs: "Breaking the Maths Barriers" (B. Marr and S. Helme, 1991) and an 84-hour course called "Adult Numeracy Teaching (ANT): Making Meaning in Mathematics (B. Johnston and D. Tout, 1995). Marr and Tout (1997) recommend numeracy professional development and training in four delivery models: (1) conference sessions and workshops, (2) short-term in-service programs, (3) long-term in-service programs, and (4) post-graduate study.

In considering professional development and training for numeracy practitioners in Ontario, we might well use the Australian programs as a basis for development – not only the content, but also the process. Their process includes the creation of local and state teams of

experienced classroom instructors who meet and discuss changes in their instructional practice. This is in keeping with their constructivist model of learning.

6.3 What are the challenges of a social and holistic approach to address workplace skills and academic competence?

In the beginning of this report, we identify three common goals of adult numeracy learners as independence, employment, and further education or training. Through holistic learning that focuses on the whole person developing self-awareness and self-confidence, a learner may clearly seek the goal of independence. Few educators would disagree.

With respect to employment, we argue that a learner can develop or enhance mathematical skills appropriate for a particular job by situating learning in contexts that are important to the learner. What is not so evident is how the context-based holistic approach helps a learner develop more generic skills that might enhance employment opportunities, since a learner seeking employment may not know the particular numeracy demands for a particular job.

In further education and training, there are typically set courses with prescribed content that may not be familiar or meaningful to the learner. If a learner has developed numeracy practice in a particular social situation, can he/she recognize similar underlying mathematical structures in situations with different surface characteristics? For example, will the learner who has discovered a way to calculate the amount of paint needed for the walls of a room be able to determine the material needed for a dress? Or will that same learner be capable of the abstract concept of dividing a surface area by smaller components to determine how many components will fit inside? When pursuing academic competence, some learners would probably need to meet traditional curricula expectations. The key in making progress in these new situations would be the attitude of the learner to the learning process.

People who feel confident in their ability to learn are more likely to engage in the process of learning. People who lack confidence in their ability to learn are more likely to view new learning as something that is challenging and overwhelming. Those who become more confident in their self-awareness as a numerate persons will be more likely to accept the rationale for learning more theoretical math when it is necessary for academic or work purposes. With supportive instruction, they will build the depth of mathematical understanding needed to transfer to additional contexts outside their range of familiarity. Therefore, we maintain that a

learner who experiences a shift in identity towards a more confident numerate individual will become more capable of dealing with the numeracy demands of workplace and academic programs.

Our assertions about attitude, shift in identity, and competence would be a likely subject of a future empirical study.

7 Directions Toward Adopting a Social and Holistic Approach

7. Directions Toward Adopting a Social and Holistic Approach

7.1 How do we see ourselves adopting and implementing a social and holistic approach to numeracy practice?

By Re-examining Goals

Goals of a learning program will start with the learner – front and centre. In a social and holistic approach, the goals will focus on the learner as a whole person situated in his/her community. They will support the learner's goal to become self-aware in using mathematics, gain confidence as a "numerate" person and make personal connections throughout the learning process.

By Holistic Assessment

Within a social and holistic approach, assessment will be authentic. Assessment tools will be created by learners and practitioners together, directly relating to goals of the individual's learning program. We promote a technique of assessment that we have termed a "blank page assessment," an open-ended interview between the learner and practitioner. The purpose of this technique is for the practitioner to learn about the whole person. To further support our approach, we highly recommend that each program acquire the resource, "Rethinking Assessment." It is an invaluable document founded on a "holistic assessment approach" that provides a model of assessment developed from listening to the voices of practitioners. There are strategies and tools to assess seven essential components including confidence, skills and knowledge, Task Process Cycle,

transfer and application, autonomy, awareness, and personal connections.

By a Fluid and Cyclical Learning Process

Clearly outlined in the Task Process Cycle in "Rethinking Assessment," we envision numeracy teaching and learning as a fluid and cyclical process not bound by a set of rules and procedures. Each phase in the learning process is totally dependent on the context of the learner. We suggested specific activities for practitioners that support a social and holistic approach.

By Innovative Curriculum

We strongly urge policy makers and curriculum developers to embark on a cutting edge curriculum based on the Australian CGEA model as a point of departure.

