

Frameworks for Adult Numeracy Education

A Survey and Discussion

2003

Prepared by the Literacy and Basic Skills Program of the
Ottawa-Carleton District School Board. Funded by the
Ministry of Training, Colleges and Universities of
Ontario and the National Literacy Secretariat of Canada

Ottawa-Carleton District School Board

Lisa Hagedorn *Report Author, Researcher/Practitioner, Literacy and Basic Skills Program*
Julie Newlands *Assistant Manager, Literacy and Basic Skills Program*
Irene Blayney *Manager, Literacy and Basic Skills Program*
Anna Bowles *Principal, Continuing Education*

Acknowledgements

We would like to thank Richard Darville of Carleton University and William Higginson of Queen's University for giving helpful guidance in their roles as reference people for this project. We would also like to thank Ann Osborne of the Literacy and Basic Skills Section of the Ministry of Training, Colleges and Universities for her support.

Thanks also go to the people in Canada and other countries who contributed to this report by responding to e-mail inquiries.

Finally, we would like to thank the National Literacy Secretariat of Canada and the Literacy and Basic Skills Section of Ontario's Ministry of Training, Colleges and Universities for funding this research.

Your Comments

We welcome your comments and questions. Please contact:

Irene Blayney or Lisa Hagedorn
Literacy and Basic Skills Program
Ottawa-Carleton District School Board
Ottawa, Ontario
(613) 239-2656
irene_blayney@ocdsb.edu.on.ca
lisa_hagedorn@ocdsb.edu.on.ca

or

Literacy and Basic Skills Section
Workplace Preparation Branch
Ministry of Training, Colleges and Universities
900 Bay Street, 23rd Floor, Toronto, Ontario M7A 1L2
Tel.: 416-326-5476
Fax: 416-326-5505
<http://www.edu.gov.on.ca/eng/training/literacy/main.html>

Contents

Introduction 1

Chapter 1 Ontario 5

The numeracy domain of the matrix of *Working with Learning Outcomes: Validation Draft* (Tables 1 & 2) and *The Level Descriptions Manual* (Tables 3, 4 & 5)

Chapter 2 England 17

The National Standards for Adult Numeracy (Table 6)

The Adult Numeracy Core Curriculum (Tables 7 & 8)

Chapter 3 Scotland 27

Numeracy in the Core Skills Framework (Tables 9, 10 & 11)

Adult Numeracy Curriculum (No table)

Chapter 4 Ireland 35

The National Adult Literacy Assessment Framework for Numeracy (Table 12)

Chapter 5 USA 43

Numeracy in the National Reporting System (Table 13)

Math in the Test of Adult Basic Education (TABE) (Table 14)

Math in the Comprehensive Adult Assessment System (CASAS) (Table 15 & 16)

Math in the Test of General Education Development (GED) (Table 17)

Math in Equipped for the Future (Tables 18 & 19)

Chapter 6 Australia 61

Numeracy in the National Reporting System (Table 20)

The 'Numeracy and Mathematics' stream of the Certificates in General Education for Adults (Tables 21 & 22)

Chapter 7 Discussion 75

References 95

Introduction

The purpose of this report

This report arises out of a need for research into adult numeracy. In particular, adult educators in Ontario have felt a need to study frameworks for adult numeracy that are being used in basic education programs around the world.

In the past, frameworks developed for organizing school mathematics for children were adapted and used in adult numeracy programs. More recently, adult educators and others have developed original frameworks to organize numeracy skills and knowledge specifically for adults. A mixture of these original and Kindergarten-to-Grade-12-based frameworks is currently in use in English-speaking countries; I present several of them in chapters one to six of this report. In chapter seven, the final chapter, I begin a discussion of the issues that arise from this collection of frameworks.

This report provides information and ideas for anyone interested in adult numeracy, whether as part of an adult education system, or as a field of academic inquiry and research.

A note about the term 'framework'

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. For example, this report includes curricula, content and performance standards, level descriptions, assessment frameworks, and reporting systems.

The concept of 'numeracy'

The term 'numeracy' is increasingly used where 'quantitative literacy' and 'mathematical literacy' have been used in the past. Numeracy involves mathematics, but emphasizes processes, understanding, use in 'real-life' situations, and communication. The term is sometimes used to limit the math involved to basic skills, though a broader conception is perhaps more useful, as explained in the quotation below:

[...] there is not a particular level of Mathematics associated with it [numeracy]: it is as important for an engineer to be numerate as it is for a primary school child, a parent, a car driver or a gardener. The different contexts will require different Mathematics to be activated and engaged in. (Johnston, 1994)

Below are two models of numeracy that show the breadth and depth of the concept:

(1) The conceptual framework of the numeracy domain of the International Adult Literacy and Lifeskills Survey (Gal et al, p. 12, 1999):

Numerate behavior involves:

Managing a situation or solving a problem in a real context,

everyday life
work
societal
further learning

by responding

identifying or locating
acting upon
interpreting
communicating about

to information about mathematical ideas

quantity & number
dimension & shape
pattern and relationships
data & chance
change

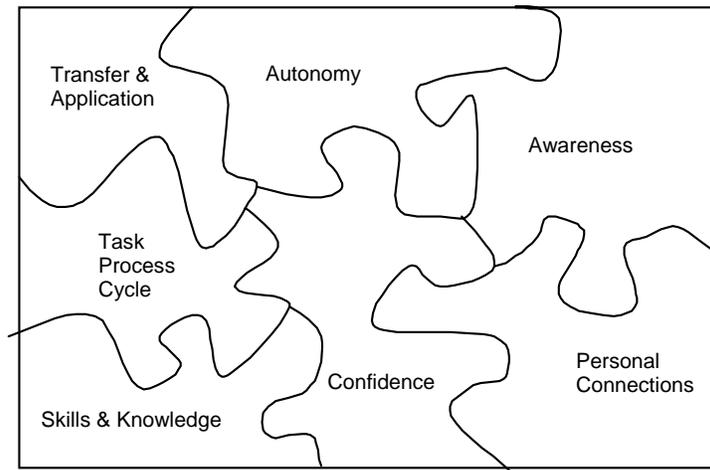
that is represented in a range of ways

objects & pictures
numbers & symbols
formulae
diagrams & maps
graphs
tables
texts

and requires activation of a range of enabling knowledge, behaviors, and processes.

mathematical knowledge and understanding
mathematical problem-solving skills
literacy skills
beliefs and attitudes

(2) The model of Holistic Adult Numeracy Competence underlying the 2003 publication, *Rethinking Assessment: Holistic Adult Numeracy Assessment* (Marr, B., Helme, S. & Tout, D.):



The frameworks presented in this report reflect these current models of numeracy to a wide variety of degrees. (For more information on these models, please see their reference information in the References section at the end of this report.)

The research process leading to this report

My search for frameworks was conducted primarily via the internet and e-mail, supplemented by phone calls and contacts made at conferences. The search found more frameworks than I had expected – more than could be presented in this report. I have chosen to present the ones that were created expressly for use in adult basic education, and, among those, the more comprehensive ones, which, together, represent the range of framework types.

During the process of reading, analyzing and writing, several people (Canadian academics, international numeracy education experts, staff of the Literacy and Basic Skills Section of Ontario’s Ministry of Training, Colleges and Universities) were consulted and gave valuable feedback.

A note on chapters one to six

Chapters one to six in this report contain, essentially, the ‘data’ on which the discussion in chapter seven is based. This ‘data’ includes, for each framework: the context and purpose of the framework; its structure and content (where possible, the entire framework is reproduced – where this would have been too large, only the framework’s structure and samples of its contents are presented); a description of how it is to be used; and, where possible, a description of its development and implementation. At the end of each chapter I present comments that users and others have made about the frameworks.

This ‘data’ is presented as a mixture of prose, tables, and direct quotations from source texts. Direct quotations are used frequently throughout this report because I have found

that the particular wording in a framework document is important in helping to understand how it has been interpreted.

Questions to consider

I considered the following questions as I compiled and examined the frameworks, and they are addressed directly in the discussion in chapter seven. It may be helpful to keep them in mind while reading the earlier, 'data' chapters.

1. What is a framework for? What purpose does it serve?
2. How are the contents of frameworks organized?
3. Can one framework fulfill all purposes, or is it better to have a separate framework for each purpose?
4. Can we use Kindergarten-to-Grade-12 curricula as frameworks for adult numeracy education?
5. How should we distribute skills and knowledge through the levels? What is easier, and what is more difficult?
6. How many levels should there be in a numeracy framework?
7. Does each level in a framework contain the same amount of knowledge and skills?
8. How is a numeracy framework different from a literacy framework?
9. How can we best use frameworks in assessment and evaluation?
10. How might we develop and implement a framework?
11. What resources can we use as we develop a framework?
12. What lies beyond development and implementation?

About the Literacy and Basic Skills Program in Ontario, for readers outside of Ontario

The Ontario government's Literacy and Basic Skills (LBS) Program provides learning opportunities for adults at over 300 sites in the province, through colleges, school boards and community organizations. These organizations deliver goal-directed, learner-centred literacy training that helps adult learners acquire skills necessary to attain employment, enter further training or education, or increase their personal independence. Services are delivered in a variety of ways, from weekly one-on-one tutoring sessions with volunteer practitioners to daily group classes with paid instructors. More than 55,000 adults are receiving these services. The LBS program also supports research and development initiatives. (Retrieved October 27, 2003 from http://www.edu.gov.on.ca/eng/training/literacy/ontliteracy/ont_lit.html).

Chapter 1

Ontario

One framework for adult numeracy education is described in this chapter:

The numeracy domain in the matrix of *Working with Learning Outcomes: Validation Draft* and its more holistic description in *The Level Descriptions Manual*¹

The matrix of learning outcomes is part of the first two stages of Ontario's four-stage Recognition of Adult Learning Strategy. This strategy began in 1994 to reform literacy training in Ontario through developing learning outcomes (Stage 1), common assessment (Stage 2), articulation of agencies (Stage 3), and recognition of learning (Stage 4).

¹ Though the framework described in this chapter is already well-known to many people in this report's primary audience, it has been included for ease of reference and for the benefit of readers outside of Ontario.

The numeracy domain in the matrix of *Working with learning outcomes: Validation draft*

In 1998, the section of the provincial government responsible for the Literacy and Basic Skills program published *Working with learning outcomes: Validation draft*. The main body of the document describes the learning outcomes approach, its principles and assessment techniques. There, it states that the Literacy and Basic Skills program values accountability, learner-centered services, adult education principles, applied demonstrations of learning, and linkages with the broader education and training system, all of which are felt to mesh with a learning outcomes approach (Literacy and Basic Skills Section, 1998 p. 4). In *Working with Learning Outcomes*, learning outcomes are defined as “[...]clear statements of the knowledge, skills, and behaviours that learners can demonstrate at different levels of proficiency” (Literacy and Basic Skills Section, 1998, p. 3).

In an appendix to this document there is a table of learning outcomes, which is described in the following quotation:

The Learning Outcomes Matrix is a framework for analysing learning outcomes; it was developed by MET [Ministry of Education and Training] in consultation with the literacy field. The Matrix is designed to be flexible and detailed, providing a broad scope for literacy practitioners to respond to the accomplishments of individual learners. (Literacy and Basic Skills Section, 1998, p. 34)

This matrix was developed so that “delivery agencies will be better able to measure and document the progress which adult learners are making toward their goals”, to ensure that “adults will be able to move easily among literacy delivery agencies, into further training and education opportunities, or into employment”, and in order to “assist delivery agencies to enhance their accountability to learners, and to the public” (Literacy and Basic Skills Section, 1998, p. 1).

The matrix contains the “generic and transferable literacy skills” that learners develop while working on their goals (Literacy and Basic Skills Section, 1998, p. 7). The matrix has five levels, the lowest being bottomless, the highest being equivalent to grade nine (Literacy and Basic Skills Section, 1998, p. 15).

Table 1 below represents the structure of the numeracy domain of the matrix. Because of the size of this domain, all of its contents are not included here. A sample of its contents follows in Table 2.

Table 1. Numeracy in Working with Learning Outcomes

	Perform Basic Operations with Numbers								Use Measurement for Various Purposes						Solve Geometric Problems			Manage Data and Probability				Use Patterning and Algebra	
	write numbers	count	add and subtract	apply place value	multiply and divide	construct and use fractions, decimals, ratios and percentages	perform basic money calculations	use roots and components	linear measurement	measurement of time	measurement of temperature	measurement of capacity, volume and mass	measurement of perimeter and area	measurement concepts	three- and two-dimensional geometry	transformational geometry	grids and co-ordinate geometry	collecting, organizing and analyzing data	concluding and reporting	probability	analyzing data	use patterning and algebra	linear equations
1																							
2																							
3																							
4																							
5																							

The contents of the cells representing ‘Add and Subtract’, within ‘Perform Basic Operations with Numbers’, are presented below in Table 2.

Table 2. Excerpt from the matrix of Working with Learning Outcomes

Numeracy				
Learning Outcome: Perform Basic Operations with Numbers				
Skill Set: Add and Subtract				
HRDC ² Essential Skills Enhanced: Numeracy; Thinking Skills (Problem Solving); Thinking Skills (Significant Use of Memory)				
Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> - demonstrates that addition involves joining and that subtraction involves taking one group away from another [1]³ - demonstrates addition and subtraction facts to 20 using concrete materials [1] - represents addition and subtraction sentences (for example: $5 + 6 = 11$) using concrete materials [1] - identifies the effect of zero in addition and subtraction [1] - adds and subtracts money amounts to 10 cents using concrete materials, drawings, and symbols [1] - mentally adds one-digit numbers [1] 	<ul style="list-style-type: none"> - recalls addition and subtraction facts to 18 [3] - determines the value of the missing term in an addition sentence (for example: $4 + _ = 13$) [3] - adds and subtracts three-digit numbers with and without regrouping using concrete materials [3] - adds and subtracts money amounts and represent [sic] the answer in decimal notation (for example: 5 dollars and 75 cents plus 10 cents is 5 dollars and 85 cents, which is \$5.85) [3] - mentally adds and subtracts two-digit numbers [3] <p style="text-align: center;"><u>Transition Markers</u></p> <ul style="list-style-type: none"> - recalls addition and subtraction facts to 18 [2] - explains a variety of strategies to find sums and differences of 2 two-digit numbers [2] - adds and subtracts two-digit numbers with and without regrouping, with sums less than 101, using concrete materials [2] - adds and subtracts money amounts to 100 cents using concrete materials, drawings, and symbols [2] - mentally adds and subtracts one-digit numbers [2] 	<ul style="list-style-type: none"> - adds 3 four-digit numbers [5] - subtracts 2 four-digit numbers [5] - adds and subtracts decimal numbers to hundredths using concrete materials, drawings, and symbols [5] <p style="text-align: center;"><u>Transition Markers</u></p> <ul style="list-style-type: none"> - adds 2 four-digit numbers [4] - subtracts a three-digit number from a four-digit number [4] - adds and subtracts decimal numbers to tenths using concrete materials, drawings, and symbols [4] 	<ul style="list-style-type: none"> - compares and orders integers (for example: on a number line) [7] - adds integers [7] <p style="text-align: center;"><u>Transition Markers</u></p> <ul style="list-style-type: none"> - adds 4 three-digit numbers [6] - subtracts a four-digit number from a five-digit number 	<ul style="list-style-type: none"> - adds and subtracts rational numbers in any form (fractions, decimals, percents); applies to practical situations [9 UR] - adds and subtracts simple fractions [8] - adds and subtracts integers [8]

Use

The matrix may be used by a practitioner when he or she is creating a learner's training plan. Creating a training plan involves first identifying a learner's goal, and then identifying the literacy and basic skills required to achieve that goal. The skills required

² HRDC = Human Resources Development Canada

³ Numbers in square brackets indicate grade levels.

can be described using the language of the learning outcomes matrix “where appropriate” (Literacy and Basic Skills Section, 1998, p. 23). Whether or not learners are shown the learning outcomes is based on their level: “Learners themselves need not be involved directly with the learning outcomes when their skill level is not sufficient” (Literacy and Basic Skills Section, 1998, p. 3).

