# IMPROVING NUMERACY IN CANADA

By John Dingwall

For the National Literacy Secretariat

March, 2000

# IMPROVING NUMERACY IN CANADA

# INTRODUCTION: CONCEPT OF NUMERACY

The purpose of this paper is to consider how numeracy can be improved in Canada, taking into account the experience so far, both in Canada and internationally. The focus is on adult numeracy, particularly at the more basic levels and in the workplace.

This paper is based in large part on interviews with numeracy practitioners, who are listed in the annex. It is also based on a review of the relevant literature, as listed in the attached bibliography of books, documents and Web sites.

## Concept/Definition of Numeracy

The word "numeracy" is a neologism a new, invented word that has come into use among specialist communities in Britain, Australia, Canada and the United States. "Numeracy" is the quantitative, mathematical counterpart of literacy. It is not yet a household word.

In French, there is, as yet, no single word that is equivalent to "numeracy". However, there is a need for a short word (such as "numéracie") to express the concept, since otherwise it is difficult to discuss the subject in a concise way or to give the concept a sufficiently wide range of meaning.

Unless there is a recognized concept such as numeracy (or a close equivalent), it is difficult to come up with a strategy and a coordinated set of programs for promoting numeracy.

Before the word "numeracy" came into use, there was discussion of terms such as "mathematical literacy" and "quantitative literacy", which placed the focus on calculations and the ways in which numbers and mathematical concepts were embedded in texts, but which did not take into account the wider practical uses of numbers and mathematics in the workplace and in personal life on an everyday basis.

Several useful definitions of numeracy have been put forward, including the following:

- Numeracy is the mathematics for effective functioning in one's group and community, and the capacity to use these skills to further one's own development and that of one's community. (1)

1 Australia, Beazley Committee, quoted in the International Life Skills Survey (ILSS) Numeracy Framework, p. 13.

- Numeracy refers to the aggregate of skills, knowledge, and dispositions that enable and support independent and effective management of diverse types of quantitative situations. (2)

- Numeracy is a critical awareness which builds bridges between mathematics and the real world, with all its diversity.(3)

Most recently, the Numeracy Working Group of the International Life Skills Survey (ILSS, described in the next section; the survey is also known as the Adult Literacy and Lifeskills survey, or ALL) has tentatively defined numeracy as: (4)

- The knowledge and skills required to effectively manage the mathematical demands of diverse situations. (5)

According to the Numeracy Working Group:

- 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 enabling knowledge, behaviours, and processes. (6)

Each of the components of this definition will now be considered. In actual situations, the concept of numeracy varies according to the content of its components. Numeracy in one context for one person for one set of purposes will be different from numeracy elsewhere. Everyone's concept and experience of numeracy will be different, even if only slightly.

Each of the components of numeracy has different aspects or dimensions, as follows:

## Purpose and Context

People solve problems and manage situations in a context with reference to a set of purposes. General contexts and sets of purposes include: (7)

---

2 Iddo Gal, 1993; from ILSS Numeracy Framework, p. 9

3 Betty Johnston, quoted in the ILSS Numeracy Framework, p. 13.

4 The following discussion briefly summarizes the relevant portions of the ILSS Numeracy Framework, which provides an excellent and extensive treatment of this subject.

5 ILSS Numeracy Framework.

6 ILSS Numeracy Framework.

7 ILSS Numeracy Framework, pp. 16 17.

- Numeracy for everyday life (e.g., budgeting, time management, games/sports, and household tasks).

- Numeracy for community, for civic participation, and for understanding social and political issues.

- Work related numeracy, including measuring, scheduling, tracking/monitoring, and managing revenues and expenditures.

- Numeracy for personal organization, in matters such as money, time, and travel.

- Numeracy for knowledge and further learning (needed for further study in disciplines and trades requiring mathematics).

## Responding to Situations and Problems

There are several types of response: (8)

- Identifying or locating relevant mathematical information in the task or situation.

- Acting upon or reacting to the information in the situation (e.g., by counting, measuring, estimating, or calculating).

- Understanding and interpreting the information, and comprehending what it means or implies (e.g., whether something makes sense or is appropriate within a given context).

- Communicating: Originating and understanding messages that contain numbers (in all forms) verbally, in writing, or visually.

## Mathematical Ideas

Numerate behaviour involves responding to information about mathematical ideas such as the following: (9)

- Quantity and number, e.g., revenues and expenditures.

---

8 ILSS Numeracy Framework, pp. 17 18.

9 ILSS Numeracy Framework, pp. 18 20.

- Dimension and shape, e.g., length, width, perimeter, area, and volume.
- Pattern and relationships, e.g., inter relationships of variables.
- Data and chance, e.g, sampling, prediction, data analysis, and likelihood.
- Change, e.g., compound interest, exponential growth, cycles, and present and future value.

## Representation of Mathematical Ideas and Information

Mathematical ideas and information may be represented in a variety of ways, including: (10)

- Concrete objects and pictures.
- Numbers, symbols, and formulae.
- Diagrams, charts, and maps.
- Graphs and tables.
- Text (e.g., in forms).

## Activation of Enabling Knowledge, Behaviours, and Processes

Numeracy depends on the total set of knowledge, skills, strategies, and attitudes which people bring to bear in situations which require the use of mathematics. Specifically, these include:(11)

- Mathematical knowledge and understanding: this includes concepts and procedures (both formal and informal), e.g., in areas such as arithmetic, measurement, geometry, and data analysis.
- Problem solving skills and strategies: these include extracting relevant information and stating and modelling the task (verbally, mathematically, and visually).

---

10 ILSS Numeracy Framework, p. 20.

11 ILSS Framework, pp. 20 22.

- Literacy skills: understanding and analyzing numerical and mathematical information embedded in texts.

- Beliefs, attitudes, and background experience: people will be resourceful if they feel resourceful especially if they have self confidence and a sense of being "at home" with numbers.

### Development of Numeracy Capabilities

It is evident from the points made above that the development of numeracy capabilities involves not only the acquisition of knowledge and skills, but their application in real situations for varying sets of purposes, supported or impeded by different attitudes and mind sets (e.g., confidence vs. anxiety). Improving numeracy can be a complex and difficult task.

## IMPORTANCE OF NUMERACY

In a modern, knowledge based economy and society in which networked computers are becoming ubiquitous, numeracy is increasingly important, and indeed essential both at the more basic and the more advanced levels. A wide range of practical skills is needed in order to cope with the increasing demands in areas such as the following:

### Economy and Workplace

In the economy, some of the key driving factors for the increased use of numeracy are:

- Widespread use of networked computers into which there is a constant flow of data, e.g., from "sensors" such as scanners at check out counters. This information is collected and analyzed using databases, spreadsheets, and "business intelligence" and other reporting tools. All of this requires ever higher degrees of numeracy on the part of everyone concerned.