By Collaborative Development of Learning Materials

Ideally, adult numeracy facilitators will need to develop and have access to materials that are relevant to the learner and are contextualized. Within this approach, the learner and facilitator would generate their own mathematics and they would develop their own materials that are meaningful to specific learning situations. Secondary resources such as prepared and adapted materials would be complementary and supportive to the learning process.

Realistically, we suggest a collaborative materials development approach as described by Hagedorn (2004) in her report, "An Exploration of Collaborating Materials Development in Adult Numeracy Teaching." Literacy practitioners, along with a numeracy resource facilitator, would work together to develop and adapt program resources.

By Flexible and Accessible Program Delivery

Our three-domain schema of being, knowing and doing with the learner as a whole person interacting with the world around requires flexible learning and teaching environments. This should include a range of delivery and scheduling, location, curriculum, and learning materials that meet the needs of learners. A central component of any program would be the opportunity for social interaction.

We draw special attention to workplace numeracy where the need is great but the programming sparse. This is due to increased demands on workers to respond to technological change and globalization. There is a need to upgrade skills, but

more importantly, to develop a more general mathematical understanding that goes beyond job-related tasks to enhance the worker's knowledge of the entire working environment and life outside.

In support of the vision of this project, "Beyond Worksheets," we look ahead to the province to take bold and creative steps that will broaden the awareness of, and add another dimension to numeracy practice from the perspective of the learner.

By Ongoing Practitioner Dialogue & Professional Development Opportunities

Professional development should reflect our social and holistic approach to learning in content and process. Opportunities should be provided to practitioners for reflection on current practice and their own belief and values system that motivate their practice.

Practitioners should receive sufficient preparation in facilitating numeracy learning. In addition, ongoing professional development should support areas of instructional techniques, materials, assessment, curriculum, as well as mathematical content and methods.

Again, we refer to the Australian professional development program that includes the creation of local and regional teams of experienced practitioners meeting and discussing changes in their literacy and numeracy practice.

8 Next Steps for Adult Numeracy Practice in Ontario

8. Next Steps for Adult Numeracy Practice in Ontario

Policy makers and funders can help facilitate the adoption and implementation of a social and holistic approach to numeracy practice by encouraging and funding:

- Development of an innovative and flexible adult numeracy curriculum. This could be done through adaptation of the Australian CGEA model for the Canadian context.

- Collaborative development of authentic assessment tools that directly relate to the goals of the learner as a whole person situated in his/her community.

- Collaborative development of learning materials and resources for learners and practitioners that reflect a social and holistic approach to numeracy.

- Conception and delivery of professional development opportunities for practitioners by using and adapting assessment and learning materials to reflect a social and holistic approach to numeracy.

- Development of training units for volunteer numeracy tutors.

- Implementation of models of accessible and flexible program delivery for numeracy.

- Development of workplace numeracy programs which consider the needs of the worker as a whole person – with needs inside and outside of the workplace.

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Appendix A

Field Scan Results

The following tables provide information regarding the responses from the "Beyond the Worksheets Project Field Scan," March 2004.

It should be noted that:

- Information should not be interpreted as a complete picture of methodologies and resources being used.
- With the exception of Table 1, the total number of responses may not match the total number of programs that responded due to no responses in some cases and multiple responses in others.

Table 1

Types of Programs	Number of Responses
Community-Based	25
School Board	9
Colleges	5
Other	2
Total	41

Question 1: How do you identify learners' numeracy needs?

Table 2

Ways to Identify Needs	Number of Responses
Interview and initial Assessment	18
Identify Learners' Goals	9
Ask Learners	3

Table 3

Types of Resources	Number of Responses
*In-house (program developed) Assessment Tool(s)	11
**Commercially Developed Assessment Tool(s)	7
Combination of In-house and Commercially Produced	2

*Examples given of in-house tools: paper and pen test; checklist of skills, topics

**Examples given of commercially produced tools: CABS online; CABS manual; Breakthrough to Math Assessment; Smart Solutions; Laubach screening materials

Table 4

Topics and Themes that Were Identified	Number of Responses
Managing Money	4
Shoppping	3
Workplace	3
Writing Bank Slips and Cheques	3
Cooking, using recipes	2
Using a calculator	2
Weather	1

Table 5

Numeracy Needs Related to Learner Goals	Number of Responses
For Upgrading, Further Training and Education	7
For Personal Day-to-Day Activities	95
For Workplace or Employment	4

Question 2: How do you address and integrate numeracy in your program?