The Literacy and Basic Skills Section states, “The Learning Outcomes Matrix is not a curriculum” (1998, p. 2). Instead, instructors are to develop their own curriculum based on learners’ needs and abilities (Literacy and Basic Skills Section, 1998, p. 3). Learners do not need to learn everything at one level of the matrix before they move on to the next level: “Learners need only develop skills, and to those levels, required by their goal” (Literacy and Basic Skills Section, 1998, p. 11).

The matrix can be used again when a learner is to be assessed. The practitioner and the learner determine when assessment takes place, preferably when the learner feels confident in his or her skills (Literacy and Basic Skills Section, 1998, p. 28). The LBS Program does not endorse a specific method of assessing literacy learning, but encourages agencies to use a mix of tools and methods that are appropriate to the goals of the learner, the nature of the agency, and the purpose of the assessment (Literacy and Basic Skills Section, 2000, p. 1). “The expectation is that practitioners will develop demonstrations [i.e., assessment tasks] with explicit reference to the outcome components, skill set, and success and transition markers that make up the Learning Outcomes Matrix” (Literacy and Basic Skills Section, 1998, p. 23). The learner’s performance is successful if it is at a level of proficiency that would be “acceptable in a real-life context” (Literacy and Basic Skills Section, 1998, p. 28).

In most cases, numeracy gains need not be reported to funders. Only when a learner is in a numeracy-only class is it necessary to report numeracy gain.

Development and Implementation

The matrix of learning outcomes was developed by the Ministry of Education and Training “in partnership with the literacy field (Literacy and Basic Skills Section, 1998, p. 1).

The Learning Outcomes document has built on research and development activity from 1990-1998. There have been many projects funded during that time period and since to inform government on the direction it should take to put a system in place. Numeracy was always a part of the development. (A. Osborne, July 2003, personal communication)

Some examples of the work that was carried out are: the Open Learning Network (1990-1994) and the Huron-Perth Recognition for Learning System (1991-1993). The work done by these two projects was brought together through the Recognition of Adult Learning Project (1994-1995). Both projects worked towards ensuring a learner centered approach to learning which invited diverse outcomes. Learners were encouraged to submit work that was meaningful to them. The approach used for the learning system was a functional approach based on what learners needed to know.

The numeracy domain of the learning outcomes matrix was drawn almost verbatim from the 1997 math curriculum for children in grades one to eight. This was done for two

reasons: (1) to build on “MET’s experience in creating contemporary educational goals”, and (2) so that “articulation to other education and training sectors becomes easier” (Literacy and Basic Skills Section, 1998, p. 1).

The Literacy and Basic Skills Section plans to monitor the consistency of assessments that are made based on the matrix, as expressed below:

Over time, as LBS agencies gain experience with the LBS learning outcomes, they will develop more consistent interpretations. The ministry is the ultimate guardian of the accuracy, quality, and consistency of the standards. (Literacy and Basic Skills Section, 2000, p. 28)

In future, MTCU [Ministry of Training, Colleges and Universities⁴] will formally sample the accuracy and consistency of the interpretations of the learning outcomes (Literacy and Basic Skills Section, 2000, p. 28).

To support consistent interpretations, the LBS section funded the Ontario Literacy Coalition in its development of the Level Descriptions Manual, which is presented below.

Numeracy in the Level Descriptions Manual

The Level Descriptions Manual was developed by the Ontario Literacy Coalition, funded by the Ministry of Training, Colleges and Universities of Ontario and Canada’s National Literacy Secretariat. The manual was to “provide a holistic perspective to the description of skills [...] that are detailed in *Working with Learning Outcomes*” (Ontario Literacy Coalition, 2000, p. 3). The Ontario Literacy Coalition set up teams of educational consultants and adult literacy practitioners to synthesize the ‘success markers’ and ‘transition markers’ of the learning outcomes matrix (described earlier in this chapter) into larger ‘performance indicators’, and to then further synthesize these into ‘summary statements’.

This was done with the intention of providing a tool to “help practitioners and programs in the move toward a common understanding of assessment results” (Ontario Literacy Coalition, 2000, p. 8).

The structure of the numeracy domain of the Level Descriptions Manual is presented in Table 3 below.

⁴ Provincial ministries were reorganized in Ontario, moving ‘Training’, of which LBS is a part, from the Ministry of Education and Training, to the Ministry of Training, Colleges and Universities.

Table 3. The Numeracy Domain of the Level Descriptions Manual – Ontario

	Use Number Sense and Computation		Use Measurement for Various Purposes						Solve Geometric Problems			Manage Data and Probability		
	Whole Numbers, Decimals and Integers	Fractions, Percents and Ratios	Time	Temperature	Length and Perimeter	Area	Capacity and Volume	Mass	Two- and Three- Dimensional Geometry	Transformational Geometry	Grids and Co-ordinate Geometry	Collecting, Organizing and Displaying Data	Analyzing Data and Drawing Conclusions	Probability
1														
2														
3														
4														
5														

Two samples of this framework’s contents are presented next. In Table 4 are the summary statements for ‘Manage Data and Probability’, and in Table 5 are the ‘performance indicators’ for ‘Fractions, Percents and Ratios’.

Table 4. Summary statements for ‘Manage Data and Probability’ from the numeracy domain of the Level Descriptions Manual

Level	Summary Statement
1	The learner collects and sorts a small number of simple data, displays these data on given charts and pictographs, and discusses these displays of data. The learner uses everyday language to discuss probability as part of familiar experience.
2	The learner conducts surveys using self-generated questions, selects appropriate graphic organizers to sort data, and constructs simple bar graphs to display data. The learner interprets data on graphs and tables, and expresses understanding in a variety of ways. The learner predicts the results of simple probability experiments and carries them out.
3	The learner designs and conducts surveys, records results on tally charts and spreadsheets, and displays data on labeled graphs. The learner calculates the mean and mode of a set of data, and identifies the important features of data collected by others. The learner conducts simple probability experiments and uses the results to make decisions.
4	The learner collects and organizes data from primary and secondary sources, and decides on the best method of display. The learner identifies trends, calculates measures of central tendency, and makes inferences and convincing arguments based on a variety of displays of data. The learner conducts probability experiments, compares theoretical and actual results, and applies probability in familiar contexts.
5	The learner designs and carries out experiments to test hypotheses and uses data in databases and spreadsheets to solve problems. The learner explains sampling techniques, and recognizes misuse of data in advertising and news reports. The learner calculates complex probabilities and applies probability in a variety of contexts.

Table 5. 'Fractions, Percents and Ratios' in Ontario's Level Descriptions

Level	Performance Indicators
1	- Uses the term 'half' to describe quantities in everyday situations
2	- Uses terms for common fractions (halves, thirds, quarters) to describe and measure quantities in everyday life - Explains common percent [sic] (25%, 50%, 100%) in terms of their relationships to common fractions (quarter, half, whole)
3	- Uses fraction terminology and notation (proper, improper, numerator, denominator, simplify, three-eighths, 3/8) - Expresses fractions represented in diagrams as words and symbols - Generates multiples and factors of given numbers in order to find equivalent fractions - Compares fractions by rewriting with a common denominator - Converts fractions to decimals and <i>vice versa</i> - Expresses a fraction with a denominator of 100 as a percent
4	- Adds, subtracts, multiplies, and divides fractions - Converts between fractions, decimals and percent - Explains the meaning of percent and ratios used in everyday situations - Solves simple, real-life problems involving fractions, percent and ratios
5	- Solves multi-step numerical and word problems involving fractions, decimals, percent and ratios - Evaluates algebraic expressions containing fractions, decimals, percent and ratios, using the correct order of operations

Use

The Level Descriptions are intended as a complement to the matrix in *Working with Learning Outcomes* (Ontario Literacy Coalition, 2000, p. 3). Which of the two documents is used in any particular situation (e.g., training plan development) is up to the professional judgment of the practitioner. When more detail is required, he or she may use the matrix of learning outcomes, and when more holistic descriptions of skill are required, he or she may use the Level Descriptions (Ontario Literacy Coalition, p. 4).

People outside the LBS program may also use this document. For example, social service workers, employers, and local training and adjustment board members can use this document to understand the teaching and learning that takes place in the LBS program.

Development and Implementation

A team of four experienced practitioners and one consultant worked to develop the numeracy level descriptions. They began with the matrix of learning outcomes in *Working with Learning Outcomes*, synthesized the smallest units of information as described earlier, and made the following kinds of changes:

- removed references to child-only materials or applications;
- added adult-relevant elements, like Imperial units of measurement;
- moved some elements to different levels, for example, benchmark percents (25%, 50%) were moved down to level 2; and
- where a skill was broken up and distributed across several levels in a way that was inappropriate for adults, the team united it at an appropriate level.

A document describing each modification and its rationale was submitted to the Literacy and Basic Skills Section for approval. After this was reviewed, the team created summary statements for each strand at each level. Finally, examples of learning activities and real-life contexts were added, “to further illustrate the level of complexity of numeracy skill in everyday activities” (Ontario Literacy Coalition, 2000, p. 58).

The final document was given and introduced directly to two practitioners from every program in half-day workshops around the province. More copies of the manual were made available from the Ontario Literacy Coalition, and it is now available on-line.

Comments on Ontario's Frameworks

In 1998, in a report initiated by the Ontario Literacy Coalition, Perrin summarized several reports written by programs across Ontario that had field tested the learning outcomes approach, including the matrix of learning outcomes in *Working with Learning Outcomes*. This work was initiated by the Ontario Literacy Coalition, and funded by the Literacy and Basic Skills Section, in order to, among other things, “provide information to the Literacy and Basic Skills Section on how the draft learning outcomes can be improved.” Below are excerpts from this report⁵:

In general, the literacy community is supportive of the move towards a learning outcomes approach.

Most [programs'] reports include comments about how use of the Framework can provide structure and focus, for both students and instructors. They say that the trials have found that it can help learners focus on goals, and that it can motivate some students. Some report that in some cases, use of a learning outcomes approach can help identify real-life learning activities. Many reports also indicate that programs find a learning outcomes approach useful for documenting or measuring progress and indicating what the student has learned.

[Perrin quotes a practitioner, whose comment, he says, is representative of the comments of many practitioners:] "The programs realized that the learning outcomes are not curriculum. However a concern that seems to surface many times is how a program could be defined in outcomes and whether the demonstrations [i.e., performance tasks used to assess learning] constituted a course of study. In either case it was very difficult to maintain a 'learner centred approach'."

Some comments suggest that the Framework should be simplified, or laid out differently, to make it easier to use.

There is virtual unanimity across the province: based upon the field trials, the Framework as it stands now is inadequate for use with low-level learners.

A number of network reports indicated that the draft learning outcomes Framework document uses language which is unclear, full of jargon and confusing terminology, and that it is hard to follow. They suggest that it be rewritten so that it is more accessible.

If literacy practitioners feel that the findings from the field trials are taken into account in the redesign of the learning outcomes approach, and they are given the assistance they say they need in order to be able to use learning outcomes effectively, most people in the field are likely to get behind this new direction. The energy and enthusiasm which exists now can be harnessed constructively, leading to effective implementation of learning outcomes, as well as to other positive outcomes. This can result in increased accountability - and in increased learning for learners in literacy programs across Ontario.

⁵ Perrin does not specify whether these findings refer to the communication outcomes, the numeracy outcomes, or both.

Tom Ciancone's 2000 article, 'Learning Outcomes: Skills or Function?', contains the following two comments on *Working with Learning Outcomes*:

My concern is not with the theory but with the content and implementation of the LBS learning outcomes.

In the absence of curriculum guidelines and appropriate training, I fear that literacy instructors who have little experience in numeracy instruction will use these LBS learning outcomes as a prescribed course of study. This would be the antithesis of learner-centred education.

My own experience (I worked on a project to write numeracy assessment tasks that were linked to the matrix of learning outcomes, I was one of the four team members who developed the numeracy domain of the Level Descriptions Manual, and I facilitated approximately six workshops across the province to introduce the numeracy domain of the Level Descriptions Manual to practitioners) enables me to make some comments here. One difficulty with the matrix of *Working with Learning Outcomes* is that realistic adult numeracy tasks seldom have their "success markers" clustered around one level, or sometimes even present at all in the matrix. A less significant difficulty is that the 'transition markers' in the matrix of *Working with Learning Outcomes* – an artifact of the children's curriculum on which it is based – have confused users. Two grade levels' 'success markers' have been grouped to form a single Literacy and Basic Skills level, with the 'success markers' from the lower grade renamed 'transition markers' to explain why there would be both, for example, "recalls multiplication and division facts to 144" and "recalls multiplication and division facts to 81" in the same Literacy and Basic Skills level. (Literacy and Basic Skills Section, 1998, p. 87). The majority of practitioners who attended the workshops that introduced the numeracy domain of the Level Descriptions Manual welcomed the new document, because, they said, its organization corresponds better to adult learning, its summary statements are helpful, its layout is more convenient, and it includes examples. Some among them felt that it still had shortcomings (e.g., some common adult numeracy skills still seemed to be missing). It would be interesting to find out more about how it is perceived and used now (three years after its publication), and how this compares to the perception and use of the original matrix of learning outcomes.

No published comments on the Level Descriptions Manual could be found.

Chapter 2

England

Two inter-related frameworks for adult numeracy education are presented in this chapter:

The National Standards for Adult Numeracy

The Adult Numeracy Core Curriculum

In the 1990s, international survey results put English adults at or near the bottom of several rankings of the numeracy skills of adults in industrialized countries (Coben, 2001, p. 126). These survey results led to a

[...] public perception in Britain that many adults lack competence and confidence in manipulating numbers in their 'everyday lives', that this has serious implications for those individuals, for the economy and for social cohesion, and that the situation is getting worse. (Coben, 2001, p. 129)

In response, the Moser Commission was established, and it produced the report, *A Fresh Start*, which recommended a national strategy for improving adult literacy and numeracy skills. This national strategy has now been created and titled *Skills for Life*. *Skills for Life* defines numeracy in this way:

Literacy and numeracy are the fundamental skills that every adult needs to be able to function and progress at work and in society in general. Collectively the skills of literacy and numeracy are often referred to as the basic skills. (Qualifications and Curriculum Authority, 2000, p. 1)

Reform in adult basic education in England has some urgency (Coben, 2001, p. 145), and the government has committed significant funding to the *Skills for Life* strategy (Coben, 2001, p. 134). The two frameworks described in this chapter are part of this strategy, and are used in all basic skills programs in England.