- Concern for quality in both manufacturing and services. This involves the use of data for control and analysis (e.g., Statistical Process Control, and also analysis of feedback from customers, through a variety of channels).

- Availability of more information through the Internet, e.g., in areas such as comparative pricing (where buyers must analyze the competing prices and merits of different products and services).

- Increasing knowledge content in all areas most notably in the trades and professions, but also in many other fields: much of this knowledge has a mathematical or numerical dimension or aspect.

- Increased teamwork: In teams, people need to develop and exercise a wider range of skills, e.g., planning, budgeting, scheduling, and process control.

While there is an increased need for numeracy in general, the increases have perhaps been greatest in areas such as the following:

- Measurement, using a wide variety of tools and methods.
- Communication, e.g., in a team context.
- Interpretation, e.g., extracting meaning from data analysis.

## Personal Life

Numeracy is also becoming more important in personal life, in areas such as:

- Budgeting and money management (e.g., banking, credit, RRSPs, stocks, bonds): Here, numeracy has always been important, but now the choices are more numerous and complicated. (For example: Should one lease or buy a car?)
- Health: Numeracy helps in understanding health related information, e.g., in areas such as medications, health risks, diet and exercise. Increasingly, the discussion of these matters involves numbers. (12)
- Household: Numeracy has always been important in home repairs and in renovation and construction. In recent years, there has been a vast expansion of "do it yourself" products and services. Both in the household context and in the economy as a whole, there is a wider range of choice in products and services and comparative shopping is becoming ever more complex as consumers deal with bulky catalogues, complicated pricing, and overchoice.
- Family: Many parents want to help children with math homework that seems to have become more challenging in recent years. (In point of fact, more has been added to the math curricula, and at earlier points.)

## Education and Knowledge

Numbers and math are becoming more important in all areas of knowledge. For example, over the past several decades, the social sciences have been making much more use of math, statistics, and data analysis more generally. Math is increasingly important as a requirement or prerequisite. For many fields, mathematics is the "gatekeeper".

---

12 An example would be the increasing number of references to fat grams and the body mass index - a new subject within the past 5 years.

## Citizenship and Public Life

As citizens, taxpayers, and stakeholders, people need to understand math and numbers, e.g., in discussions of taxes, expenditures, interest rates, employment levels, public opinion polls, and elections. More data is now available, and more data enters into the discussion of public policy issues. For example, the current discussion of education and school closures in Ontario (with important implications for adult numeracy education) involves consideration of a funding formula and a space formula, both of which are based on complex calculations covering a range of variables. These formulas are being applied in the context of demographic trends and school enrollments, in a situation where a closure or program change affecting one school will impact on programs and enrollments in neighbouring schools.

# SURVEYS AND STUDIES

## International Studies

Canada has participated (and is continuing to participate) in major international studies such as the following:

## International Adult Literacy Survey (IALS)

In the *International Adult Literacy Survey*, there were three literacy scales: prose literacy, document literacy, and quantitative literacy (which was defined as, "the knowledge and skills required to apply arithmetic operations, either alone or sequentially, to numbers embedded in printed materials, such as balancing a chequebook, figuring out a tip, completing an order form, or determining the amount of interest on a loan from an advertisement.")(13) In this context, mathematical and numerical skills were closely linked to literacy skills, and were not measured separately from literacy. The focus was on math operations on numbers embedded in text.

In the International Adult Literacy Survey, Canada ranked second in prose literacy, fifth in document literacy, and seventh (out of thirteen) in quantitative literacy. Sweden ranked highest in all three categories, while the Netherlands ranked second in prose and document literacy and third in quantitative literacy (where Germany was second).(14)

Within Canada, the measured skill levels for all forms of literacy were higher in Ontario and, especially, for the Western provinces, while the levels were lower in Quebec and the Atlantic provinces.

---

*13 Highlights from the Second Report of IALS.*

*14 Ibid.*

In quantitative literacy, Alberta had the highest scores, with 65% at Levels 3, 4, and 5, and 35% at Levels 1 and 2. Internationally, this would put Alberta second (behind Sweden and ahead of Germany). Quebec had the lowest scores, with 40% at Levels 3, 4, and 5, and 60% at Levels 1 and 2. Internationally, this would put Quebec second from last (behind Ireland and ahead of Poland). (15)

## Third International Mathematics and Science Study (TIMSS)

In 1994-95, through the *Third International Mathematics and Science Study*, students in more than 40 countries in grades 3, 4, 7, 8 and the final year of secondary school were tested for mathematics and science knowledge related to their school curricula.(16)

In mathematics "literacy", for students in the final year of secondary school, Canada ranked 9th out of 21 countries, with a score that was higher than the international average (519 for Canada vs. an average of 500). Countries ranking higher than Canada were: the Netherlands, Sweden, Denmark, Switzerland, Iceland, Norway, France, and New Zealand in that order.(17)

In advanced mathematics, Canada ranked 10th (just behind Sweden), with a score that was not significantly different from the international average (509 for Canada vs. an average of 500).(18) The top three countries for the advanced mathematics component were France, Russia, and Switzerland.

## Program for International Student Assessment (PISA)

The *Program for International Student Assessment*, being conducted under the auspices of the Organisation for Economic Co-operation and Development (OECD), will provide comparative data on the performance of 15-year olds in different countries, with a view to assessing how well prepared the students are for life beyond secondary school.(19) PISA will assess a wide range of mathematical knowledge and ability, in areas such as the following: mathematical thinking, reasoning, and argumentation; posing and solving problems; using mathematical representations; working with symbolic, formal, and technical elements of mathematics; communication; and use of mathematical aids and materials.(20)

---

15 Calculated from data in the *Highlights from the Second Report of IALS and Highlights from the Canadian Report.*

16 In 1998-99, TIMSS was again administered to students in grade 8, but the results are not yet available.

17 *TIMSS Highlights*, on the Boston College Web site.

*18 Ibid.*

19 Please see: www.pisa.oecd.org

20 *Internationales und nationales Rahmenkonzept für die Erfassung von mathematischer Grundbildung in PISA*, pp. 2 3. (Berlin: Max Planck Institut für Bildungsforschung)

The first PISA survey will be done from March to April, 2000 in Northern Hemisphere countries, with a focus on reading literacy as the major domain of interest. Mathematical and scientific "literacy" will be the minor domains in this round. Results will be published in September 2001, and will be based on an analysis of samples ranging between 4,000 and 10,000 per country, with extensive information on background information and attitudes, as well as performance on the test items.

In 2003, the second PISA assessment will be done with mathematical "literacy" as the major domain; a third assessment will be done in 2006, with scientific "literacy" as the major domain.