Table 6

Types of Delivery	Number of Responses
One-to-One Tutoring	18
Class	13
Small Group	9
Integration into Overall Programming	8
Individualized Programming, Working Independently with Support and Resource	6
Workshops	1

Table 7

Frequency of Delivery	Number of Responses
Once a Week	5
More Than Once a Week	4
Daily, Part-time	4
Daily, Full-time	1

Table 8

Facilitators of Numeracy Programming	Number of Responses
Program Staff	19
Volunteers	9

Table 9

Resources	Number of Responses
Commercially Produced (textbooks, workbooks, software, websites, manipulatives	11
In-house (program developed materials, activities, workshops)	7
Authentic Materials	2

Appendix B

Beyond Worksheets Workshop
February 15 and February 17, 2005
6:00 p.m. – 9:00 p.m.

Workshop Coordinator - Colleen D'Souza;
Facilitators - Tom Ciancone, Flora Hood, Joy Lehmann

Workshop Goal and Objectives

Goal:
To present the essential components of the draft report*, Beyond Worksheets: A Social and Holistic Approach to Numeracy.*

Objectives:
To provide an atmosphere and activities in the workshop that will convey and promote the approach.

To provide participants with the opportunity to reflect upon the approach in terms of their own lives and experiences, as well as their numeracy support to adult learners, including aspects of assessment, resources/materials, and program capacity.

To encourage discussion about ways that the approach may be effectively incorporated and implemented into participants' present situation as literacy practitioners.

Workshop Outline

Upon arrival, participants were given a jigsaw piece and were asked to follow instructions at tables where they sat.

Taped in the centre of each table, there was a "Worksheet" with instructions for two tasks: (1) Alpha Value and (2) Question about Math (see accompanying worksheet). Participants were to complete both tasks prior to the workshop commencing. Responses were to be written on the jigsaw piece.

Introduction to the Workshop: purpose for development of the report resource, description of the project and facilitators

Review of Agenda and Explanation of Workshop Journal (to provide an ongoing unstructured evaluation)

- referred to coloured index cards on tables to explain Workshop Journal; asked participants to jot down running notes (i.e. words, phrases, pictures that expressed thoughts and feelings about what was happening throughout the workshop)
- informed participants that cards would be collected at the end of the workshop

You and Math

- asked participants to describe and write down two "critical incidents" related to math that influences or has influenced their lives in learning, attitudes or daily activity (not specific to work as practitioners):
    - a positive experience related to math – an incident/situation when they have felt an "Aha" moment or a good feeling
    - a negative experience related to math – an incident/situation when they have been frustrated or discouraged
- in pairs, participants exchanged information re: the two incidents, and shared the information on the jigsaw piece
- then they briefly introduced one another to the whole group

Transition into next activity.

Participants were asked to put jigsaw pieces together on a large project table. They were also asked to keep the jigsaw puzzle in mind for the rest of the workshop.

Math and You, Part 1

- one participant was asked to volunteer from the group to build on his/her incidents
- carried out an informal interview/conversation to draw out/identify specific math need(s) modelling a "blank page assessment," without naming it
- then, stopped the process and asked the group about their impressions and familiarity with what happened
- following the feedback, continued the process by suggesting next steps to generate ideas of possible math tasks/activities, strategies and resources

The Definitions

- gave a brief introduction to the approach highlighting the 2 definitions that underpin the approach (see p. 27 of the report)

Math and You, Part 2

- asked the group to keep aspects of definitions in mind while observing the next interview
- selected another participant and proceeded through the same type of assessment
- asked group for general impressions and specifics to the definitions
- asked for group suggestions for next step (as detailed above in Part 1)

Break

The Schema

Explanation was given regarding the schema developed to visually represent the approach (see p. 28 of the report)

Math and Us: Group Activity (the 3 facilitators joined the groups to observe and help guide process if needed)

- in small groups, participants were asked to model the "blank page assessment"
- they were given instructions re: three steps – modelling, reflection, next steps
- they were also given specific instructions re: note-taking of the assessment process keeping in mind the three aspects of the "self," "knowing" and "doing," on a "Reflection Circle" (see accompanying Reflection Circle); and note-taking/reporting of next steps
- participants chose one member's incident
- each member took on a role: interviewee, interviewer, observer/note-taker, note-taker/reporter
- the groups were asked to stop after specific math need(s) had begun to be identified and to reflect on what happened
- then groups discussed the next steps
- each group reported back to large group

Distributed the hand-out, "The Approach in Practice" (see accompanying handout) that outlined the "blank page assessment," the next steps of developing relevant tasks/activities, and the selection and creation of effective resources.