The National Standards for Adult Numeracy

The National Standards for Adult Numeracy are statements about what adults can do in several math-related areas at five levels, and they underlie the country's national tests for numeracy, screening and diagnostic materials, national survey of adults, new qualifications for teachers of numeracy, and the adult numeracy core curriculum (this last item is described later in this chapter) (Qualifications and Curriculum Authority, 2000, p. 1). Since 2001, literacy and numeracy programs have been required to follow the standards.

The national standards are reproduced in Table 6 on the following page.

Table 6. The National Standards for Adult Numeracy (England)

Entry Level			Level 1	Level 2
Entry 1	Entry 2	Entry 3		
Understanding and using mathematical information				
<i>Adults can:</i>				
<p>read and understand information given by numbers and symbols in simple graphical, numerical and written material</p> <p>specify and describe a practical problem or task using numbers and measures</p>	<p>read and understand information given by numbers, symbols, simple diagrams and charts in graphical, numerical and written material</p> <p>specify and describe a practical problem or task using numbers, measures and simple shapes to record essential information</p>	<p>read and understand information given by numbers, symbols, diagrams and charts used for different purposes and in different ways in graphical, numerical and written material</p> <p>specify and describe a practical problem or task using numbers, measures and diagrams to collect and record relevant information</p>	<p>read and understand straightforward mathematical information used for different purposes and independently select relevant information from given graphical, numerical and written material</p> <p>specify and describe a practical activity, problem or task using mathematical information and language to make accurate observations and identify suitable calculations to achieve an appropriate number</p>	<p>read and understand mathematical information used for different purposes and independently select and compare relevant information from a variety of graphical, numerical and written material</p> <p>specify and describe a practical activity, problem or task using mathematical information and language to increase understanding and select appropriate methods for carrying through a substantial activity</p>
Calculating and manipulating mathematical information				
<i>Adults can:</i>				
<p>generate results which make sense and use given methods and given checking procedures appropriate to the specified purpose</p>	<p>generate results to a given level of accuracy using given methods and given checking procedures appropriate to the specified purpose</p>	<p>generate results to a given level of accuracy using given methods, measures and checking procedures appropriate to the specified purpose</p>	<p>generate results to a given level of accuracy using methods, measures and checking procedures appropriate to the specified purpose</p>	<p>generate results to an appropriate level of accuracy using methods, measures and checking procedures appropriate to the specified purpose</p>
Interpreting results and communicating mathematical information				
<i>Adults can:</i>				
<p>present and explain results which show an understanding of the intended purpose using appropriate numbers, measures, objects or pictures</p>	<p>present and explain results which meet the intended purpose using appropriate numbers, simple diagrams and symbols</p>	<p>present and explain results which meet the intended purpose using appropriate numbers, diagrams, charts and symbols</p>	<p>present and explain results which meet the intended purpose using an appropriate format to a given level of accuracy</p>	<p>present and explain results clearly and accurately using numerical, graphical and written formats appropriate to purpose, findings and audience</p>

Structure and Content

The standards in the preceding table consist of precisely-worded statements that describe how well an adult will be able to understand, use, manipulate, interpret and communicate mathematical information at each of five levels.

The table produced here contains only the standards themselves; the actual document that presents them, however, also describes the mathematical knowledge to be used at each level, and includes sample activities and applications.

The five levels are, from lowest to highest: Entry Level 1, Entry Level 2, Entry Level 3, Level 1, Level 2. They have been so named to make it explicit that the two highest levels are at Levels 1 and 2 of England's national qualifications grid (Qualifications and Curriculum Authority, 2000, p. 5).

Use

The standards are intended “for use by designers of qualifications, developers of curricula, and those who are responsible for providing training and support for adult literacy and numeracy. The standards have not been written for adult learners themselves.” (Qualifications and Curriculum Authority, 2000, p. 1)

Development and Implementation

These standards are the result of “a review of existing or similar frameworks, including the national numeracy strategy for schools, the national curriculum levels for mathematics, and the ‘Key Skills’”, and, following this review, “development work and widespread consultation” (Qualifications and Curriculum Authority, 2000, p. 2).

They were developed relatively quickly; the report that called for a national strategy for adult literacy and numeracy came out in 1999, and these standards were published in 2000. The publication of the Adult Numeracy Core Curriculum (presented next in this report) followed a year later, in 2001.

The Adult Numeracy Core Curriculum

This curriculum’s purpose is to “improve the quality and consistency of provision”, so that learners, “no matter which type of course they choose or where the learning takes place, [...] can be confident of a common approach and effective support” (Department for Education and Skills, 2001, p. v).

The core curriculum document includes the national standards (the previous framework presented in this report), and refers to them interchangeably as standards and capabilities. However, the bulk of the curriculum is the ‘curriculum elements’, or math strands (e.g., whole numbers). The curriculum elements are too detailed to reproduce in full here, so I will first present their organizing structure (Table 7) and then sample some of their contents (Table 8).

Table 7. The Adult Numeracy Core Curriculum (England) – Curriculum Elements

	Number		Measures, Shape and Space		Handling Data	
	Whole Numbers	Fractions, Decimals and Percentages	Common Measures	Shape and Space	Data and Statistical Measures	Probability
Entry Level 1		n/a				n/a
Entry Level 2						n/a
Entry Level 3						n/a
Level 1						
Level 2						

Each empty cell in the preceding table actually contains a set of skills, knowledge and understanding, which are further broken down, and illustrated with examples. For example, Table 8 below presents the contents of the cell representing Whole Numbers at Entry Level 3:

Table 8. Whole Numbers at Entry Level 3 in the Adult Numeracy Core Curriculum

Skills, Knowledge and Understanding Adults should be taught to:	Example
1. count reliably up to 20 items - count in twos and tens up to 100 - count on in tens up to 100, starting from any two-digit number	Count the items in a delivery
2. read, write, order and compare numbers up to 1000 - understand that the position of a digit signifies its value - know what each digit in a two-digit number represents, including the use of zero as a placeholder - recognise odd and even numbers up to 30	Choose numbers on a lottery ticket and check the winning numbers. Find an address by reading door numbers Read speed limits on traffic signs. Use page numbers to locate information.
3. add and subtract two-digit whole numbers	Calculate the cost in pence of two items, e.g. a newspaper and a can of drink.
4. recall addition and subtraction facts up to 10 - understand that there are different strategies to help with mental addition and subtraction - understand that subtraction is the inverse of addition - know how to align numbers for column addition	Calculate the difference in price in pence between two products, e.g. between two cans of drink.
5. multiply using single-digit whole numbers - understand and use the vocabulary of multiplication, e.g., multiplied by, times, lots of - understand the operation of multiplication as repeated addition, e.g., $3 \times 5 = 5 + 5 + 5$ - understand that multiplication is commutative, e.g., $2 \times 4 = 4 \times 2$, but that the meaning is different, e.g. take 2 tablets 4 times a day (4×2) is different from take 4 tablets twice a day (2×4) - know doubles of numbers to 10 - understand the relationship between halving and doubling	Check delivery of goods in small batches. Calculate the total number of items, e.g. three books of stamps with four stamps each.
6. approximate by rounding to the nearest 10 - understand place value for units and tens	Round numbers to make approximate calculations.
7. use and interpret +, -, X and = in practical situations and for - solving problems - understand that +, - and X represent operations	Use symbols to record whole-number calculations when solving problems.
8. use a calculator to check calculations using whole numbers - understand the order to enter a two-digit number - understand the order to key in numbers and operators - know how to clear the display and cancel a wrong entry	Any calculations at this level.

Use

Quotations from the curriculum document and other government publications describe how the curriculum is to be used:

This adult numeracy core curriculum provides the skills framework, the learner provides the context, and the teacher needs to bring them together in a learning programme. (Basic Skills Agency, 2001, p. 9)

The curriculum has been written primarily for use by adult literacy and numeracy teachers and tutors. However, it will be an important document for programme managers and developers, for those involved in research and for a wider group of those bodies and individuals that are increasingly concerned with the adult literacy and numeracy agenda. (Department for Education and Skills, 2001, p. 1)

The curriculum elements must be clear and used *with* learners.[...] Evidence shows that the inclusion of explicit curriculum targets in learning programmes has resulted in clearer identification of outcomes *by learners* as well as by teachers, and in better attendance and progression by learners. (Department for Education and Skills, 2001, p. 8)

Adult literacy and numeracy teachers will be able to use the core curriculum to develop learning programmes. It will help them to:

- use information from diagnostic assessment to identify learners' skills both, those that they already have and those that they need;

- draw those elements from the curriculum into the learning plan and assessment regime; use their knowledge of the learners' context and priorities to find relevant applications where learners can practise the skills and knowledge they are acquiring;

- follow the progression through the standards and the curriculum elements to build a formative and summative assessment regime into the learning plan. (Basic Skills Agency, 2001, p. 2)

The Adult Numeracy Core Curriculum is tied very closely to assessment. At the Entry Levels, learners earn recognition for progress partly (50%) through assessments which are external (Qualifications and Curriculum Authority, 2003), and partly (50%) through other means of assessment. At Levels 1 and 2, learners earn recognition by passing the national test for each level. Since September, 2001, "all new learners embarking on a literacy or numeracy programme leading to Level 1 or Level 2 will work towards the National Test" (Department for Education and Skills, 2001, p. 48). The national test for numeracy at each of the two levels has 40 multiple choice questions, and learners are allowed an hour and fifteen minutes to complete it. A minimum score between 55% and 75% is required to pass (the precise minimum required may vary). Certain bodies are certified to offer the national test, and they usually do so once a month. Practice tests are available on the internet, and, in the future, learners may complete the official tests on the internet (Department for Education and Skills, 2003).

Development and Implementation

The curriculum was created out of a "national consultation with teachers and managers of adult literacy and numeracy programmes, and relevant bodies." In the curriculum's introduction, it is stated that the adult numeracy core curriculum "draws heavily on existing and planned curricula and strategies in this country and overseas" including the national curriculum in schools [for children] that was introduced in 2000, and the 'key skill' of 'application of number' that was developed by the Qualifications and Curriculum Authority (Department for Education and Skills or Basic Skills Agency, 2001, p. 1).

Users can access the curriculum on-line and in hard copy for free upon request from the government.

Comments on English Frameworks

The first set of comments comes from a 2001 paper by Coben:

It is hard to see how any pre-determined curriculum could accommodate the complex and varied nature of the mathematical practices and demands of adult life and of adults' mathematical abilities, interests and experience. The new curriculum attempts to do this, by covering a range of mathematical topics at a range of levels and by insisting that "the learner brings the context that will be the ultimate 'proving ground' for their improved skills": (Basic Skills Agency, 2001a, p. 8). This is problematic on several counts. [...] I shall outline some concerns about context, teaching and learning, content and level. (Coben, 2001, p. 140).

Some of the examples given in the curriculum document do not inspire confidence that a 'realistic' adult context is being addressed, rather, some of the examples smack of desperation in the attempt to tailor what is at heart a children's curriculum to adults. (Coben, 2001, p. 140).

Far too little is known about how adults learn mathematics and how best to teach it so that adults become 'numerate'. (Coben, 2001, p. 141)

The content of the adult numeracy core curriculum follows the general pattern of organisation of the National Curriculum for Mathematics[...] This is both to be welcomed and deplored. It is welcome in that the curriculum is not limited to number only, but includes measures, shape and space, and handling data. However, [...] content is fragmented and distinctions between elements in the curriculum seem arbitrary and laboured. (Coben, 2001, p. 141)

[The levels are based on] the National Curriculum in Mathematics in schools on the assumption that these levels also apply to adults' learning. This is unproven. (Coben, 2001, p. 142)

Skills for Life says little about evaluation [of the curriculum] (Coben, 2001, p. 142).

Future evaluators should listen to experienced practitioners and to adult learners, since no curriculum will work unless it has the support of these two groups. (Coben, 2001, p. 143)

The second set of comments comes from a paper by the National Institute of Adult Continuing Education (NIACE, 2001) written in response to the *Skills for Life* strategy:

Numeracy and Literacy are different skills and there is little indication that the strategy will address the subjects differently. There are different levels of skills in the population and each will require different promotional strategies and provision. It is recognised that different stigma apply in each case. (NIACE, 2001)

It appears as if *Skills for Life* has thoroughly confused the purpose of the tests being developed at the moment. The document suggests that the tests can be used for surveying, screening for diagnostic purposes and as a qualification. This is educationally and practically unsound. It would be better to focus on one purpose, a qualification perhaps. (NIACE, 2001)

[...] the national curriculum for literacy, for numeracy and for ESOL have each had limited exposure to the field for testing and review. It would be helpful to state that these three separate documents should be reviewed regularly. (NIACE, 2001)

While welcoming *Skills for Life*, NIACE has concerns that a hurried approach to developing a strategy that has waited all these years might spoil the strategic approach. We are not keen to see a 'crusade,' preferring a calm and well resourced strategy that is inclusive and developmental and aims to increase participation in learning for all. (NIACE, 2001)

The third set of comments is from a 2002 report, *Pathfinders – Lessons for Success*, which describes the experiences of practitioners and learners in nine projects set up to field test the Skills for Life strategy:

The overriding findings of the evaluation [by pathfinder partners of their experience with the new infrastructure] were positive. (p. 1)

As was expected there were challenges to be faced and issues to be addressed, not the least for a coherent framework for teacher training and continuous professional development. There were lessons too as regards access to national qualifications: it is important that these reflect the needs of learners and providers, not just the administrative arrangements of awarding bodies and regulators. (p. 1)

The very positive response, especially to the new curriculum, the intensive teacher training and the National Tests, has provided real confidence that the new teaching and learning infrastructure works and can deliver the outcomes for which it was designed. (p. 27)

The response of teachers in the Pathfinders as they were introduced to and began to use the new literacy and numeracy core curricula with their adult learners was overwhelmingly positive. The curricula were seen as providing a very real and consistent framework at a practical level. (p. 28)

The fourth and final set of comments is from a report on a 2001 conference of NIACE and NATFHE (a trade union and professional association for lecturers, trainers, researchers and managers in further and higher education in England, Wales and Northern Ireland):

Ursula Howard, Director of Research at the Learning and Skills Development Agency, [...] urged us to see the new national curriculum as 'a rough guide rather than an instruction manual' (Derrick, p. 3)

Sue Gardener of the Urban Learning Foundation compared the national strategies for Adult Basic Skills of the UK, Australia and the USA, and found the UK's continuing emphasis on qualifications and level definitions disappointing, particularly as the other countries are taking a more sophisticated approach. (Derrick, p. 3)

Chapter 3

SCOTLAND

Two frameworks for adult numeracy will be described in this chapter:

Numeracy in the Core Skills Framework

Adult Numeracy Curriculum Framework (in progress)

In Scotland in 2001, a report was published ‘to provide a focus for the development of national policy and strategy on adult literacy and numeracy’ (Scottish Executive, 2001, p. 5). The report defines literacy and numeracy in the same statement:

The ability to read, write and use numeracy, to handle information, to express ideas and opinions, to make decisions and solve problems, as family members, workers, citizens and lifelong learners. (Scottish Executive, 2001, p. 7)

Also, the report proposed that a ‘development engine’ be established in the national government, to drive national literacy and numeracy strategy (Scottish Executive, 2001, p. 20). This has come to be set up in the Communities Scotland department of the government, and is called ‘The Development Centre for Community Learning and Development and Adult Literacy and Numeracy’ (as of this writing a new name was being sought for the centre).