## International Life Skills Survey (ILSS)

The most comprehensive international assessment of numeracy (in the broadest sense) will be done in the context of the *International Life Skills Survey (also known as the Adult Literacy and Lifeskills survey, ALL)*, in which Canada is playing an important co-ordinating role. The study, which is being developed in co-operation with the OECD, will assess the levels and distributions of cognitive skills which people need to acquire, use, and update in order to participate successfully in a knowledge based economy and society.

This study will assess the performance of adults (from 16 and over) in the areas of prose and document literacy, numeracy, and problem solving. There will also be assessments (through behavioural reports) of computer familiarity and interpersonal/teamwork. In addition, information will be collected on relevant variables, including work force participation, education and training, literacy activities, and skill demands of the workplace.

Each of the participating countries will provide: a representative for the Project Advisory Group(21); a National Project Manager; a sampling statistician; a survey team; any necessary localization of the survey instrument (e.g., with respect to language and units of measurement); and a team of researchers to analyze the national data. Overall co ordination and expertise are being provided by Statistics Canada and the US National Centre for Education Statistics, particularly through a Project Management Team, with representatives from Canada, the USA, Sweden, and the OECD.(22)

In Canada, the survey will be administered to a basic sample of 10,000 respondents. However, there will be "over sampling" of certain groups - notably anglophones in Quebec and francophones in Ontario - in order to obtain more precise results for these particular groups, at a higher level of statistical confidence.

---

21 The Project Advisory Group comprises representatives of the participating countries, the OECD Secretariat, and members of the Project Team.

22 The Canadian representative on the Project Management Team is T. Scott Murray.

The survey is to be completed by 2002, and the analysis is to be completed by early 2004.

In each of the main areas being tested, there is an Instrument Design Team working group. In particular, there is a Numeracy Working Group which has developed an excellent framework document providing an operational definition of numeracy and numerate behaviour (as detailed on the previous section) and which is currently developing the test items, using the framework as the point of departure. (23)

## Canadian Studies Essential

### Skills Research Project

Human Resources Development Canada has done extensive work (involving 3,000 interviews) to identify the essential skills in a wide range of occupations. Essential skills are grouped within the following categories: reading text; using documents; writing; numeracy; oral communication; thinking skills (problem solving, decision-making, job task planning and organizing, memory, and finding information); working with others; computer use; and continuous learning.

So far, Essential Skills Profiles have been developed for 150 occupations, with 30 more currently being added.(24) The profiles identify which skills are relevant and applicable for each occupation, and at what level of complexity. Examples are also provided.

For the profiles, the numeracy section includes:

- Complexity ratings for numerical estimation and for numerical calculations (concerning money, scheduling, budgeting, accounting, measurement, and data analysis).
- Examples.
- Math skills profile, covering: mathematical foundations used; how calculations are performed; and measurement instruments.

The Essential Skills Profiles provide specific, practical information on the use of numeracy and other skills in different occupations. The profiles should be a valuable planning tool for many purposes. They have already been useful in program planning for numeracy (and literacy) education; and in discussions between employers and prospective employees, concerning which skills are needed and at what levels.

---

23 The Numeracy Working Group comprises: *Mary Jane Schmitt (Harvard); *Iddo Gal (University of Haifa); *Dave Tout (Language Australia); *Mieke van Groenestijn (Utrecht University, Holland); Myrna Manly (El Camino College, California); and *Stan Jones (Statistics Canada). Persons whose names are marked with an *asterisk were interviewed for this paper.

24 The profiles are available at:
www.hrdc-drhc.gc.ca/essentialskills

**Test of Workplace Essential Skills (TOWES)**

The Essential Skills Profiles have also been useful in developing the Test of Workplace Essential Skills.(25) From high school transcripts, it is difficult for employers to ascertain whether prospective employees have the particular skills needed for specific jobs - hence the need for "alternate credentialing". TOWES provides employers with assurances that their employees do indeed have the skills that they require, at the appropriate level of competence. This also helps in program planning and in choosing the appropriate courses, both at the entry level and for upgrading.(26)

# DELIVERY OF PROGRAMS AND SERVICES

Programs and services for increasing adult numeracy can usefully be considered under three main headings:

- Workplace education.
- Adult basic education and upgrading.
- Further education and continuous learning.

## Workplace Education and Numeracy

**Purposes and Requirements**

The purpose of workplace education is to make sure that people have the skills they need for the job - to keep their jobs, upgrade their qualifications, and sustain and enhance a high level of performance.

Each job or work situation has its own specific set of numeracy requirements. For example, a crane operator will need to know about angles and centres of gravity, while a carpenter will need to know about measurement, areas, etc. Within the set of requirements for a particular job, it is increasingly important for people to have very high levels of competence. For example, they may have to make very precise measurements (e.g., auto mechanics) or do exact calculations of what will fit where (e.g., carpet layers). An approximate knowledge of general math will not be sufficient, although this is certainly helpful.

As noted above, the Essential Skills Research Project has done excellent work in identifying the particular skills and areas of knowledge which are needed for over 150 occupations - and the Test of Workplace Essential Skills helps in measuring and assessing these skills. These approaches have been especially useful in the construction industry, where high levels of competence and precision are required.

---

25 This is being co-developed by SkillPlan, in Vancouver, and Bow Valley College, in Alberta.
26 For more on TOWES, please see: www.towes.com

**Types of Programs and Services**

In order to meet the expanding requirements and to enhance skills, programs and services are being provided in the following contexts:

### *On Site*

An excellent example of on-site training and education is the program which has been developed by Keyano College (in Fort McMurray, Alberta) under contract to Syncrude. Instructors from Keyano College provide the training on-site - an arrangement which minimizes travel time for the workers. The courses and the materials are adapted to the specific requirements and situation of Syncrude, with the examples being drawn from the workplace.

### *Community Colleges*

In general, the training and education provided in community colleges is highly relevant to the requirements of the workplace, and there is usually a math/numeracy component to the programs, either through mathematics courses or through mathematical content in other courses. In many cases, the classroom component of apprenticeship training (several weeks per year) is provided by community colleges.

One advantage of community colleges is that in addition to classroom education, they can provide support services such as the following:

- Learning centres with resource materials, tutors, guidance services, and places to meet and study. For example, Bow Valley College (in Alberta) provides a comprehensive set of materials and services, including services for students with learning disabilities and special needs.

- Assessment and counseling services which help students clarify their goals, choose programs, and monitor their progress. A good example would be Algonquin College (in Ottawa) which does detailed assessments and helps students to adjust their goals to their progress.

### *Unions, Employer Associations, and Professional Associations*

As knowledge, education, and literacy/numeracy become more important, some industries have been organizing themselves to ensure high levels of competence in the required areas of skill and knowledge. They have been setting standards, working on methods of assessment, and developing materials and courses to meet the needs of their members.