The Report

- talked briefly about the process of the project, as well as the approach itself
- reflected on the definitions and schema that were introduced, and emphasized the primary goal and method of the approach.
- made reference to the main resources* used in researching and developing
  Supporting Learning, Supporting Change, K. Grieve, 2003;
  Frameworks for Adult Numeracy Education, L. Hagedorn, 2003;
  Numeracy in Practice: Effective Pedagogy in Numeracy for the Unemployed Young People, B. Johnston et al, 1997;
  CGEA, Certificates in General Education for Adults, J. Hagston et al, 2002; and
  Rethinking Assessment: Strategies for Holistic Adult Numeracy Assessment, B. Marr, S. Helme and D. Tout, 2003
- commented on the significance of the "jigsaw puzzle" from *Rethinking Assessment*
- then invited Q&As and discussion
- finally, distributed the report

Feedback and Workshop Journal

- noted the feedback sheet inserted in the Draft Report and asked participants to add a final thought to the Workshop Journal cards.

* Resources, including main ones from report as mentioned above, were on display for participants during the workshop.

WORKSHEET

TASK #1

Calculate the value of your first name by adding the letters according to the chart below:

Alpha Values

A = 1	**E = 5**	**I = 9**	**N = 14**	**S = 19**	**W = 23**
B = 2	**F = 6**	**J = 10**	**O = 15**	**T = 20**	**X = 24**
C = 3	**G = 7**	**K = 11**	**P = 16**	**U = 21**	**Y = 25**
D = 4	**H = 8**	**L = 12**	**Q = 17**	**V = 22**	**Z = 26**
		M - 13	**R = 18**		

For example : COLLEEN = 3 + 15 + 12 + 12 +5 +5 +14 =66

TASK #2

Think of a question that you have about MATH.

TASK #3

On the jigsaw puzzle piece that you received upon registration, write with a marker:

Your name
Your alpha value
Your question

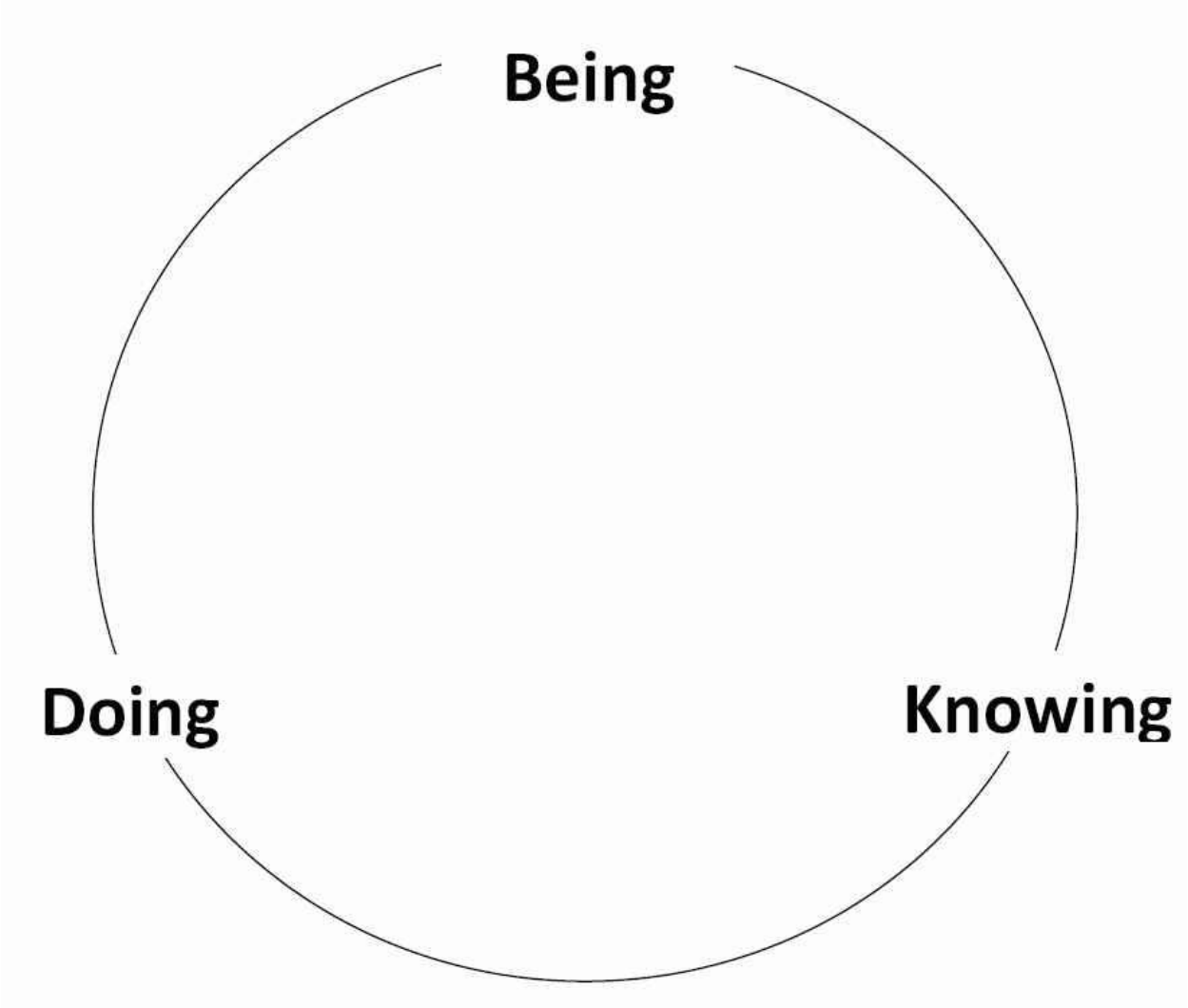
Keep it on hand for further instruction

The Approach in Practice

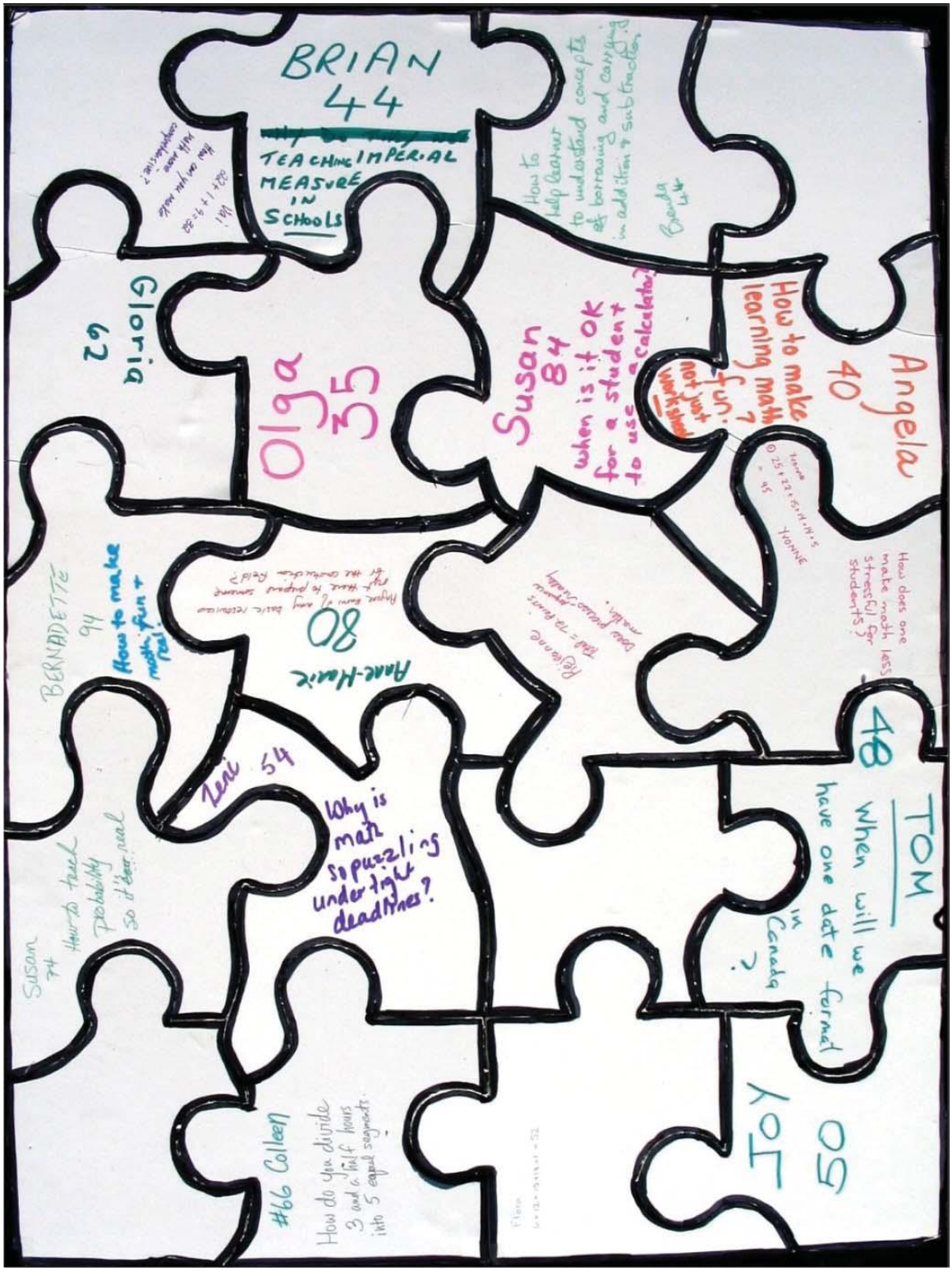
Numeracy practitioners need to be able to recognize, separate and link basic math concepts in a variety of contexts. They can isolate the gap in the learner's knowledge and they can create learning activities that teach what is needed.

- It is essential that practitioners become comfortable with the process of identifying the need.
- The process is the "blank page assessment," supporting a guided conversation with the learner.
- Once the need is identified, the practitioner has to decide what and how to teach the learner.
- Resources emerge from the authentic assessment of the learner's need.
- The most effective resources are those generated from the life circumstances and current knowledge of the learner. Textbooks, workbooks, software, and other commercially produced resources can supplement skills, but perhaps be viewed as secondary rather than primary resources.