Though other jurisdictions in this report also have core skills frameworks, I have decided to present only Scotland’s, because in Scotland the core skills framework is to be used much more centrally and explicitly in the literacy program – it is even to be used by teachers and tutors.

Numeracy in the Core Skills Framework

Core Skills in Numeracy are defined in the following quotation:

To cope with the demands of everyday life, including work and study, people need to be comfortable with numbers and with graphs, symbols, diagrams and calculators. The skills needed for this are essentially those of interpreting, processing and communicating quantifiable and spatial information. (Scottish Qualifications Authority, 2003, p. 2)

In the Core Skills Framework, Numeracy is divided into two sub topics, 'Using Number' and 'Using Graphical Information', at five levels (Access 2, Access 3, Intermediate 1, Intermediate 2 and Higher). These are described in Table 9 on the following page.

Table 9. Numeracy in Scotland's Core Skills Framework

	Using Number		Using Graphical Information	
	General Skill	Specific Skills	General Skill	Specific Skills
Access 2	Apply very simple numerical skills in familiar everyday contexts.	<ul style="list-style-type: none"> - recognise and use some basic numerical notation - decide on one numerical operation to be carried out - carry out very simple numerical calculations 	Read and use very simple graphical information in familiar everyday contexts.	<ul style="list-style-type: none"> - read and use a very simple scale - identify information in very simple tables - identify information in very simple diagrams - communicate information in very simple tables and diagrams with support
Access 3	Apply simple numerical skills in everyday contexts.	<ul style="list-style-type: none"> - work with basic numerical notation - decide on the numerical operations to be carried out - carry out simple numerical calculations 	Interpret and communicate simple graphical information in everyday contexts.	<ul style="list-style-type: none"> - read and use a simple scale - extract information from three of the following: simple tables, graphs, charts or diagrams - communicate information in simple tables, graphs, charts or diagrams as appropriate
Intermediate 1	Apply a range of straightforward numerical skills in everyday contexts.	<ul style="list-style-type: none"> - work confidently with basic numerical notation - decide on the numerical operations to be carried out - carry out straightforward calculations 	Interpret and communicate straightforward graphical information in everyday contexts.	<ul style="list-style-type: none"> - read and use a straightforward scale - extract information from straightforward tables, graphs, charts or diagrams - communicate information in straightforward tables, graphs, charts or diagrams as appropriate
Intermediate 2	Apply a wide range of numerical skills in everyday and generalised contexts.	<ul style="list-style-type: none"> - work confidently with a numerical concept - decide on the numerical operations to be carried out - carry out complex calculations or a number of sustained calculations 	Interpret and communicate graphical information in everyday and generalised contexts.	<ul style="list-style-type: none"> - interpret information from tables, graphs, charts or diagrams - select an appropriate form of tables, graphs, charts or diagrams and communicate information in that form
Higher	Apply in combination a wide range of numerical, statistical and other mathematical skills to process complex information in generalised contexts.	<ul style="list-style-type: none"> - work confidently with a numerical or statistical concept - decide on the steps and operations to be carried out - carry out a number of sustained, complex calculations 	Apply a wide range of graphical skills to interpret and present complex information in generalised contexts.	<ul style="list-style-type: none"> - analyse and interpret complex graphical information - select an appropriate form of table, graph, chart, diagram or qualitative form and communicate information in that form

For each cell in the previous table, the core skills framework provides a page of information. Below is the page of information for ‘Using Number’ at the Intermediate 1 Level (Table 10), and on the next page is the information for ‘Using Graphical Information at the Access 2 Level (Table 11).

Table 10. Using Number at the Intermediate 1 Level (Scotland)

USING NUMBER	INTERMEDIATE 1
<p>General skill Apply a range of straightforward numerical skills in everyday contexts.</p>	
<p>Specific skills</p> <ul style="list-style-type: none"> - work confidently with basic numerical notation - decide on the numerical operations to be carried out - carry out straightforward calculations 	
<p>Further information on the general skill</p> <p>Contexts might involve money, time (including the 24 hour clock), length, weight, area, volume, or temperature.</p> <p>Calculations may be carried out mentally, in writing or by calculator. It is assumed that candidates will be able to add, subtract, multiply and divide but evidence of all of the basic operations is not required. Candidates will round answers to a given degree of accuracy (eg. to two decimal places or three significant figures).</p> <p>Candidates should check answers, although evidence of checking is not required.</p> <p>Further information on the specific skills</p> <p>The candidate must:</p> <ul style="list-style-type: none"> - use notations for all of the following: whole numbers, decimals, percentages, fractions, simple ratios (eg 1:3, 5:1) - decide which operations are to be carried out (eg add and multiply) and the order in which to carry them out. At this level, candidates must show that they can carry out calculations involving three operations - carry out calculations with whole numbers and decimals - carry out calculations involving two of the following: percentages, fractions, simple ratios, simple formulae in symbols 	
<p>Examples of tasks might include:</p> <ul style="list-style-type: none"> - calculating the volume required to store a defined weight of a product - calculating the ratio of male to female in a group - mileage calculations for travel expenses - using a formula such as $f=ma$ 	

Table 11. Using Graphical Information at the Access 2 Level (Scotland)

USING GRAPHICAL INFORMATION	ACCESS 2
<p>General skill Read and use very simple graphical information in familiar everyday contexts.</p>	
<p>Specific skills</p> <ul style="list-style-type: none"> - read and use a very simple scale - identify information in very simple tables - identify information in very simple diagrams - communicate information in very simple tables and diagrams with support 	
<p>Further information on the general skill</p> <p>Familiar everyday contexts might involve calendars, work timetables or schedules or transport timetables. The candidate should be able to work in such contexts with support.</p> <p>Tables and diagrams should be designed for the candidate to complete with support as required.</p> <p>Further information on the specific skills</p> <p>The candidate must:</p> <ul style="list-style-type: none"> - read and use a very simple scale, on which every division is numbered - use a familiar measuring instrument to measure to the nearest marked number or use the scale on a graph to determine quantities to the nearest marked number - identify information from a very simple table containing one category of information - identify information from a very simple diagram (eg a diagram of very simple 2D shapes such as squares or rectangles, a very simple diagram of furniture in a room or a very simple map) - communicate information by inserting information to complete partially completed tables and diagrams 	
<p>Examples of tasks might include:</p> <ul style="list-style-type: none"> - measuring with a ruler, metre stick or tape measure - weighing ingredients with household scales - taking the temperature of a room with a thermometer - finding bus departure times from a table showing one destination - finding the price of components from a table showing prices for different sizes of one item - identifying local places on a street plan 	

Use

The document containing this framework states that it is to be used “by those designing and auditing Units, Courses, assessment programmes and Group Awards, and by staff of the Scottish Qualifications Authority” (Scottish Qualifications

Authority, p. 5, 2003). Scotland's literacy and numeracy strategy recommends that literacy and numeracy practitioners also use it.

Adult Numeracy Curriculum

The Scottish Further Education Unit and the University of Edinburgh have begun to develop an adult literacy and numeracy curriculum framework. It is to be completed by the end of December, 2004. The objectives of this curriculum framework are:

- to produce guidelines for approaches to learning and teaching in adult literacy and numeracy
- to produce guidelines and tools for identifying learner needs and assessment
- to produce guidelines on the use of Progress File and develop progress indicators to measure performance-based achievement and progression
- to provide case studies and examples on how to level and assess Core Skills [described in this chapter] for inclusion in the SCQF and how to record levels of achievement or Core Skills attainment.
- to provide tools for the purpose of curricular audit as well as literacies proofing for providers and policy makers. (Communities Scotland, 2003, p. 2)

This curriculum framework will use two sub-frameworks: a set of progress indicators (as yet unspecified), and the country's Core Skills framework (the previous framework presented in this report).

Comments on Scotland's frameworks

No comments on Scotland's frameworks were found.

Chapter 4

IRELAND

One framework for adult numeracy education is described in this chapter:

The National Adult Literacy Agency's Assessment Framework for Numeracy

Numeracy is included in Ireland's definition of literacy:

NALA [The National Adult Literacy Agency] defines literacy as the integration of listening, speaking, reading, writing and numeracy. It also encompasses aspects of personal development -- social, economic, emotional and is concerned with improving self esteem and building confidence. It goes far beyond mere technical skills of communication. The underlying aim of good literacy practice is to enable people to understand and reflect critically on their life circumstances with a view to exploring new possibilities and initiating constructive change. (Merrifield, Coleman and McDonogh, 2001, p. 1)

In 2001, Merrifield et al wrote:

[...] adult literacy in Ireland is in process of profound change – from volunteer-based work to increased numbers of paid professional staff, from small and marginal to the mainstream of VECs [Vocational Educational Committees], from under-resourced to increased levels of resource and funding. (p. 1).

This process of change, for numeracy specifically, will be mapped out in the Adult Numeracy Work Group's report, *Meeting the Numeracy Challenge*, to be published in the fall of 2003. The report will include recommendations for the development of numeracy within adult literacy practice, and a strategic plan for 2003-2006 (National Adult Literacy Agency, 2003).

Numeracy in The National Adult Literacy Agency's Assessment Framework for Literacy and Numeracy

The National Adult Literacy Agency (NALA) is Ireland's co-coordinating, training and campaigning organization (National Adult Literacy Agency, 2003, p. 8). NALA started work on its assessment framework in 2000, after its members identified assessment as the top priority for research. At that time, there was no "single nationally endorsed assessment framework and methodology for assessing literacy levels within Irish literacy schemes."

At the beginning of the development process, a team produced the document *Issues and Opportunities in Assessment* in spring of 2001. The document outlines approaches to assessment, and the results of consultation with the field regarding assessment in Ireland. The team then developed a draft framework, which was field tested by practitioners (tutors and program organizers) in twelve settings across Ireland. Feedback from these trials was integrated into the framework, and the revised framework was published in October 2002. The October 2002 draft has since been field tested in approximately twenty settings across the country, and a further revised version – the final version of the framework – will be published in the next few months (National Adult Literacy Agency, 2003, p. 5). My research must be completed before the final version of Ireland's framework is published, so the October 2002 version of it is presented here.

The general purpose of the framework is to support and manage the demonstration and description of learning (Merrifield & McSkeane, 2002, p. 2). More specifically, it is to be used for the following reasons:

Learners have the right to know that they are making progress, and to know how 'progress' is determined, with judgements made consistently and in relation to agreed criteria. A common assessment framework allows tutors and learners to feel confident about where they are and where they are going. It helps organisers and managers plan their work effectively. Knowing how many learners are at different levels enables organisers to plan the kinds of resource materials, tutor training and support, and gives tutors guidance about how teaching should be planned. (Merrifield & McSkeane, 200, p. 2)

Structure and Content

An assessment of a learner's performance on a task is given in the form of four measurements, each on a nine-point scale. Each measurement is of a 'cornerstone'. The four cornerstones are: (1) knowledge base, (2) depth of understanding and critical awareness, (3) fluency and independence, and (4) range of application (Merrifield & McSkeane, 2002, p. 22). Within the first cornerstone (i.e., 'knowledge base') there are four 'learning areas,' one of which is 'use basic maths to solve everyday problems'. (The other learning areas are (1) writing, (2) reading, and (3) listening and speaking.) This structure and the criteria for making numeracy

assessment decisions are, in the original framework document, described in prose and tables, together with the literacy elements. In Table 12 below, I present what I understand the numeracy elements of the framework to be. I was unable to confirm the accuracy of this understanding before sending this report to press. I hope that it is accurate, and I welcome any clarifications.

Table 12. Math in the NALA Assessment Framework (Ireland)

Cornerstones	BEGINNING Managing the basic tools			MID-LEVEL Applying basic tools and concepts			UPPER LEVEL Using the tools in more complex ways		
Knowledge and Skill Base – in the learning area of ‘use basic maths to solve everyday problems’	Uses and understands: <ul style="list-style-type: none"> - single digit numbers and their value, common symbols (+, -, = signs) - value of coins and notes - how time is counted - concepts of height, weight, temperature - how to compare sizes 			Uses and understands: <ul style="list-style-type: none"> - counting strategies (2s, 5s, 10s) - how to add values of coins and calculate change due - time to quarter hour - measuring length, weight, temperature - how to estimate simple addition, subtraction, measure or weight 			Uses and understands: <ul style="list-style-type: none"> - the uses of different number systems, e.g., decimals, fractions, percentages, graphs and charts - timetables and 24-hour clock - relative costs and values - how to calculate amounts needed for different purposes - how to check multiplication and division to ensure answer is about right 		
	has very limited knowledge of tools and concepts	has mastered some but not all of the tools and concepts	has mastered the tools and concepts	has very limited knowledge of tools and concepts	has mastered some but not all of the tools and concepts	has mastered the tools and concepts	has very limited knowledge of tools and concepts	has mastered some but not all of the tools and concepts	has mastered the tools and concepts
	1	2	3	4	5	6	7	8	9
Depth of Understanding and Critical Awareness	<ul style="list-style-type: none"> - draws on personal knowledge and direct experience - expresses own opinions - sets own general goals 			<ul style="list-style-type: none"> - applies own knowledge/experience to understand task - identifies different points of view and gives reasons for own - sets of concrete goals for self 			<ul style="list-style-type: none"> - uses own knowledge and experience to guide actions - evaluates information in terms of its source, bias & relevance - evaluates and monitors own progress 		
	has very limited knowledge of tools and concepts	has mastered some but not all of the tools and concepts	has mastered the tools and concepts	has very limited knowledge of tools and concepts	has mastered some but not all of the tools and concepts	has mastered the tools and concepts	has very limited knowledge of tools and concepts	has mastered some but not all of the tools and concepts	has mastered the tools and concepts
	1	2	3	4	5	6	7	8	9
Fluency and Independence	<ul style="list-style-type: none"> - some difficulty or hesitation in completing tasks and needs extra time - can accomplish task one week but not the next - completes tasks that provide vocabulary and support - uses constant support from tutor or other 			<ul style="list-style-type: none"> - accomplishes tasks with more ease and needs only some extra time to complete - can repeat tasks with some reminders - completes tasks providing some (not complete) guidelines for words and structure - requests less help from tutor 			<ul style="list-style-type: none"> - works fluently with no hesitation and completes task in about the time a tutor would take - can carry out activities done before without problems - works independently with little support - accomplishes with little or no help from tutor 		
	has very limited knowledge of tools and concepts	has mastered some but not all of the tools and concepts	has mastered the tools and concepts	has very limited knowledge of tools and concepts	has mastered some but not all of the tools and concepts	has mastered the tools and concepts	has very limited knowledge of tools and concepts	has mastered some but not all of the tools and concepts	has mastered the tools and concepts
	1	2	3	4	5	6	7	8	9
Range of Application	<ul style="list-style-type: none"> - accomplishes familiar tasks in familiar format and context - accomplishes tasks in familiar settings - applies knowledge and skill within private and secure settings 			<ul style="list-style-type: none"> - works on familiar content in unfamiliar format - accomplishes familiar tasks in less familiar settings - applies knowledge and skills in more public settings but still low-risk 			<ul style="list-style-type: none"> - uses all knowledge and skills to approach an unfamiliar task appropriately - uses knowledge and skills to approach familiar tasks in unfamiliar settings - applies knowledge and skills in situations that carry some risk 		
	has very limited knowledge of tools and concepts	has mastered some but not all of the tools and concepts	has mastered the tools and concepts	has very limited knowledge of tools and concepts	has mastered some but not all of the tools and concepts	has mastered the tools and concepts	has very limited knowledge of tools and concepts	has mastered some but not all of the tools and concepts	has mastered the tools and concepts
	1	2	3	4	5	6	7	8	9

Use

The procedure for assessing a learner's performance is as follows: First, the features of the task determine whether the learner's performance will fall in the first third of the scale (i.e., the beginner level: points 1, 2 and 3), the middle third of the scale (i.e., the mid-level: points 4, 5 and 6) or the final third of the scale (i.e., the upper level: points 7, 8 and 9) for each 'cornerstone'. Then, the appropriate point within the relevant third of the scale is determined by how well the learner performs the task.