For example, in British Columbia and the Yukon, the construction trades are served by SkillPlan, which links people to learning opportunities, develops courses and workshops, does needs assessments and related research, and provides policy advice on skills upgrading for the construction industry.(27) Another good example would be the Operating Engineers' College of Newfoundland, which provides courses and materials for trades in the construction industry (e.g.,

for crane operators). There are also important initiatives in Alberta (construction) and Manitoba (manufacturing).

It makes sense to develop courses, materials, standards, and programs for specific trades and industries. The students are motivated (since their progress will be important for professional certification and upgrading); the employers see this as a means of ensuring high levels of competence; and the education and training are highly relevant to the needs of the trades and industries.

## Issues and Concerns

Issues and concerns which are particularly important for workplace training and education are as follows:

- *Relevance:* Linking the programs and services to the actual numeracy requirements of the job. For this, the Essential Skills Research Project and the Test of Workplace Essential Skills (TOWES) have been highly useful. Skillplan and Bow Valley College have been co developing TOWES and building upon the work done for the Essential Skills Research Project.

- *Competence:* As noted above, within the set of relevant requirements, it is essential to have a very high level of competence. For example, in any job involving the use of materials, the measurements and calculations must be done correctly, or materials will be wasted. Where safety is an issue, it is all the more important to have no mistakes.

- *Speed:* Both the employers and the employees are concerned to move through the training as quickly as possible. It is helpful if the new or enhanced skills and knowledge can be applied immediately in work situations.

- *Teamwork and co operation:* This involves working together with others to apply knowledge and skills related to numeracy. For example, teams are widely used at Syncrude. Workers who are in teams are motivated to improve their numeracy skills so that they can pull their weight in the teams, over the whole range of tasks with which the teams are concerned.

## Adult Basic Education and Upgrading

### Levels

In adult basic education and upgrading, the concern is to bring people from what may be minimal levels of skill and knowledge up through various levels, and (if they so choose and can do the work) all the way up to pre college or pre apprenticeship standards.

---

27 Please see: www.nald.ca/province/bc/skill/spca.htm

There are three general levels:

- Elementary math, e.g., basic addition and subtraction.
- Math equivalent to middle school, e.g., percents.
- Math equivalent to high school, all the way up to Grade 12 general math (or its equivalent).

Within these general levels, there may be other levels, in varying gradations.

Experience shows that those who enter at the most basic level often take a long time to progress through that level - and in many cases they will not move beyond that level. They will often require individualized assistance (e.g., tutoring) on an ongoing basis.

On the other hand, students who enter at the middle or higher levels will typically make more rapid progress, and are more able to make progress on their own.

**Types of Programs**

Numeracy and mathematics education is provided in the context of programs such as the following:

- Literacy training, where numeracy is usually one component of a much wider program. The amount of attention which is specifically devoted to numeracy will vary.
- General skills upgrading and pre-employment training, e.g., for recipients of social assistance and unemployment insurance. (This may be part of the requirement for receiving continued assistance.)
- ESL (English as a Second Language).
- Math instruction as part of a high school diploma (or its equivalent).

One feature of these programs is that there is a diversity of students, with a wide spectrum of experience, abilities, and goals.

**Program Delivery**

Programs and services are provided by or through:

### *Community Colleges*

Community colleges have a range of programs, at different levels. As noted, one advantage of the community college programs is the comprehensive set of services which they can offer: assessment; counseling; learning centres; and other services. Such services are important for

continuity in education: at the adult level, those who drop out of the programs typically do so because of events and conditions in their personal lives. The more that they are able to bring these other factors into balance, the more likely it is that they will be able to stay in the programs.

### *School Boards*

School boards provide valuable education in numeracy and mathematics, as part of adult basic education and high school equivalency programs. In some places (such as Ottawa and Toronto) the school boards have developed innovative methods and materials, and have been able to employ specialists in numeracy. However, school board budgets have been under pressure in some provinces, and the tendency is to give priority to education for children, rather than adults, with the result that adult numeracy programs (along with other adult education programs) have been curtailed or jeopardized in recent years.

### *Community Based Organizations*

Community-based organizations offer a wide range of literacy programs and services, on small budgets, making use of community resources such as volunteer tutors and community facilities (e.g., libraries and community centres). In larger centres, there may be several programs and services, between which there can be some co-ordination and some grouping of students - but in smaller centres, organizations will have to teach across the spectrum.

For community-based programs, it is especially important to develop appropriate and useful materials and methods, and to "train the trainers", most of whom are part-time or volunteers. In some provinces (e.g., Manitoba, Saskatchewan, and Quebec), innovative and useful materials (e.g., learning kits and CD/ROMs) have been developed for teaching numeracy.

### *Unions, Trade and Professional Associations*

Unions and trade and professional associations provide basic education and training in numeracy and literacy as part of the pre-qualification process, to enable people to qualify for apprenticeship or specialist training and certification. An example would be the Operating Engineers' College in Newfoundland which makes innovative use of home-based assistance for its students: it sends them learning packages for home use, where students can learn on their own, assisted by their spouse, or children, or other family members. In general, this arrangement has worked well, except for cases where the students have started from the most basic levels, and where they lack the literacy skills which are the prerequisite for this type of learning. (Where literacy skills are lacking, students also find it difficult to learn mathematics.)

## Issues and Concerns

Issues and concerns affecting adult basic education are as follows:

- Diversity of students: These programs usually take students with varying goals, abilities, experience, and motivations. If the programs are large, they can group the students

accordingly. If not, they will be teaching across the range of students.

- It is important to have mechanisms and procedures for moving between and across levels, and to adapt the pace of this to the abilities and efforts of the students.

## Further Education and Lifelong Learning

### Needs

So far, in numeracy programs, much of the attention has been on workplace training and on adult basic education and upgrading. However, there is an increasing need for higher levels of numeracy across the economy and society more generally, in a wide variety of contexts. Some of these needs are met through formal programs, and some are met more informally and in the course of everyday life (through various forms of continuous learning). (28)

### Programs and Services

Programs and services for further education and lifelong learning include the following:

- Courses offered by universities, colleges, and school boards (beyond the context of basic-level instruction), e.g., through night school and correspondence courses.

- Incidental and situational learning, e.g., learning how to operate appliances and equipment (which often involves numeracy).

- Instruction in how to operate appliances and equipment and services, e.g., banking machines.

- Other consumer training, e.g., through Home Depot.

- Self study.

- Games and puzzles and sports.

- Experience in using mathematics (and numeracy more generally) in everyday life, e.g., in household projects and in helping children with homework.

- On-the-job experience.

- Experience and services related to money management and investments (and other financial matters) ranging from RRSP seminars to credit counseling.

---

28 In Australia, in particular, there is recognition of the wider role of numeracy - not just in the context of workplace training and adult basic education and upgrading.

In all of these activities, much of the responsibility is with the learners themselves. The idea here is to work with the learners, to provide instruction (often on a "just in time" basis) and to provide appropriate materials.