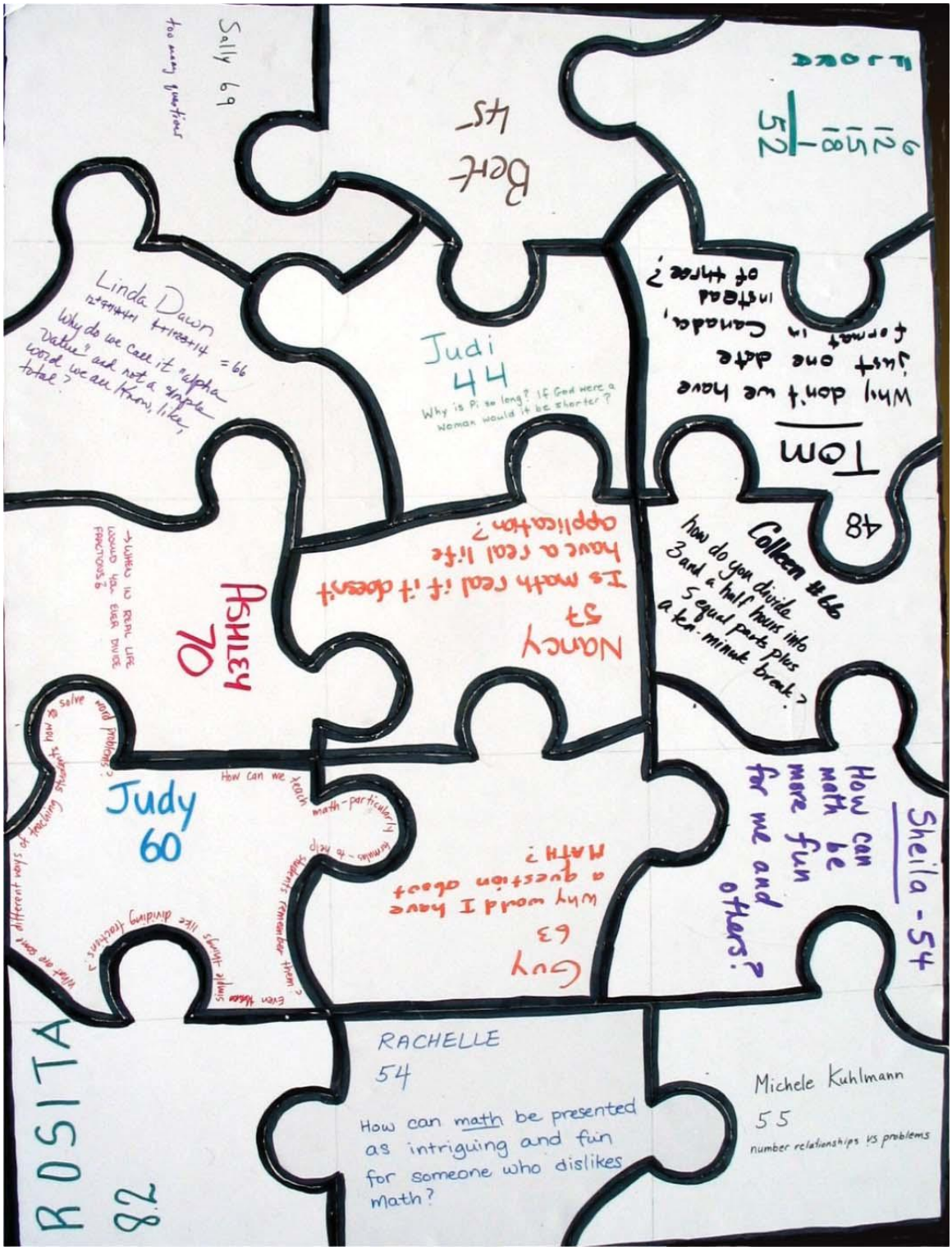
Reflection Circle



Beyond Worksheets Workshop, February 15, 2005
Participants' Jigsaw



Beyond Worksheets Workshop, February 17, 2005
Participants' Jigsaw



Appendix C

Beyond Worksheets Project List of Workshop Participants

February 15, 2005

1	Angela Bisby	Frontier College Independent Studies
2	Brian Burns	Literacy for East Toronto (volunteer)
3	Olga Contogeorgos	CNIB Deafblind Literacy Program
4	Anne-Marie Kaskens	Literacy for East Toronto
5	Rejeanne Lavallee	Ministry of Training Colleges and Universities
6	Susan Lefebvre	Literacy for East Toronto
7	Susan Macdonald	Frontier College Independent Studies
8	Karin Meyinzer	Preparatory Training Program
9	Cheryl Reid	Regent Park Learning Centre
10	Brenda Short	Toronto Public Library Adult Literacy Program
11	Yvonne Smythe	Preparatory Training Program
12	Gloria Snodden	Street Haven Learning Centre (volunteer)
13	Zeni Shariff	Toronto Laubach Literacy Council
14	Bernadette Walsh	OISE/UofT (graduate student)
15	Vai Wong	Toronto Laubach Literacy Council (volunteer)

February 17, 2005

1	Rosita Bacchus	Frontier College Beat the Street
2	Guy Ewing	MTML Lifelong Learning Project
3	Nancy Friday	AlphaPlus
4	Sally Gaikezheyongai	Davenport Perth Neighbourhood Centre Literacy Program
5	Ashley Holland	St. Christopher House Adult Literacy Program (volunteer)
6	Michelle Kulhmann	Davenport Perth Neighbourhood Centre Literacy Program
7	Rachelle Ng	Operation Springboard
8	Judy Perry	Frontier College Beat the Street
9	Linda Dawn Pettigrew	St. Stephens Community House
10	Bert Providence	Toronto Public Library Adult Literacy Program
11	Judi Snively	St. Christopher House Adult Literacy Program
12	Sheila Stewart	OISE/UofT Festival of Literacies