The framework "is designed to track learner progress over time in a holistic way"; it should not be used as a "readymade programme of instruction to be taught in a sequential manner"; it can be used "to plan instruction" and "to review progress and see when learners are ready to move on" (Merrifield & McSkeane, 2002). The document that contains the framework gives examples of how it can be used when a practitioner must assess a learner's performance. The document does not elaborate on how assessments made using the framework could be aggregated for a learner, a class, or a program, which would be necessary for the framework to fulfill its other purposes, i.e., to help managers plan their work, to help organisers determine the practitioner supports that are needed.

Principles

Developers identify the following guiding principles for the framework:

Draft Principles for Assessment Framework

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 oneself and others), values and cultural understandings.
7. It should recognise 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. (Merrifield, Coleman & McDonogh, 2001, p. 22)

Comments on Ireland's frameworks

No comments on Ireland's frameworks were found.

Chapter 5

The United States

Five frameworks for adult numeracy education are described in this chapter:

Numeracy in the National Reporting System

Math in the Test of Adult Basic Education (TABE)

Math in the Comprehensive Adult Assessment System (CASAS)

Math in the Test of General Education Development (GED)

Math in Equipped for the Future (EFF)

Thousands of organizations in the United States offer adult literacy and basic skills programs under the Adult Education and Family Literacy Act of 1998 (Sticht, 2001, p. 5). The Act includes math in its definition of literacy:

The term 'literacy' means an individual's ability to read, write, and speak in English, *compute, and solve problems*, at levels of proficiency necessary to function on the job, in the family of the individual, and in society. (italics added) (Workforce Investment Act, Sec. 203 (12))

The accountability requirements of this act are set out in the National Reporting System for Adult Education. This reporting system recognizes only the results of standardized assessments, which leads most programs to use commercially-available standardized tests (e.g., TABE and CASAS) to measure, recognize and report learner progress. However, a different kind of standardized assessment is being developed, that is, the materials produced by the *Equipped for the Future* project. The numeracy frameworks, that underly these systems (either explicitly or implicitly) are presented in this chapter.

Numeracy in the National Reporting System (NRS)

The USA's National Reporting System for Adult Education was developed to meet the accountability requirements for the federally-funded adult education program as set out in the Workforce Investment Act. The most recent version of the primary document in this system, *The National Reporting System for Adult Education: Implementation Guidelines*, was published in 2001. It uses the term "numeracy" where the previous version used "computation" (Division of Adult Education and Literacy, 2001, p. 9). Its purpose is described in the following quotation:

Although the primary purpose of the NRS is to collect data to improve program accountability, DAEL's [Division of Adult Education and Literacy's] staff is exploring how to put the data to additional use to support program improvement. (Hartman & Pugsley, 1999)

The National Reporting System asks for several measures of program activity, one of which is educational gain. This is the part of the system that is relevant to this report. The NRS recognizes educational gain through six levels, from beginning literacy to the equivalent of grade twelve. Table 13 on the following page presents the numeracy elements of the system.

Table 13. Numeracy in the National Reporting System for Adult Education

Level	Educational Functioning Level Descriptors for Numeracy*	Equivalent Scores on Standardized Tests	Grade Level Equivalent
Beginning ABE Literacy	Individual has little or no recognition of numbers or simple counting skills or may have only minimal skills, such as the ability to add or subtract single digit numbers.	TABE** (7-8) math \leq 313 CASAS*** \leq 200 AMES**** math \leq 476 ABLE***** math $<$ 521	0 – 1.9
Beginning Basic Education	Individual can count, add and subtract three digit numbers, can perform multiplication through 12; can identify simple fractions and perform other simple arithmetic operations.	TABE (7-8) math 314 - 441 CASAS 201 - 210 AMES math 477 - 492 ABLE math 530 - 591	2 – 3.9
Low Intermediate Basic Education	Individual can perform with high accuracy all four basic math operations using whole numbers up to three digits; can identify and use all basic mathematical symbols.	TABE (7-8) math 442 - 505 CASAS 210 - 220 AMES math (B) 494 – 603 AMES math (C) 493 - 508 ABLE math 593 - 641	4 – 5.9
High Intermediate Basic Education	Individual can perform all four basic math operations with whole numbers and fractions; can determine correct math operations for solving narrative math problems and can convert fractions to decimals and decimals to fractions; can perform basic operations on fractions.	TABE (7-8) math 506 - 565 CASAS 221 - 235 AMES math (C) 510 - 627 AMES math (D) 509 - 532 ABLE math 643 - 693	6 – 8.9
Low Adult Secondary Education	Individual can perform all basic math functions with whole numbers, decimals and fractions; can interpret and solve simple algebraic equations, tables and graphs and can develop own tables and graphs; can use math in business transactions.	TABE (7-8) math 566 - 594 CASAS 236 - 245 AMES math (E) 534 - 548 ABLE math 694 - 716	9 – 10.9
High Adult Secondary Education	Individual can make mathematical estimates of time and space and can apply principles of geometry to measure angles, lines and surfaces; can also apply trigonometric functions	TABE (7-8) math \geq 595 CASAS \geq 246 AMES math (E) \geq 551 ABLE math \geq 717	11 – 12.9

*At each level, the skills of a learner *entering* that level are described (Division of Adult Education and Literacy, 2001, pp. 14-18).

**Test of Adult Basic Education

*** Comprehensive Adult Student Assessment System

****Adult Measures of Essential Skills

***** Adult Basic Learning Examination

Structure and Content

The ‘educational functioning level descriptors’ in this framework give a general impression of learner abilities, but are not precise or comprehensive descriptions of learner skill and knowledge. This framework perhaps depends more on shared understanding among practitioners of standardized test results and school grades, than on its ‘educational functioning level descriptors’. The *Equipped for the Future* project, described later in this chapter, aims to elaborate on these descriptors.

This is the only framework in this report whose descriptors are of a learner’s knowledge and skills upon *entering* a level. It is more common to describe the knowledge and skills a learner will possess upon completing a level.

Use

Upon entering a program, a learner is given a pre-test which identifies his or her level. A learner’s lowest ‘educational functioning level’ in a relevant area is used to place him or her in an NRS level initially (Division of Adult Education and Literacy, 2001, p. 19). Then a learner is re-tested at least once within the next year (Division of Adult Education and Literacy, 2001, p. 40), and movement from level to level is reported to administrators. The NRS requires that an assessment system that is standard within each state be used for this testing. Programs are not required to use the standardized tests that appear in the NRS framework; rather, what is required is expressed like this:

[...] all programs must use a standardized assessment procedure approved by the state when determining students’ educational functioning levels. The assessment procedure may be a standardized test, or a performance-based assessment with a standardized scoring rubric. If performance-based assessment is used, the scoring rubrics should be based on objective, observable criteria and program staff should be trained in scoring to ensure that the measures are valid and reliable across programs and students (Division of Adult Education and Literacy, 2001, p. 40).

Still, most programs use commercially published standardized tests (Bingman, 2000, p. 6) because they feel the tests are reliable, cost-effective, feasible, and valid. Looking at two tests that are widely used, the Test of Adult Basic Education (TABE) and the Comprehensive Adult Student Assessment System (CASAS), is useful to understand what sometimes effectively becomes the numeracy curriculum that the United States’ National Reporting System leads adult educators to follow, and these two tests will be described later in this chapter.

Using the results of the testing described above, administrators aggregate data for their programs, which they report to state officials who then aggregate the data for their state and report it to the federal Division of Adult Education and Literacy. These numbers, and others, are used by state officials to make decisions about funding local programs (Keenan, 2001, n.p.). The numbers are used at the federal level to meet the accountability requirements of the Workforce Investment Act, to determine the awarding of “incentive grants” (Division of Adult Education and

Literacy, 2001, p. 34) and to present a case to Congress when requesting increased funding for adult education programs (Keenan, 2001, n.p.).

Development and Implementation

In 1996, in an environment of calls for increased government accountability, the federal government was considering integrating the division of adult education and literacy into a larger system of workforce preparation. State directors felt that the division was stronger as a separate entity, so they developed a framework for program accountability – the beginning of the National Reporting System for Adult Education – to collect data to demonstrate the strength of the system. When it began in 1997, it was voluntary – the value of showing what the system was doing was thought to be incentive enough for programs and states to do the work of collecting the data. It became required, though, in 1998, when the Workforce Investment Act became law, establishing accountability requirements that the NRS was then expanded to meet (Department of Adult Education and Literacy, 2001, p. 1).

A revised document was pilot tested in 1999 in eight programs across the country. Responses were collected regarding the definitions of what was to be measured, the proposed methods of data collection, and the resources required to do this (Condelli et al, 1999, p. 5). This research was carried out by eight staff members of the Pelavin Research Centre of the American Institutes for Research in Washington, DC, advised by a thirteen-member board representing state adult education departments and local literacy organizations from ten states (Department of Adult Education and Literacy, 2001, p. A1). Input was also sought from federal education officials and experts in performance accountability systems (DAEL, 2001, p. 6), and several documents were consulted, including the National Reporting System in Australia, the Comprehensive Adult Student Assessment System, assessment tools in the workforce, and academic literature (Department of Adult Education and Literacy, 2001, pp. 11-12). This resulted in the most recent version of the system, published in March of 2001.

In-person training sessions were provided for state-level staff, the system's primary users. The system's secondary users (local-level administrators, professional development coordinators, instructors) were given selected professional development. Training is now available on the internet (oei-tech.com/nrs, retrieved May 6, 2003). As well, the most recent implementation guideline is available on the internet.

The Test of Adult Basic Education (TABE)

This standardized test is recognized by the NRS and is widely used. It is published by CTB/McGraw-Hill, a company that develops and sells standardized achievement tests for children and adults (www.ctb.com, accessed May 5, 2003). The most recent version of the TABE is gradually becoming available in 2003. This report is based on the previous version, published in 2000. The TABE consists of five sub-tests (reading, mathematics computation, applied mathematics, language and spelling) and requires approximately 3.5 hours to complete. Each math sub-test consists of between 40 and 50 multiple choice questions, which test-takers are allowed approximately 40 minutes to complete (Cumming & Gal, 2000, p. 318).

The content of the TABE is approximately what is in Table 14 below (ABE Florida, 2003).

Table 14. Math in the TABE

TABE Level	Grade Range	Math Content (adapted from the TABE User's Manual by ABE Florida)	
		Mathematics Computation	Applied Mathematics
Literacy	0-1.9	none	none
Easy	1.6-3.9	addition, subtraction, multiplication and division of whole numbers	<ul style="list-style-type: none"> - numeration - number theory - data interpretation - pre-algebra and algebra - measurement - geometry - computation in context - estimation
Medium	3.6-6.9	contents of previous level, plus decimals and fractions	
Difficult	6.6-8.9	contents of previous level, plus integers and percents	
Advanced	8.6-12.9	contents of previous level, plus algebraic operations	

In this framework, operations on whole numbers are considered easier than operations on fractions and decimals, which are themselves considered easier than manipulating percents and integers.

Use

The TABE is widely used to pre- and post-test students, and to predict performance on the Tests of General Educational Development (GED) (described later in this chapter). Test results are given as grade-level equivalents, grouped into five TABE levels (the 2003 version will have six levels).

Many American adult numeracy workbooks have been published, based on this framework.

Comprehensive Adult Student Assessment System (CASAS)

The Comprehensive Adult Student Assessment System (CASAS) is another widely-used standardized assessment. It is commercially produced and sold to institutions. Instructors can use CASAS assessment instruments (more than 100 available) to place learners, diagnose their learning needs, monitor progress, and “certify mastery of basic functional skills” (www.casas.org). It fulfills the requirements of the National Reporting System, and connects with Equipped for the Future (described later in this chapter).

A consortium representing twenty states develops ‘competencies’ and updates them annually. The following quotation explains what is meant by ‘competency’, and how the competencies are developed:

[The competencies] identify more than 300 essential skills that youth and adults need to be successful members of families, the communities, and the workforce. Since 1980 these critical competencies for youth and adult learners have been developed and validated at state and national levels, based on field research and recommendations from education providers, learners, business and industry representatives, and community-based agencies. (Retrieved May 6, 2003, from http://www.casas.org/01AboutCasas/01Competencies_p1.cfm?wtarget=body&selected_id=610)

CASAS’s 300 competencies are grouped into nine categories, and Table 15 represents the three categories that relate most closely to numeracy: consumer economics, community resources, and computation⁶.

⁶ Presenting here only these three categories is practical, but risks misrepresenting the competencies. The reader should be aware that several competencies in other categories have mathematical elements, e.g., in the category of employment, one finds the competency, “identify or demonstrate effective management of material resources, including acquisition, storage and distribution” (competency 4.7.2).