**Issues and Concerns**

Issues related particularly to numeracy through further education and lifelong learning include the following:

- Systematic attention to the quality and difficulty level of the numerical content of written and other communications, with a view to making them more comprehensible and more readily useful. Just as there are low-literacy and "plain language" materials, so there should be low-numeracy materials that are clear and simple to understand.(29)

- Partnerships and strategies for working together to enhance numeracy in particular areas (e.g., health, investments, etc.). This should lead to improved co-ordination of services, and to approaching numeracy problems from several angles.

- Enabling people to take further education and training without requiring them to obtain prerequisites which may be difficult and intimidating, or which may not seem relevant, and which they may not pursue. (For example, there is ongoing controversy over the extent to which fractions and long division really need to be taught, or whether it is possible to work around a limited knowledge of these, e.g., by using calculators and percents.)

In lifelong learning and further education, it is helpful if people come to appreciate mathematics and numeracy for their own sake. Most adult education in mathematics and numeracy is highly goal-driven, relevant, and specific. However, for ongoing learning and self study, it is very useful if people actually enjoy the subject - and many come to enjoy it as they develop competence and confidence, as they solve real problems and obtain real benefits, and as they become more curious about the underlying basis of mathematics.

# WHAT WORKS WELL: SUCCESS FACTORS

In general, adult numeracy programs work well if they are designed and delivered in accordance with the principles and "best practices" of adult education. These include: linkage to goals and purposes; working with pre-existing knowledge and experience; relevance, realism, and practicality; focusing on learners (and their wider situations); and maximizing accessibility, flexibility, and choice.

---

29 A case in point would be the use of fractions: mathematics instructors find that many people have difficulty with fractions, so it may be necessary in many cases to work around a limited knowledge of fractions.

## Linkage to Goals and Purposes

Numeracy instruction works best when it is linked to strong goals that have the power to motivate and inspire people - so that they want to learn and apply mathematics.

It helps if programs do not take goals for granted, but if teachers and counselors speak to students at length at the beginning of the program (and if they come back to these questions during the program), to make sure that the goals are realistic and that the students have the confidence they need to continue pursuing them. That is, there should be a proportionality between the goals and the efforts and degree of success required for the programs.

## Building on Knowledge and Constructing Systems

Adults come to education programs with a great deal of experience and informal knowledge. While they may have forgotten (and may never have learned) much of mathematics in the more formal sense, they may well have developed informal methods, such as techniques for estimation. They also have a sense of the contexts in which mathematics and numeracy are to be applied.

More generally, adults construct and maintain mental models and systems which help them to understand and (to varying degrees) manage the world around them. Instruction in numeracy needs to provide knowledge and skills which people can use to adjust and expand and, in some cases, to question and revise the mathematical and quantitative components of the systems and models they use in their personal and work lives. By working with pre-existing knowledge and strategies, new knowledge and skills are more readily learned, understood, and applied.

## Relevance, Realism, and Practicality

In numeracy, the point is to be able to apply mathematical and numerical skills and knowledge in real life situations, in the service of the goals and objectives of the students. Successful application of the new knowledge and skills will reinforce both the learning and the motivation for learning.

To enable and ensure effective applications, it is helpful to use appropriate and realistic materials, e.g., examples drawn directly from the workplace. Where workplace examples are not available or applicable, there are other possibilities. For example, some programs have had the students set up a canteen or tuck shop which does double duty in providing both refreshments and realistic practice (e.g., in sales and inventory).

Since most adults have to deal with money (e.g., budgeting, banking, savings and credit), examples and exercises involving money are relevant and useful across the whole range of students and have usually been highly successful. Other popular applications include cooking and gardening.(30)

---

30 Materials on these subjects have been developed in Quebec.

## Focusing on Learners

Successful programs focus on the learner and take the whole person into account, recognizing that experience in one's work and personal life will facilitate or inhibit learning. Assessment and counseling services help students to take stock of what is possible and realistic, and to stay on track.

Students need support not just from the provider of the program, but also within their wider social situation. For example, some programs have been highly successful in working with family members who can help students learn math.(31) In work situations, it is very helpful if both the immediate supervisors and senior managers are supportive.

Learners differ in their styles of learning - and students who previously had difficulty in math may have been taught using a style which did not resonate with them (e.g., the teacher may have moved quickly through complex steps). In addition to using realistic materials, it is also helpful in many cases to use visual and "hands on" materials such as "math manipulatives" - objects which teach concepts (e.g., tiles for teaching geometric patterns).

Students who previously had difficulty with math (and perhaps also with other aspects of their education) will need to build positive attitudes, and to develop a sense of competence and confidence. Here again, the experience of using math to get real results in real situations will do much to develop a solid base for further learning. In building confidence, it is essential to portray the program as providing skills which adults can and should learn for their everyday lives - and to make sure that the program is not simply seen as remedial learning.

## Accessibility, Flexibility, and Choice

To improve numeracy across the population, it is important for programs to be accessible and for there to be a range of choice, accompanied by flexibility. Much has been done along these lines, including the following:

- Resource centres which students can visit at times which are most convenient for them. (For resource centres, it is important not just to have computers, documents, and materials, but also to have assistance from teachers and tutors.)

- Modular courses, where students can pick and choose those sections or modules which are of the most use and relevance to them, subject to the need for prerequisites and for following a logical sequence in their learning. (This involves looking carefully at what students really need at each point, not simply what they have traditionally been taught.) Ideally, it would be possible to have a "just in time" approach to learning numeracy skills.

---

31 An example would be the Operating Engineers' College in Newfoundland, mentioned earlier.

## Advisory Committees and Stakeholder Involvement

Client and stakeholder involvement and participation are a key ingredient in many different programs and services for literacy and numeracy. Advisory and governing committees have been especially helpful, especially in cases such as the following:

- Education for aboriginal people, e.g., on the advice of the Aboriginal Elders' Council.
- Apprenticeship programs: For example, in the reform of the apprenticeship system in Ontario, there will be governing committees (e.g., for setting standards) for each of the trades.
- Workplace programs, such as Syncrude's, where an advisory committee has increased participation and "buy-in" on the part of both the workers and the supervisors, while helping to ensure relevance.

# CHALLENGES AND ISSUES

## Staffing and Training

It is unusual to find teachers who teach only numeracy and mathematics, who do this on a full time basis, and who have opportunities for regular professional development relating to numeracy.

More often, numeracy and mathematics are taught within a broader program, e.g., a broader program of literacy. In many cases, the teachers may not have a background or extensive training in mathematics, may not be up-to-date on current practices in teaching mathematics, and may well have had difficulty with mathematics when they studied it. (On the other hand, those who themselves had difficulty in the past with mathematics often make good teachers of the subject when they come back to it later: they understand the problems that the students may be experiencing, and they may follow a careful step-by-step approach.)