Table 15. Sample Competencies in CASAS (table continues on next page)

CONSUMER ECONOMICS

- 1.1 Use weights, measures, measurement scales, and money**
 - 1.1.1 Interpret recipes
 - 1.1.2 Use the metric system
 - 1.1.3 Interpret maps and graphs
 - 1.1.4 Select, compute, or interpret appropriate standard measurement for length, width, perimeter, area, volume, height, or weight
 - 1.1.5 Interpret temperatures
 - 1.1.6 Count, convert, and use coins and currency, and recognize symbols such as (\$) and (.)
 - 1.1.7 Identify product containers and interpret weight and volume
 - 1.1.8 Compute averages
 - 1.1.9 Interpret clothing and pattern sizes and use height and weight tables
- 1.2 Apply principles of comparison shopping in the selection of goods and services**
 - 1.2.1 Interpret advertisements, labels, charts, and price tags in selecting goods and services
 - 1.2.2 Compare price or quality to determine the best buys for goods and services
 - 1.2.3 Compute discounts
 - 1.2.4 Compute unit pricing
 - 1.2.5 Interpret letters, articles, and information about consumer-related topics
- 1.3 Understand methods and procedures used to purchase goods and services**
 - 1.3.1 Compare different methods used to purchase goods and services
 - 1.3.2 Interpret credit applications and recognize how to use and maintain credit
 - 1.3.3 Identify or use various methods to purchase goods and services, and make returns and exchanges
 - 1.3.4 Use catalogs, order forms, and related information to purchase goods and services
 - 1.3.5 Use coupons to purchase goods and services
 - 1.3.6 Use coin-operated machines
 - 1.3.7 Interpret information or directions to locate merchandise
 - 1.3.8 Identify common food items
 - 1.3.9 Identify common articles of clothing
- 1.4 Understand methods and procedures to obtain housing and related services**
 - 1.4.1 Identify different kinds of housing, areas of the home, and common household items
 - 1.4.2 Select appropriate housing by interpreting classified ads, signs, and other information
 - 1.4.3 Interpret lease and rental agreements
 - 1.4.4 Interpret information to obtain, maintain, or cancel housing utilities
 - 1.4.5 Interpret information about tenant and landlord rights
 - 1.4.6 Interpret information about housing loans and home-related insurance
 - 1.4.7 Interpret information about home maintenance, and communicate housing problems to a landlord
 - 1.4.8 Recognize home theft and fire prevention measures
- 1.5 Apply principles of budgeting in the management of money**
 - 1.5.1 Interpret information about personal and family budgets
 - 1.5.2 Plan for major purchases
 - 1.5.3 Interpret bills
- 1.6 Understand consumer protection measures**
 - 1.6.1 Interpret food packaging labels

- 1.6.2 Identify consumer protection resources available when confronted with fraudulent practices
- 1.6.3 Identify procedures the consumer can follow if merchandise or service is unsatisfactory
- 1.6.4 Check sales receipts
- 1.7 Understand procedures for the care, maintenance, and use of personal possessions**
 - 1.7.1 Interpret product guarantees and warranties
 - 1.7.2 Interpret clothing care labels
 - 1.7.3 Interpret operating instructions, directions, or labels for consumer products
 - 1.7.4 Interpret maintenance procedures for household appliances and personal possessions
 - 1.7.5 Interpret information to obtain repairs
- 1.8 Use banking and financial services in the community**
 - 1.8.1 Demonstrate the use of savings and checking accounts, including using an ATM
 - 1.8.2 Interpret the procedures and forms associated with banking services, including writing checks
 - 1.8.3 Interpret interest or interest-earning savings plans
 - 1.8.4 Interpret information about the types of loans available through lending institutions
 - 1.8.5 Interpret information on financial agencies and financial planning
- 1.9 Understand methods and procedures for the purchase and maintenance of an automobile and interpret driving regulations**
 - 1.9.1 Understand methods and procedures for the purchase and maintenance of an automobile and interpret driving regulations
 - 1.9.2 Interpret highway and traffic signs
 - 1.9.3 Identify driving regulations and procedures to obtain a driver's license
 - 1.9.4 Compute mileage and gasoline consumption
 - 1.9.5 Interpret maps related to driving
 - 1.9.6 Interpret information related to the selection and purchase of a car
 - 1.9.7 Interpret information related to automobile maintenance
 - 1.9.8 Recognize what to do in case of automobile emergencies
 - 1.9.9 Interpret information about automobile insurance

COMMUNITY RESOURCES

- 2.1 Use the telephone and telephone book**
 - 2.1.1 Use the telephone directory and related publications to locate information
 - 2.1.2 Identify emergency numbers and place emergency calls
 - 2.1.3 Interpret information about time zones
 - 2.1.4 Interpret telephone billings
 - 2.1.5 Interpret telegram rates and procedures
 - 2.1.6 Interpret information about using a pay telephone
 - 2.1.7 Take and interpret telephone messages, leave messages on answering machines, and interpret recorded messages
 - 2.1.8 Use the telephone to make and receive routine personal and business calls
- 2.2 Understand how to locate and use different types of transportation and interpret related travel information**
 - 2.2.1 Ask for, give, follow, or clarify directions
 - 2.2.2 Recognize and use signs related to transportation
 - 2.2.3 Identify or use different types of transportation in the community, and interpret traffic information
 - 2.2.4 Interpret transportation schedules and fares

- 2.2.5 Use maps relating to travel needs
- 2.3 Understand concepts of time and weather**
- 2.3.1 Interpret clock time
- 2.3.2 Identify the months of the year and the days of the week
- 2.3.3 Interpret information about weather conditions
- 2.4 Use postal services**
- 2.4.1 Address letters and envelopes
- 2.4.2 Interpret postal rates and types of mailing services
- 2.4.3 Interpret postal service forms and instructions on returned mail
- 2.4.4 Purchase stamps and other postal items and services
- 2.4.5 Interpret procedures for tracing a lost letter or parcel
- 2.4.6 Interpret a postal money order form

COMPUTATION

- 6.0 Demonstrate pre-computation skills**
- 6.0.1 Identify and classify numeric symbols
- 6.0.2 Count and associate numbers with quantities, including recognizing correct number sequencing
- 6.0.3 Identify information needed to solve a given problem
- 6.0.4 Determine appropriate operation to apply to a given problem
- 6.0.5 Demonstrate use of a calculator
- 6.1 Compute using whole numbers**
- 6.1.1 Add whole numbers
- 6.1.2 Subtract whole numbers
- 6.1.3 Multiply whole numbers
- 6.1.4 Divide whole numbers
- 6.1.5 Perform multiple operations using whole numbers
- 6.2 Compute using decimal fractions**
- 6.2.1 Add decimal fractions
- 6.2.2 Subtract decimal fractions
- 6.2.3 Multiply decimal fractions
- 6.2.4 Divide decimal fractions
- 6.2.5 Perform multiple operations using decimal fractions
- 6.2.6 Convert decimal fractions to common fractions or percents
- 6.3 Compute using fractions**
- 6.3.1 Add common or mixed fractions
- 6.3.2 Subtract common or mixed fractions
- 6.3.3 Multiply common or mixed fractions
- 6.3.4 Divide common or mixed fractions
- 6.3.5 Perform multiple operations using common or mixed fractions

- 6.3.6 Convert common or mixed fractions to decimal fractions or percents
- 6.3.7 Identify or calculate equivalent fractions
- 6.4 Compute with percents, rate, ratio, and proportion**
- 6.4.1 Apply a percent to determine amount of discount
- 6.4.2 Apply a percent in a context not involving money
- 6.4.3 Calculate percents
- 6.4.4 Convert percents to common, mixed, or decimal fractions
- 6.4.5 Use rate to compute increase or decrease
- 6.4.6 Compute using ratio or proportion
- 6.5 Use expressions, equations, and formulas**
- 6.5.1 Recognize and evaluate simple consumer formulas
- 6.5.2 Recognize and apply simple geometric formulas
- 6.5.3 Recognize and apply simple algebraic formulas
- 6.5.4 Recognize and evaluate logical statements
- 6.6 Demonstrate measurement skills**
- 6.6.1 Convert units of U.S. standard measurement and metric system
- 6.6.2 Recognize, use, and measure linear dimensions, geometric shapes, or angles
- 6.6.3 Measure area and volume of geometric shapes
- 6.6.4 Use or interpret measurement instruments, such as rulers, scales, gauges, and dials
- 6.6.5 Interpret diagrams, illustrations, and scale drawings
- 6.6.6 Calculate with units of time
- 6.6.7 Solve measurement problems in stipulated situations
- 6.6.8 Interpret mechanical concepts or spatial relationships
- 6.6.9 Use or interpret switches and controls
- 6.7 Interpret data from graphs and compute averages**
- 6.7.1 Interpret data given in a line graph
- 6.7.2 Interpret data given in a bar graph
- 6.7.3 Interpret data given in a picture graph
- 6.7.4 Interpret data given in a circle graph
- 6.7.5 Compute averages, medians, or modes
- 6.8 Use statistics and probability**
- 6.8.1 Interpret statistical information used in news reports and articles
- 6.8.2 Interpret statements of probability
- 6.9 Use estimation and mental arithmetic**
- 6.9.1 Use computation short cuts
- 6.9.2 Estimate answers

The following quotation describes how the competencies are used to make tests:

In the Comprehensive Adult Student Assessment System (CASAS) hundreds of [...] competencies judged to be important to be mastered by adult basic education learners have been identified. For each of the hundreds of competencies, a number of test items have been developed to assess mastery of the competencies at different levels of difficulty. These thousands of test items have been formed into a number of standardized tests to determine if adult learners can perform the competencies at different levels of ability. (Sticht, 1999, p. 65)

Writing a CASAS test yields a score that places a learner in one of six CASAS levels. These levels range from beginning literacy to high school competencies, and correspond to the six levels of the national reporting system (CASAS, 2003). They are presented in Table 16 below (the basic math elements of these descriptors are underlined; the full text of each descriptor is also presented because numeracy is implicit in some other parts of each descriptor):

Table 16. CASAS Level Descriptors

Descriptors	CASAS Score
<p>Beginning Literacy/Pre-Beginning</p> <p>Very limited ability to read or write. Persons at the upper end of this score range <u>can read and write numbers</u> and letters and simple words and phrases related to immediate needs. Can provide very basic personal identification in written form such as on job applications. Can handle routine entry level jobs that require only basic written communication.</p>	200 and below
<p>Beginning Basic Skills</p> <p>Can fill out simple forms requiring basic personal information, write a simple list or telephone message, <u>calculate a single simple operation when numbers are given, and make simple change</u>. Can read and interpret simple sentences on familiar topics. <u>Can read and interpret simple directions, signs, maps, and simple menus</u>. Can handle entry level jobs that involve some simple written communication.</p>	201 – 210
<p>Intermediate Basic Skills</p> <p>Can handle basic reading, writing, and <u>computational tasks related to life roles</u>. Can read and interpret simplified and some authentic materials on familiar topics. <u>Can interpret simple charts, graphs, and labels; interpret a basic payroll stub; follow basic written instructions and diagrams. Can complete a simple order form and do calculations</u>; fill out basic medical information forms and basic job applications; follow basic oral and written instructions and diagrams. Can handle jobs and/or job training that involve following basic oral or written instructions and diagrams if they can be clarified orally.</p>	211 – 220
<p>Advanced Basic Skills</p> <p><u>Can handle most routine reading, writing, and computational tasks related to their life roles. Can interpret routine charts, graphs, and labels; read and interpret a simple handbook for employees; interpret a payroll stub; complete an order form and do calculations; compute tips; reconcile a bank statement</u>; fill out medical information forms and job applications. Can follow multi-step diagrams and written instructions; <u>maintain a family budget</u>; and write a simple accident or incident report. Can handle jobs and job training situations that involve following oral and simple written instructions and diagrams. Persons at the upper end of this score range are able to <u>begin GED preparation</u>.</p>	221 – 235
<p>Adult Secondary</p> <p>Can read and follow multi-step directions; read and interpret common legal forms and manuals; <u>use math in business, such as calculating discounts; create and use tables and graphs</u>; communicate personal opinion in written form; write an accident or incident report. <u>Can integrate information from multiple texts, charts, and graphs as well as evaluate and organize information</u>. Can perform tasks that involve oral and written instructions in both familiar and unfamiliar situations.</p>	236 – 245
<p>Advanced Adult Secondary</p> <p>With some assistance, persons at this level are able to <u>interpret technical information</u>, more complex manuals, and material safety data sheets (MSDS). Can comprehend some college textbooks and apprenticeship manuals.</p>	246 and above

CASAS reluctantly provides a crosswalk from their scores to grade levels. They say that these references to grade levels should be used only for administrative purposes when someone is required by a state or federal law to report a grade level. They warn that grade levels should not be used in any high stakes situations, such as hiring, firing, or promotion, and should not be shared with students. “Reporting adult assessments as grade level equivalents is inappropriate on two counts. First, it relates the adults’ performance to that of other individuals, rather than to a defined set of skills. Second, it compares adults’ performance to that of *children*, when skill expectations for the two groups – one with over 16 years of life experience, the other with less than 16 – are quite different” (CASAS, 1998, p.2).

Tests of General Educational Development (GED)

The GED consists of five tests and an essay that one may complete to show that one has acquired the major academic outcomes that are normally acquired by completing high school in the United States. Many students in the adult basic education system are working toward this credential.

Each of the tests is on a high school subject, one of them being math. This test has been normed on high school graduating seniors in the spring of their graduating year. The test items are created by high school teachers and adult educators. A detailed math framework underlying this test was not found, but one may get a sense of the underlying concept or framework of math from the following information that was available.

The math test involves Measurement, Algebra, Geometry, Number Relations and Data Analysis. Learners are given 1.5 hours to complete 50 questions. One quarter of the questions (12.5 questions?) ask the learner to choose the correct way to solve a problem, but do not require them to calculate an answer. One part of the test permits the use of a calculator, and the other does not; they are equally weighted. (Centre for Adult Learning Educational Credentials, 2003a)

New Reader's Press, the publishing arm of ProLiteracy, publishes a *Comprehensive Math Review* text as part of its *Math Sense* series of texts (name changed from *Smart Solutions* in 2002). This text is aimed at students who are preparing for the GED. "With Math Sense we guarantee your students will [...] receive the tools, strategies and confidence needed to pass both parts of the GED math test". Therefore its contents convey an idea of the framework underlying the math curriculum in GED-preparation classes. The text's table of contents is presented in Table 17 below:

Table 17. Table of Contents of New Reader's Press's 'Comprehensive Math Review' Text

Unit 1: Whole Number Review

When Do I Use Whole Numbers? • Addition • Subtraction • Multiplication • Division • Division by Two or More Digits • Mental Math and Estimation (Tools) • The Five-Step Plan (Problem Solver) • Using Your Calculator (Tools) • Gridding in Answers (Tools) • Unit 1 Review • Unit 1 Practice Test

Unit 2: Decimals and Money

When Do I Use Decimals? • Understanding Decimals • Writing Decimals • Decimals and Money (Application) • Comparing Decimals • Adding Decimals • Subtracting Decimals • Solving Multistep Problems (Problem Solver) • Mixed Review • Calculators and Decimals (Tools) • Multiplying Decimals • Dividing Decimals • Choosing a Method (Problem Solver) • Figuring Unit Price and Total Cost (Application) • Gridding in Decimal Answers (Tools) • Unit 2 Review • Unit 2 Practice Test

Unit 3: Fractions, Ratios, and Percents

When Do I Use Fractions, Ratios, and Percents? • Relating Decimals and Fractions • Different Forms of Fractions • Equivalent Fractions • English and Metric Rulers (Tools) • Adding and Subtracting Like Fractions • Finding Common Denominators • Adding and Subtracting Unlike Fractions • Working with Distances (Application) • Multiplying Fractions • Dividing Fractions • Dividing Fractions with Mixed Numbers • Mixed Review • Relating Fractions and Ratios • Writing Ratios • Writing Proportions • Solving Problems with Proportions • Understanding Percents • Decimals, Fractions, and Percents • The Percent Equation • Solving Percent Equations • Discounts (Application) • Two-Step Percent Problems (Problem Solver) • Calculators and Fractions (Tools) • Gridding in Fraction Answers (Tools) • Unit 3 Review • Unit 3 Practice Test

Unit 4: Data and Measurement

When Do I Measure and Use Data? • English Units of Length • Working with Length • Measuring Capacity • Using Rulers, Cups, and Spoons (Tools) • Measuring Weight • Using Metric Units • Measuring Temperature • Reading Scales and Meters (Tools) • Figuring Distance, Rate, and Time (Application) • Mixed Review • Tables and Charts • Computer Spreadsheets (Tools) • Bar Graphs • Line Graphs • Circle Graphs • Scatter Diagrams • Using More than One Data Source (Problem Solver) • Simple and Compound Probability • Seeing Trends, Making Predictions (Problem Solver) • Mean, Median, and Mode (Application) • Calculators and Measurement (Tools) • Gridding in Answers (Tools) • Unit 4 Review • Unit 4 Practice Test

Unit 5: Algebra and Geometry

When Do I Use Algebra and Geometry? • Writing Expressions • The Number Line (Tools) • Powers and Roots • Writing Equations • Order of Operations • The Distributive Property • Addition and Subtraction Equations • Multiplication and Division Equations • Working with Formulas (Application) • Substituting to Solve Equations (Problem Solver) • Writing and Solving Inequalities • Translating Words to Equations (Problem Solver) • Calculators and Algebra (Tools) • Mixed Review • Points, Lines, and Angles • Protractors (Tools) • Types of Angles • Circles • Quadrilaterals • Triangles • Similar Geometric Figures • Finding Patterns in Algebra and Geometry (Problem Solver) • The Pythagorean Theorem • Reading Maps (Application) • Perimeter and Circumference • Area • Volume • Choosing Area, Perimeter, or Volume (Problem Solver) • The Coordinate System • Slope and Intercept • Gridding in Algebra and Geometry Answers (Tools) • Unit 5 Review • Unit 5 Practice Test

(Retrieved October 10, 2003, from

<http://www.mathsense.newreaderspress.com/comprehensive-toc.asp>

Equipped for the Future

Equipped for the Future (EFF) is a multi-year, standards-based national reform initiative funded by the federal government and aimed at “improving the quality of the adult literacy system and building the capacity of that system to more effectively assist adults in accomplishing their goals in life” (<http://www.nifl.gov/lincs/collections/eff/eff.html>).

The National Institute for Literacy is carrying out the project, and speaks of its overall purpose this way:

The National Institute for Literacy (NIFL) undertook this effort in order to better understand what we need to do, as a nation, to meet the challenge posted in the National Education Goal for Adult Literacy and Lifelong Learning:

‘Every American adult will be literate and possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship.’

By elaborating a new content framework that specifies the knowledge and skills required to fulfill these adult responsibilities, the NIFL’s Equipped for the Future initiative makes it possible for the national goal to serve as a guide to practice, as well as policy, for meeting adult learners’ needs and informing system accountability. (Stein, 2001)

I will present here two main parts of the EFF system: the content standards and the assessment framework.

EFF content standards

The EFF project has developed sixteen statements, called ‘content standards’, to describe what adults need to be able to do to fulfill their roles as family members, community members and workers. Five of the content standards relate to communication skills, four to decision-making skills, four to interpersonal skills, and four to lifelong learning skills. Numeracy is present in one of the standards under ‘decision-making’. This standard is presented in Table 18 below:

Table 18. *Math Content Standard in Equipped for the Future*

Use Math to Solve Problems and Communicate

In order to fulfill responsibilities as parents/family members, citizens/community members and workers, adults must be able to:

- Understand, interpret, and work with pictures, numbers, and symbolic information.
- Apply knowledge of mathematical concepts and procedures to figure out how to answer a question, solve a problem, make a prediction, or carry out a task that has a mathematical dimension.
- Define and select data to be used in solving the problem.
- Determine the degree of precision required by the situation.
- Solve problem using appropriate quantitative procedures and verify that the results are reasonable.
- Communicate results using a variety of mathematical representations, including graphs, chart, tables, and algebraic models.

This standard describes ‘what’ an adult needs to be able to do, and EFF is, as of this writing, developing an assessment framework to describe ‘how well’ an adult will be able to do it – that is, to give levels to it and to describe how to use the levels.

EFF Assessment Framework

The EFF assessment framework will not be published in time to be included in this report. However, quite a bit of introductory information about it is available, including its purpose, its guiding principles, general descriptions of its components, and preliminary information about its levels and categories of assessment criteria.

The assessment framework is intended:

- To provide information on learner achievements and mastery that is useful to the learner as well as the teacher throughout the instructional process.
- To provide information about what learners can do that is credible to employers, educational institutions, and policymakers, as well as to the learners themselves.
- To provide information that is useful for program and system improvement and accountability. (Stein, 2001, p. 62)

The EFF consortium has published its guiding principles for developing the assessment framework. They are in Table 19 below:

Table 19. Guiding Principles for EFF Assessment Framework

1. The EFF Assessment Framework must address multiple purposes for assessment.

The Framework must provide for

- information on learner achievements and mastery that is useful to the learner as well as the teacher throughout the instructional process;
- information about what learners can do that is credible to employers, educational institutions, and policymakers, as well as to learners themselves; and
- information that is useful for program and system improvement and accountability.

2. To address these multiple purposes, the EFF Assessment Framework must support a multidimensional, flexible, and systemic approach to assessment.

Teachers and programs will be able to choose from a range of tools, to be identified or developed, that enable them to accurately measure performance against EFF Standards and that are linked to one another so that multiple assessments can provide a rich portrait of learner competence.

3. The EFF Assessment Framework must address learning over a lifetime.

Strategies for assessment and credentialing must take into account the fact that adults build skills over time (rather than all at once) in response to changes in their life situations. Certificates and other credentials must be modular, designed to define competence or mastery at a particular point, and within a framework that assumes continuing development of competence as skills, knowledge, and understanding are further developed over time.

4. Since EFF Standards define skills all adults need in order to carry out their roles as workers and as members of families and communities, the EFF Assessment Framework must address a single continuum of performance for all adults—adults with only minimal formal education and those with many

years of formal education, including advanced degrees.

5. Each level defined in the EFF Assessment Framework must communicate clearly what an adult at that level can do.

Numerical levels don't communicate meaning to external audiences. Grade levels seem to communicate a common picture of performance; but, in fact, the meaning behind the label varies widely from community to community and state to state. Grade levels are particularly misleading when applied to adult performance, since they focus on developmental skill levels that don't match the ways in which adults, with their broader background and range of experience, can combine skills and knowledge to perform effectively in daily life.

6. The levels defined in the EFF Assessment Framework must be explicitly linked to key external measures of competence

(e.g., certificates of mastery, NAAL/IAL survey levels, diplomas, and other credentials) and key pathways (e.g., entry to higher education and entry to employment as defined by occupational skill standards) so that adults and systems can rely on them as accurate predictors of real-world performance.

7. The levels defined in the EFF Assessment Framework must be the product of a national consensus-building process that assures portability of certificates and credentials.

8. Work on the development of this framework must maintain the strong customer focus that has distinguished the EFF Standards development process to date. It must be based on a broad, inclusive definition of maximizing accountability for all activities to all customers, starting with the adult learner.

(EFF Consortium, 2002, p. 4)

The assessment framework will include, for each content standard, a performance continuum, model performance-based assessments and scoring guidelines. Materials, training and technical assistance to support the implementation of these products will also be included (EFF Assessment Consortium, 2002, p. 2). Each performance continuum will be divided into ten levels, from novice (0) to expert (100). The first six levels (0-60) will be the domain of adult basic education programs. At each level, EFF's performance continuum will describe the following features of a person's performance: (1) structure of knowledge base, (2) fluency of performance, (3) independence of performance, and (4) range of conditions for performance (EFF Consortium, 2002, p. 8). These are called 'dimensions', and they will apply to every standard, whether it is *Read for*

Understanding, or Resolve Conflict and Negotiate, or Use Math to Solve Problems and Communicate.

The six levels of EFF will correspond to the six levels of the National Reporting System. EFF staff are developing the assessment framework jointly with personnel from the National Reporting System, in order to “enable programs using Equipped for the Future as a framework for instruction to report student progress from level to level on the National Reporting System” (EFF Assessment Consortium, 2002, p. 1). A letter written jointly by the Executive Director of the National Institute for Literacy (the institute responsible for EFF) and the Director of the Division of Adult Education and Literacy of the US Department of Education (the division responsible for the NRS) confirms this:

We agreed we should work to make NRS performance levels required by the Workforce Investment Act and EFF mastery of essential content knowledge compatible. In this way evidence collected to document student mastery of EFF standards can also be used to respond to NRS reporting requirements where the EFF standards meet the statutory requirements of the Act. We don't want programs to have to make multiple kinds of measurements. (Hartman & Pugsley, 1999)

Development Process

The development of EFF has been (and continues to be) a multi-year process – initially expected to go from 1994 to 2001, it has now been extended to 2004 (EFF Assessment Consortium, 2002, p. 34). Readers who are interested in its process are referred to the National Institute for Literacy's two detailed reports on the development process: *Equipped for the Future Research Report: Building the Framework* (EFF Assessment Consortium, 2002); and *EFF/NRS Data Collection Project, 2000-2001: An interim report of the development of the EFF assessment framework* (Merrifield, 2000). It has involved a wide range of stakeholders – the widest of any framework described in this report, and many documents were consulted, including educational frameworks and standards for K-12 schooling, research on families, research into workplace essential skills, and industry standards (Stein, 2001, p. 14). When the consortium began its work to define the continua of performance, they looked at the frameworks behind large-scale literacy surveys, as well as the qualifications frameworks developed by Australia, England, Scotland, South Africa, and New Zealand (Stein, 2001, p. 58). Theoretical foundations came in large part from Bransford et al (1999) *How People Learn: Brain, Mind, Experience and School*.

The processes followed in developing the standards and performance continua were often ones of naturalistic inquiry that involved repeatedly collecting data, analyzing and synthesizing it, and re-presenting it to stakeholders for refinement and validation. (Merrifield, 2001, p. 18). Merrifield writes,

[...] the whole is always being modified by the development of the parts. This is an iterative approach to theory building that has been widely accepted in social science (2000, p. 39)

Use

Teachers are already using the content standards. Several teachers began by first creating learning projects that were appropriate for their students, and then looking to the standards to identify which of the standards were present in the project. This helped to “make sure that the students understood the ways in which this activity was legitimate learning” (Stein, 2000, p. 68). Other teachers reported that “EFF makes skills explicit and gives students a way to talk about them” (p. 69), and that “using the framework to reflect on learning afterward gave students the chance to appreciate and integrate what they have learned” (p. 71). In several cases, using the framework “allowed the students to feel like they are really learning something useful and gives those hours more of an academic feel which the students want” (Stein, 2000, p. 38).

Comments on the United States’ Frameworks

The first comments come from a variety of sources, but they all relate to the standardized tests recognized by the National Reporting System.

Nationally standardized tests, properly administered, can provide information about broad growth in literacy or mathematics skills. But this growth will typically not exceed one or two “years” in 25, 50 or 100 hours. (Sticht, 1999, p. 74)

The effectiveness of adult education programs is evaluated in terms of the percentages of students whose scores increase at least one NRS level from pretest to posttest [...] although many students may make important gains in terms of their own individual learning goals, these gains may not move them from one NRS level to the next, and so they would be recorded as having made no gain. (National Research Council, 2002, pp. 63-64).

[...] there is relatively little increase in the standardized test scores of most adult learners in the relatively brief time that they attend programs. The nationally standardized and normed tests are not sensitive enough to the specifics of what is being taught (Sticht, 1999, p. 66)

The tests are neither broad enough nor sensitive enough to capture the changes that matter to learners or to measure the performance of programs in supporting these changes. (Bingman, 2000, p. 14)

There is a desire for more curriculum-based assessment so that learners’ “true” gains can be detected. (Sticht, 1999, p. 66)

The worst scenario occurs when a test such as the TABE is used as the entry and departure test for a program and hence becomes the driving force for the instructional program. (Cumming & Gal, 2000, p. 320)

The next set of comments comes from an article by Stites in the September 1999 issue of *Focus on Basics*, the quarterly publication of the National Center for the Study of Adult Learning and Literacy at Harvard University. His comments are made in the context of adult basic education, with EFF in mind.

Both critics and advocates characterize the educational standards movement as an “assessment-driven” reform effort. The basic idea here is that since teachers often teach to the test, one way to improve teaching and learning is to create a better test.

A good system of educational standards should support teaching and learning in at least three ways. Content standards should help to clarify long-term learning goals for learning and to situate particular learning objectives on a pathway leading to long-term goals. Performance standards should help to establish milestones on the pathway that both teachers and learners can use to mark progress and plan further learning. Opportunity-to-learn standards should help to develop a better understanding of the time and resources that teachers and learners will need to make reasonable progress toward learning goals.

Opportunity-to-learn standards may be especially critical for a system of education (adult literacy) that is chronically underfunded.

In the ideal model of standards-based educational reform, content, performance, and OTL standards each have clear and distinct roles to play. In practice, however, the line between content and performance standards often becomes blurred and OTL standards have been mostly neglected.

Chapter 6

Australia

Two numeracy frameworks are described in this chapter:

Numeracy in the National Reporting System

The Numeracy and Mathematics stream of the Certificates in General Education for Adults

Australia's National Reporting System explains numeracy like this:

Numeracy is about using mathematics to make sense of the world; to assist in dealing with real situations which arise in workplace, personal and community settings. While it necessarily involves understanding mathematical ideas, notations and techniques, it also involves drawing on knowledge of particular contexts and circumstances in deciding when to use mathematics, choosing the mathematics to use and critically evaluating its use. (Coates et al, 1995, p. 6)

The National Reporting System “provides a point of reference for all accredited adult literacy and English as a second language curriculum” (Hagstrom, 2002, p. 5). One of these accredited curricula is the Certificates in General Education for Adults, “a nationally accredited, competency-based curriculum framework that is probably the most widely used in Australia” (Johnston, 2002, p. 31).

The National Reporting System: A mechanism for reporting outcomes of adult English language, literacy and numeracy programs

The National Reporting System (NRS) is a “mechanism for reporting the outcomes of adult English language, literacy and numeracy provision in the vocational education and training system, in labour market programs and in the adult, community education sector” (Coates et al, 1995, p. 1). It is neither a curriculum nor an assessment system (Coates et al, 1995, p. 2). It is “a means for reporting the outcomes of already existing curricula.” (Coates et al, 1995, p. 17), and is to be mapped onto existing assessments. It replaces “simple tools used in the past for initial and on-going assessment” which were “either limited in their reliability” or had been “extended beyond their intended functions and capabilities” due to “changed social and economic circumstances” (Coates et al, 1995. p. 1).