It is important to have ongoing numeracy and mathematics training for teachers, to ensure that they are up-to-date and that they are exchanging ideas and practices among themselves. However, funding is always a problem for professional development.

## Challenges Related to Clients

Numeracy programs (like the literacy programs of which they are often a part) serve a wide range of clients, with different levels of ability, experience, interest, and motivation. It is a challenge to adapt the programs to the diverse needs of the students. In larger programs, e.g., at some community colleges, it may be possible to group the students by ability and experience so

that so that they can be taught more readily - but most programs are not large enough for anything but the most general grouping.

While most students are able to move ahead in their work on mathematics and numeracy, some find it difficult to make progress and may become stuck at the elementary or middle level. Students with learning disabilities will need special attention, which may be available in some programs (e.g., community colleges) but not in other programs.

Another problem has been the presence of unmotivated students in some programs. While most students are in math/numeracy programs of their own free will, some are there because attendance at a literacy or numeracy program is necessary in order to continue receiving welfare or unemployment insurance payments.(32) In these cases, the students may lack motivation or may be starting from a level from which progress is discouragingly slow.

For most clients in adult education programs, finding time is a challenge: there are competing demands from the workplace and/or from family and personal life. When students drop out of the programs, the usual reason is that something in their personal lives is out of balance: too many competing obligations; "overload" situations; and personal problems such as divorce and substance abuse.

## Funding and Resources

For publicly funded programs, there are always funding issues. Programs provided by school boards have been particularly vulnerable to funding cutbacks in recent years (especially in Ontario). One problem is that adult education has a smaller and more fragmented constituency (with a much smaller presence in school councils) - and the programs are optional, not mandated. Enrollments can fluctuate substantially according to the state of the economy and the interests, motivations, and situations of the students. The result is that adult education tends to have a lower funding priority - even in cases where excellent work is being done.(33)

In recent years, programs in community colleges have been constrained but not substantially reduced by funding limitations: they are affected by general funding limitations, but have not been targeted for reductions over and above these.

Finding funding is always a problem for community-based programs. Funding may well be available for particular projects, but it is difficult to ensure continuity and consistency over the longer term.

For privately funded programs (e.g., workplace training), the level of funding depends on the.

---

32 This was mentioned as a problem in Ontario (and also in Australia).

33 An example would be metropolitan Toronto: an innovative numeracy program was going strong in the late 1980's, but has since been hit by a continuing series of funding cutbacks.

degree of commitment which the organization has, as well as on the willingness of employees to invest their own time and money in numeracy training.

## Emotional Factors

While math has a reputation for being rational and logical, it is also very much affected by emotion: when people feel confident and resourceful, they can do their best; when they feel anxious and inadequate, they find it difficult to handle the math. For many, "math anxiety" inhibits their learning.

Lack of math is a factor which often impedes further advancement. For example, there are many students who cannot enter the trades (or other subjects) of their choice because they lack the math prerequisites.(34)

Students who learn math as adults may well have had feelings and experiences of inadequacy and failure in math in earlier education. In addition, feelings about math may be linked to more general negative experiences with schooling in the past.(35)

## Sequencing, Choices, and Flexibility

For math and numeracy, sequencing is always an issue, in that it has traditionally been held that mathematical knowledge and skills should follow a logical sequence, in which one element builds upon another. However, for adult education, this can be a problem, in that time is at a premium, so the question arises as to whether certain areas of skill and knowledge are strictly necessary. In particular, there is debate over the extent to which students must master fractions and long divisions - or whether areas such as these can be bypassed (for the time being) while students work with calculators and computers.

Aside from sequencing, there is the question of what to focus on in the programs: math is a vast field, and many areas are relevant. For example, is enough attention being paid to statistics and data analysis, as compared with other areas of math?

## Accountability and Testing

One challenge which affects publicly-funded programs and services is the concern over accountability, and the need to provide assurances that taxpayers' money is being well spent. Ideally, expenditures should be related to the desired outcomes: for example, if numeracy programs are supposed to contribute to employability, then success in finding jobs would be the appropriate measure.

---

34 Lack of literacy and numeracy were mentioned as the top two blocking factors, in that order.

35 This was mentioned as a problem for older aboriginal students who had gone through the residential school system.

However, it is a very difficult and complex task to ensure accountability on this basis. In the job-finding example, many other factors may contribute to employability, and we may not know exactly which aspects of numeracy are the most important. It is also difficult to do the necessary research over a wide range of programs and students with different situations and goals.

It is much easier simply to administer a test of mathematical skills that can be readily measured, e.g., skills in arithmetic. In some cases, the tests may be linked directly to what is needed in the workplace (particularly in cases of workplace numeracy training). In other cases, the tests may be context free. Where tests are important, there is a tendency for instructors to "teach to the test" and for students to "learn to the test". For many students, math is a complex and difficult subject, and they need to focus their efforts.

In a publicly-funded system, there will always be strong pressures for accountability, so this problem is unavoidable. One solution is to make the tests ever more sophisticated and realistic - but this takes time, effort, and money. Another solution is to involve stakeholders - especially employers - more closely in the process.

# STRATEGIES, ACTIONS, AND FUTURE DIRECTIONS

What actions are being taken and should be taken to address the problems and challenges discussed above and to ensure a high degree of success in numeracy programs and services? What strategies should be considered?

Here, we discuss general types of actions and strategies which are being undertaken in Canada and elsewhere, and which could be expanded or enhanced in order to improve numeracy further in Canada.

The first item on everyone's list is improved teacher training.

## Staffing, Training, and Professional Development

As noted, many (perhaps most) of the teachers who teach numeracy and basic mathematics do not have extensive backgrounds in mathematics, and may also lack specific training in numeracy (i.e., in the application of mathematics in real life situations).

Internationally, the country that has the most well developed programs for teacher training is Australia, which has developed both shorter courses and more extensive programs, including a certificate in adult numeracy.

Training is also connected with staffing. If there are full-time continuing staff, an investment in training can be more readily justified, and may be more likely to pay off. If there are part-time staff who work on a temporary or contract basis, there is less scope for training - at least insofar as the employer is concerned. (Individuals still have the option of pursuing training of their own accord, on their own time, at their own expense - possible, but less likely.)

Given that many of the teachers in this field are likely to be part-time or working on an temporary or contract basis (and also working primarily on other programs in addition to numeracy), it will be important to develop courses and other forms of training and development to meet their needs for attaining higher levels of proficiency in education related to numeracy.

The training of volunteers and tutors should not be neglected. In mathematics, there will always be a need for tutors - but most tutors lack specific training.

As numeracy and basic mathematics education become more important, it will also be necessary to add more full-time teachers - especially resource teachers - who are specialized in numeracy and who can provide support to other teachers (and to volunteers).

## Co-ordination and Integration of Programs and Services

For numeracy, it is important that instruction in mathematics be connected with instruction in other areas - all the more so since numeracy involves the use of math and numbers in a wide variety of situations. Ideally, math and numbers should be a component of other courses, in a co-ordinated way: just as there is "reading across the curriculum", so there should be "math across the curriculum".

Another approach which has been effective in many cases is to enhance numeracy learning through verbalization. An example would be "paired problem solving" in which two students work together on a problem: one solves the problem and "thinks aloud", verbalizing the different ideas and steps in coming at the problem, while the other student observes, takes notes, and provides comments and feedback at the end of the process. More generally, teamwork is helpful in promoting a more integrated approach, especially since it develops the communication component of numeracy.

It also helps if numeracy and adult education programs are integrated with other programs and services which more broadly address the needs of adult learners, e.g., counseling services and social programs which provide assistance in difficult personal situations, thereby enabling the students to stay in the adult education and numeracy programs.

Ideally, numeracy and adult education programs should be part of a broader human development agenda for governments at all levels, with co operation and co ordination between the different jurisdictions. For this, it helps if there is an underlying strategy or at least a set of shared values and principles. In this connection, it may be worth looking at the experience of Britain, which has developed a National Numeracy Strategy.(36)

---

36 This is aimed primarily at improving numeracy for children.

## Needs, Goals, and Programs

In adult education, as noted above, goals are important in creating and sustaining motivation - and adult education is, in general, highly goal oriented. If the goals can be strengthened and kept front and centre, then this strengthens the motivation to learn and to persist in learning, even for difficult courses such as math - as long as students are convinced that math and numbers will help them reach their goals.

Some numeracy programs have had success in focusing on the goals of the students, e.g., by providing assessment and counseling services and by revisiting student goals in the light of progress (or non-progress) in their math programs. In some cases, the goals may need to be revised. For instance, students who are having difficulty with math may need to look at community college programs which do not involve the extensive use of math, while students who are more successful than they had expected in math may wish to raise their sights.

## Research and Curriculum Development

Much curriculum development is done on an incremental basis, in response to practical experience and current issues and concerns. However, in curriculum development, there are also advantages to working from a research base, with attention to the underlying theoretical and philosophical issues. This allows for examining - and possibly reconsidering - some of the fundamental assumptions, and it certainly helps in considering some basic issues more consciously and thoroughly.

In both Holland and Australia, there are extensive research programs. In Holland, the focus is on Realistic Math Education.(37) In Australia, there has been research into constructivism and critical numeracy.(38)

Attention to research and to theoretical and philosophical issues also helps in building a sense of commitment and direction for the longer term. This is true both for numeracy education and for all forms of further education and lifelong learning.

---

37 Please see the bibliography, especially the work by Mieke van Groenestijn.

38 Please see the bibliography, especially the work by Betty Johnston.

## Development and Sharing of Resources and Materials

Good (often excellent) work has already been done in developing resources and materials such as the following:

- Publications and other printed materials (e.g., binders, kits, and sets of documents).(39)
- CD/ROMs (e.g., in both Saskatchewan and Quebec).
- Videos (e.g., in Quebec).
- Internet based resources.

These materials are well-adapted to the needs of adult learners, and they make extensive use of real-world applications (e.g., personal budgeting, household applications, workplace applications, etc.).

All in all, there are substantial resources both in Canada and in other countries. The challenge is to ensure that they are collected and shared. One problem here is that while funding may be available (in some cases) for creating resource materials, it is rarely available for ensuring that they are collected and shared (e.g., through Internet collections or through organizing and attending conferences).

## Sharing + Collaboration: Networks + Conferences

While it is important to collect and share resources, it is also important to promote a more general collaboration and sharing. This can be done through a variety of mechanisms: Internet (ListServs and chat rooms); conferences and seminars; networks and associations; and publications (e.g., research studies and conference proceedings).

While some Canadian numeracy practitioners belong to these associations and participate in these activities, there is room for more involvement - particularly through conference attendance (which raises the question of funding).

## Identifying Needs for Training and Funding

Of the different components of literacy, it is quantitative literacy - or rather, numeracy more generally - which is most closely associated with positive labour market outcomes. This is a subject that merits further inquiry, to see which components of numeracy are particularly important in different situations. In this respect, valuable work has already been done through the Essential Skills Research Project (for numeracy in the workplace), but this work could be expanded (or similar studies could be done) to cover other applications of numeracy.

---

39 Examples would include Saskatchewan and Metropolitan Toronto School Board.

More generally, it would be useful to do further studies relating to "human capital" and "intellectual capital", highlighting the role that numeracy and literacy can play. This would help in making a systematic case for further funding (particularly at the adult level where there are many gaps).

As work proceeds on the International Life Skills Survey (ILSS), we will learn much more about the needs and gaps. The survey will provide precise information about levels of competence in numeracy, and will relate these to a wide range of background variables (e.g., demographic variables). However, the ILSS will not be completed until 2002, and the results will not be available until 18 months later in 2003.(40) In the meantime, it would be helpful to do complementary studies (e.g., on the connection between numeracy, intellectual capital, labour market outcomes, and economic and human development).

---

40 It will take time to score and scale the test results.

# BIBLIOGRAPHY + RESOURCES + REFERENCES

## Concepts + Numeracy Generally

Curry, Donna, Mary Jane Schmitt, and Sally Waldron, *A Framework for Adult Numeracy Standards: The Mathematical Skills and Abilities Adults Need To Be Equipped for the Future*. Adult Numeracy Practitioners Network, System Reform Planning Project (July, 1996). Internet : www.std.com/anpn/framewk.html

*Numeracy Framework: International Life Skills Survey*
Internet: No longer available

National Center on Adult Literacy; National Council of Teachers of Mathematics; and Office of Vocational and Adult Education, U.S. Department of Education. *Proceedings: Conference on Adult Mathematical Literacy*. Arlington (Virginia): March 20 24, 1994.

## Why Numeracy? Importance, Context, and Applications

Murnane, Richard J., and Frank Levy, *Teaching the New Basic Skills*. New York: The Free Press, 1996.

Steen, Lynn A., *Why Numbers Count: Quantitative Literacy for Tomorrow's America*. College Entrance Examination Board, 1997.

## Studies and Surveys

### Canada: Studies + Surveys

Essential Skills Research Project
www.hrdc-drhc.gc.ca/essentialskills/

Test of Workplace Essential Skills
www.towes.com

### International: Studies + Surveys

International Life Skills Survey (ILSS):
No longer available

Program for International Student Assessment (PISA):
www.pisa.oecd.org

Third International Mathematics and Science Study (TIMSS):
www.timss.org/

**Programs + Services + Teaching + Resources**

Canada: Programs + Services

Ciancone, Tom, *Numeracy in the Adult ESL Classroom*. ERIC Digest, National Clearinghouse for ESL Literacy Education (February, 1996).

Ciancone, Tom, and C. Jay, *Planning Numeracy Lessons for an ESL Literacy Classroom.* Toronto: Toronto Board of Education, Adult Basic Education Unit, 1991.

Lucas, K., B. Dondertman, and Tom Ciancone, *A Sequencing Guide for Numeracy: Whole Numbers*. Toronto: Toronto Board of Education, Adult Basic Education Unit, 1991.

SkillPlan

WIN + Keyano College

**Australia: Programs + Services**

Adult Numeracy in Australia:
http://sunsite.anu.edu.au/language-australia/numeracy/

Adult Numeracy and Maths On Line (ANAMOL):
http://sunsite.anu.edu.au/language-australia/numeracy/anamol/index.htm

ARIS: Adult Education Resource and Information Service:
http://sunsite.anu.edu.au/language-australia/aris/index.html

Numeracy Resources:
http://sunsite.anu.edu.au/language-australia/numeracy/resources.html

Faculty of Education, University of Technology, Sydney. *Course Handbook: TA 86: Graduate Certificate in Numeracy Teaching* (January, 2000).

**International Research and Networks**

Adults Learning Mathematics (Internet Research Forum)
Index and General Information:
http://www.alm-online.org/

Adults Learning Mathematics (Internet Research Forum)
Newsletters: http://www.alm-online.org/

Adult Numeracy Practitioners Network
www.std.com/anpn/

**Netherlands: Programs + Services**

Freudenthal Institute: www.fi.ruu.nl/en/indexalgemeen.html

**United States: Programs + Services**

Gal, Iddo, and Alex Schuh, *Who Counts in Adult Literacy Programs? A National Survey of Numeracy Education*. Philadelphia: National Center on Adult Literacy, University of Pennsylvania (December, 1994). NCAL Technical Report TR94 09.

Ginsburg, Lynda, and Iddo Gal, *Instructional Strategies for Teaching Adult Numeracy Skills*. Philadelpia: National Center on Adult Literacy, University of Pennsylvania (May, 1996). NCAL Technical Report TR96 02

Ginsburg, Lynda, Iddo Gal, and Alex Schuh, *What Does "100% Juice" Mean? Exploring Adult Learners' Informal Knowledge of Percent*. Philadelpia: National Center on Adult Literacy, University of Pennsylvania (1995). NCAL Technical Report TR95 06

National Institute for Literacy
www.nifl.gov

Issues, Challenges, and Success Factors

Gal, Iddo, *Issues and Challenges in Adult Numeracy*. Philadelpia: National Center on Adult Literacy, University of Pennsylvania (December, 1993). NCAL Technical Report TR93 15

**Strategies and Future Directions**

Moser, Sir Claus (Working Group chair), *Improving Literacy and Numeracy: A Fresh Start*. 1999 (Britain)

The National Numeracy Strateegy (Britain)
www.standards.dfee.gov.uk/numeracy/

# INTERVIEWS

**Canada**

| | |
|---|---|
| Kim Blevins<br>Communications Coordinator<br>Saskatchewan Literacy Network<br>Saskatoon, Saskatchewan | Iris Burrows<br>Learner Support Services<br>Bow Valley College<br>Calgary, Alberta |
| Tom Ciancone<br>Numeracy Consultant and Instructor<br>Toronto Board of Education<br>Toronto, Ontario | Yolande Clément<br>Director<br>Centre franco-ontarien de ressources en alphabétisation (Centre FORA)<br>Sudbury, Ontario |
| Yvan Clermont<br>Coordinator, International Life Skills Survey<br>Statistics Canada<br>Ottawa, Ontario | Charles Craig<br>Consultant<br>Academic Readiness for Apprenticeship Training<br>Georgian College<br>Barrie, Ontario |
| Anne Croll<br>Coordinator<br>College Preparatory<br>Algonquin College<br>Nepean, Ontario | Susan Devins<br>Project Coordinator<br>Literacy Initiatives in Communities<br>Edmonton, Alberta |
| Lynda Fownes<br>Manager<br>SkillPlan<br>Burnaby, British Columbia | Lisa Hagedorn<br>Instructor<br>Literacy and Basic Skill;s Program<br>Continuing Education Centre<br>Ottawa Carleton District School Board |
| Stan Jones<br>Consultant<br>Yarmouth, Nova Scotia | Nicole Lachapelle<br>Coordonnatrice<br>Regroupement des groupes populaires en alphabétisation du Québec<br>Montréal, Québec |

**Canada**

| | |
|---|---|
| Debra Mair<br>Chief, Research<br>Standards, Planning, and Analysis<br>Human Resources Development<br>Canada Hull, Quebec | Marie Matheson<br>Ministry of Education<br>Winnipeg, Manitoba |
| Conrad Murphy<br>Dean<br>Business and Industrial Training<br>Bow Valley College<br>Calgary, Alberta | John Pitcher<br>Operating Engineers' College<br>Holyrood, Newfoundland |
| Debbie Purton<br>Literacy Specialist<br>Saskatchewan Literacy Network<br>Saskatoon, Saskatchewan | Andrée Racine<br>Ministère de l'Education<br>Gouvernement du Québec<br>Québec, Québec |
| Denise Theunissen<br>Learner Support Services<br>Bow Valley College<br>Calgary, Alberta | Rosalie Daly Todd<br>Literacy Advisor<br>Consumers' Association of Canadaand Federated Women's Institutes of Canada<br>Manotick, Ontario |
| Tamara Topolnisky<br>Literacy Coordinator<br>Community and Upgrading Education<br>Keyano College<br>Fort McMurray, Alberta | Yvon Wagner<br>Consultant<br>Lac St. Charles, Québec |
| Kerry Woollard<br>Foundations for Learning Centre<br>Winnipeg, Manitoba | |

**International**

| | |
|---|---|
| Dr. Iddo Gal<br>Professor<br>University of Haifa<br>Israel | Dr. Lynda Ginsburg<br>National Center for Adult Literacy<br>University of Pennsylvania<br>Philadelphia, Pennsylvania<br>USA |
| Dr. Betty Johnston<br>University of Technology<br>Sydney, New South Wales<br>Australia | Gene Maier<br>The Math Learning Center<br>Portland, Oregon<br>USA |
| Jan Phillips<br>Adult Educational Development<br>William Rainey Harper College<br>Palatine, Illinois<br>USA | Mary Jane Schmitt<br>Harvard University<br>Cambridge, Mass.,<br>USA |
| Dr. Mieke van Groenestijn<br>Professor<br>University of Utrecht<br>Netherlands | Dave Tout<br>Publications and Clearinghouse Manager,<br>Language Australia<br>Coordinator, ARIS, The Adult Education Resource and Information Service<br>Melbourne, Victoria<br>Australia |