The primary numeracy elements of the NRS are reproduced in Table 20 on the following page. The table’s backbone is the column of ‘indicators of competence’, describing what learners leaving a level do. The remaining two columns describe contexts and conditions of performance.

Table 20. 'Indicators of Competence,' 'Conditions of Performance' and 'Workplace and Social Contexts' in the Numeracy Framework of the Australian National Reporting System

	Indicators of Competence	Conditions of Performance	Workplace and Social Contexts
Level 1	<p>1.10 Locates simple key mathematical information in a familiar real life activity or text.</p> <p>1.11 Recognises and uses straight forward mathematical actions which relate to immediate contexts.</p> <p>1.12 Uses rough estimation and prior experience to identify purpose and check reasonableness of the process and outcomes of a mathematical activity.</p> <p>1.13 Uses everyday informal oral language and representation including familiar symbols and diagrams to communicate mathematically.</p>	<ul style="list-style-type: none"> Works alongside expert/mentor/teacher where advice/modeling is readily available and recourse to first/other language is acceptable if required. Incorporates communication supports as required. Demonstrates competence in immediate contexts. 	<ul style="list-style-type: none"> Begins shifting from one cultural context to another. Understands English texts which include one explicit agenda. Performs successfully when interaction is with sympathetic participants/interlocutors
Level 2	<p>2.9 Locates relevant mathematical information in a familiar real life activity or text.</p> <p>2.10 Selects and uses straight forward mathematical actions in familiar and predictable contexts.</p> <p>2.11 Uses estimation and prior experience to examine purpose and check reasonableness of the process and outcomes of a mathematical activity.</p> <p>2.12 Uses oral and written informal and formal language and representation including some symbols and diagrams to communicate mathematically.</p>	<ul style="list-style-type: none"> Performs where access to support from expert/mentor is available, advice/modeling is available and recourse to first/other language is acceptable if required. Incorporates communication supports as required. Demonstrates competence in familiar and predictable contexts. 	<ul style="list-style-type: none"> Shifts from one cultural context to another and begins to adapt the skills from one culture to another. Understands texts which include one or more explicit agendas. Enhances performance by interaction with sympathetic participants/interlocutors.
Level 3	<p>3.10 Selects appropriate mathematical information embedded in a real life activity, item or text.</p> <p>3.11 Selects and applies a range of mathematical strategies to solve problems in a number of contexts, which are familiar yet may be interrelated.</p> <p>3.12 Reflects on and questions reasonableness and appropriateness of the purpose, process and outcomes of a mathematical activity.</p> <p>3.13 Uses oral and written informal and formal language and representation including symbols and diagrams to communicate mathematically.</p>	<ul style="list-style-type: none"> Performs where advice/modeling is available if required. Incorporates communication supports as required. Demonstrates competence in a number of contexts which may be interrelated. 	<ul style="list-style-type: none"> Adapts the skills of one cultural context to another. Understands texts which include meanings which are predominantly explicit. Performs without reliance on interaction with sympathetic participants/interlocutors. Uses a narrow range of skills and knowledge for employment related skills, preparatory courses, broad-based training and specific workplace skills.
Level 4	<p>4.10 Selects and investigates appropriate mathematical information and relationships embedded in an activity, item or text.</p> <p>4.11 Selects and applies an expanding range of mathematical strategies flexibly to solve problems in a variety of contexts.</p> <p>4.12 Examines and questions the appropriateness, possible interpretations and implications of aspects of a mathematical activity.</p> <p>4.13 Uses a range of oral and written informal and formal language and representation including symbols, diagrams and charts to communicate mathematically.</p>	<ul style="list-style-type: none"> Performs where support is available only if required. Incorporates communication supports as required. Demonstrates competence within a variety of contexts. 	<ul style="list-style-type: none"> Adapts the skills of one cultural context to multicultural social contexts where people move between differing sets of cultural and linguistic/mathematical knowledge. Understands texts which include meanings which may be hidden or obscured. Maintains performance irrespective of neutral or indifferent participants/interlocutors. Uses a recommended range of functions in known routines and procedures to perform more non-routine employment related and course related activities
Level 5	<p>5.10 Interprets, selects and investigates appropriate mathematical information and relationships highly embedded in an activity, item or text.</p> <p>5.11 Selects and applies a wide range of mathematical strategies flexibly to generate solutions to problems across a broad range of contexts.</p> <p>5.12 Analyses and evaluates the appropriateness, interpretations and wider implications of all aspects of a mathematical activity.</p> <p>5.13 Uses a wide range of oral and written informal and formal language and representation including symbols, diagrams and charts to communicate mathematically.</p>	<ul style="list-style-type: none"> Requires little or no support from teacher, other participants or interlocutors. Incorporates communication supports as required. Demonstrates competence across a broad range of contexts. 	<ul style="list-style-type: none"> Participates in a fully multicultural social context where people move between differing sets of cultural and linguistic/mathematical knowledge, skills and attributes and where differences are used as a positive resource. Understands texts which typically contain multiple and hidden meanings. Maintains performance irrespective of participants/interlocutors who range from neutral to antagonistic. Performs a defined range of skilled operations with discretion and some judgment.

(Coates et al, 1995, n.p.)

At each level there are four ‘indicators of performance’; the first indicators of performance in each level correspond to each other, the second indicators of performance also correspond to each other, and so on. Below, I present the first indicator of competence at each level, to illustrate how the increasing difficulty is described (the words in each indicator have been spaced to isolate the terms to be compared from level to level):

Level 1	Locates	simple key	mathematical information	in	a familiar real life activity or text.
Level 2	Locates	relevant	mathematical information	in	a familiar real life activity or text.
Level 3	Selects	appropriate	mathematical information	embedded in	a real life activity, item or text.
Level 4	Selects and investigates	appropriate	mathematical information and relationships	embedded in	an activity, item or text.
Level 5	Interprets, selects and investigates	appropriate	mathematical information and relationships	highly embedded in	an activity, item or text.

The remaining three indicators for each level describe “doing the mathematics required for carrying out the task,” “reflecting on the effect of the use of mathematics for the task, including interpreting results, judging their reasonableness in the context, and commenting on the appropriateness of the mathematics for the circumstances,” and “using formal and informal language, symbolic notation and the conventions of mathematics needed to carry out and report on a task” (Coates et al, 1995, p. 7).

Use

Use of the NRS is now compulsory in many adult literacy and numeracy programs (McGuirk, 2001, p. 48). Service providers must report ‘numeracy achievements’ to funders. Their different curricula alone would not allow this information to be aggregated, so the NRS acts as the lingua franca for reporting learner achievements to funders. As Coates et al state:

The National Reporting System is designed to allow a nationally consistent means of reporting student outcomes from accredited and non-accredited curriculum (Coates et al, 1995, appears at each level of ‘NRS Components’ section, n.p.).

The NRS is not to lead to curricula, but to be mapped onto existing curricula. Providers of accredited courses negotiate ‘translation agreements’ with the NRS (e.g., Hagstrom, 2002). These agreements describe the elements of the NRS that are addressed by the specific courses offered (Coates et al, 1995, p. 18).

Data gathered through the NRS is used to review provider performance, to plan future courses, and to improve program accountability and program development (McGuirk, 2001, pp. 18-19).

The NRS sets out the following “Assessment Principles”:

- Assessment tasks should be grounded in a relevant context and not be culturally biased.
- Students should be assessed across a wide range of tasks integrated into practice, in order to increase reliability and validity of assessment. One-off assessment tasks do not provide a reliable and valid measure of competence.
- Instructions for assessment tasks should be clear, explicit and ordered. Students must know what is expected, and the criteria by which they will be judged.
- Time allowed to complete a task should be reasonable and specified, and should allow for preparation and redrafting as appropriate to the task.
- Assessment should ideally be moderated by more than one teacher, and/or across providers.
- Appropriate reference materials, should be available to students during assessment, e.g. personal word lists, dictionaries, thesaurus, calculators. (Coates et al, 1995, appears at each level of ‘NRS Components’ section, n.p.).

Development and Implementation

Creating the National Reporting System involved a 23-member advisory committee and a 9-member academic reference group, as well as approximately 14 people who managed or contributed to the project. Also, several people provided consultancy services (Coates et al, 1995, pp. iii-v). The quotation below provides more information about the process:

The NRS has been developed by a team of experienced English as a Second Language (ESL), Numeracy and Adult Literacy and Basic Education (ABLE) practitioners. The research has drawn from a range of sources, including the National Framework of Adult English Language, Literacy and Numeracy Competence (National Framework) theories of language development and task complexity, and an analysis of over 30 curriculum documents. Wider practitioner input has been achieved through Focus Groups workshops and Field Testing processes. (Coates et al, 1995, p. 3)

Developers state that:

It was agreed that the NRS must:

- satisfy a variety of purposes, and the requirements of a range of prospective users;
- reflect and promote good educational practice;
- be fair to participants, valid and reliable; and
- be functional in practice. (Coates et al, 1995, p. 1)

They also mention the theories that they considered in their work:

[...] the NRS has been designed to be inclusive of the range of theories, philosophies and curriculum approaches currently in practice. These include activity theory, genre theory, and Systemic Functional Linguistics, critical linguistics, critical literacy pedagogy and theories of task and text complexity, adult learning, constructivism, critical constructivism, second language acquisition and assessment. (Coates et al, 1995, p. 3)

The Numeracy and Mathematics Stream of the Certificates in General Education (CGEA)

The CGEA was originally created to meet the following needs:

- (1) the need to recognise the learning of adult learners with credentials,
- (2) to provide multiple pathways to further education or training,
- (3) to give teachers a common base for developing their teaching practice and learner progress. (Adult, Community and Further Education Board, 2002, p. 7)

“The CGEA provide a range of educational opportunities for adults wishing to prepare for further study, improve their employment status and enhance their participation in the community. The Certificates allow adults to study for a formal credential which gives them credit for improving their reading, writing, mathematical, oral communication and general education skills” (retrieved May 14, 2003 from <http://www.acfe.vic.gov.au/courses/index.htm>)

The certificates give recognition for achievements up to approximately the equivalent of grade 11 of secondary education (Marr et al, 1998, p. 1).

The CGEA uses both terms, ‘numeracy’ and ‘mathematics’, and divides these up into four purposes for using math, at four levels. At each level, learners study six or seven learning outcomes. The learning outcomes and their organization into levels and purposes, are presented in Table 21 on the following page.

Table 21. Learning Outcomes in the Numeracy and Mathematics Stream of the CGEA

		Introductory Level	Level I	Level II	Level III
Numeracy for Practical Purposes	Design	1 can use everyday informal language of shape, size, colour and other commonly used attributes to identify and recognise shapes in the context of their common usage and application	1 can interpret and use the knowledge and conventions of common shapes and their representation for describing, designing or representing real life objects	1 can translate between 2 dimensional and 3 dimensional real life objects and their diagrammatic representations for the purposes of measurement, design, and interpretation	
	Measuring	2 can use familiar simple quantities of length, mass, capacity and temperature to compare or measure materials or objects in personal situations	2 can use straight forward measurement and the metric system to estimate and measure for the purpose of interpreting, making or purchasing materials in familiar practical situations	2 can use measurements, the metric system and simple measurement formulae for the purpose of interpreting, making or purchasing materials in practical situations	
Numeracy for Personal Organisation	Money and Time	3 can identify and use familiar everyday numbers, and units of money and time to make decisions about money and time in personal situations	3 can use and interpret whole numbers (including large numbers), simple fractions, decimals and percentages to make decisions about money and time in familiar situations		
	Location	4 can use simple everyday language of location to give and follow informal oral directions	4 can interpret and use everyday language and symbols of location and direction to give and follow oral and written directions	3 can use the conventions of distance, location and direction to read, create and use maps	
Numeracy for Interpreting Society	Data	5 can use simple everyday tables and graphs to interpret public information which is of personal interest or use	5 can use and create everyday tables and graphs to represent and interpret public information which is of interest or relevance	4 can use and create graphs and charts, and calculate and use averages, in order to interpret and reflect on information of relevance to self, work, or community	1 can use graphs, charts and measures of central tendency and spread to interpret, analyse and describe information of relevance to self, work and community
	Numerical Information	6 can use simple everyday numbers and figures to interpret information which is in texts of personal relevance or interest	6 can identify and translate everyday numerical concepts to interpret public information which is in texts of interest or relevance	5 can use, and calculate with, fractions, percentages, decimals, rates and large numbers, to reflect on aspects of personal, work or community life	2 can calculate and use rational numbers to analyse and evaluate relevant aspects of personal, work or community life
Numeracy for Knowledge – Further Study in Maths	formulae			6 can develop and use simple formulae to describe and represent relationships between variables in real life contexts	
	formulae and graphs				3 can develop and use formulae and their graphs to describe and represent relationships between variables in a range of contexts
	algebraic				4 can use algebraic techniques to investigate and solve mathematical problems
	Area A				5 can use formal maths techniques relevant to an area of further study to interpret, investigate and solve mathematical problems
	Area B				6 can use formal maths techniques relevant to an area of further study to interpret, investigate and solve mathematical problems
	problem solving			7 can use simple mathematical problem solving techniques to interpret and solve straight forward mathematical problems	7 can use mathematical problem solving techniques to interpret, investigate and solve mathematical problems

The CGEA document includes, for each level: prerequisites for the level, the purpose of the level, a ‘crosswalk’ to other qualifications systems, a summary statement for each learning outcome at that level, a recommended delivery strategy, teaching/learning strategies, resources (including people, equipment and print-based materials), assessment methods, conditions of assessment, and sample assessment tasks (e.g., Adult, Community and Further Education Board, 2002, pp. 241-247).

Also, each of the learning outcomes in the table on the previous page is elaborated on in the curriculum document with: assessment criteria (sorted under three headings of Mathematical knowledge and techniques, language, and interpretation), and educational practices (sub-divided into content range, examples of assessment tasks, and conditions of assessment).

A feature of this framework that does not appear in any other framework is the ‘nominal hours’ – 100 hours for the numeracy and mathematics stream at each level.

Use

The CGEA is the most widely used adult basic education curriculum in Australia (retrieved May 14, 2003 from <http://www.acfe.vic.gov.au/courses/index.htm>).

The numeracy and mathematics stream of the CGEA is used by teachers to plan learning activities, to assess progress and to recognize achievement. Also, Marr et al’s analysis reveals that the framework is: “useful to classroom teachers as an inspiration or focus,” “useful in offering professional development for new teachers,” “useful in improving the relevance of the programs to students,” and “useful in a strategic sense,” “to promote a numeracy agenda” (1988, teacher analysis, p. 6).

Learners work toward a certificate at a particular level. To achieve the certificate, a learner must show that he or she has achieved all but one of the learning outcomes in a level (i.e., five of six outcomes at the lower two levels, and six of seven outcomes at the higher two levels). The learner does this according to guidelines set out in the CGEA, which are:

Assessment should be undertaken as an ongoing process which integrates knowledge and skills with their practical application over a period of time. It will require a combination of evidence collected mainly through teacher observations and some collection of written records of students’ attempts at tasks.

At the Introductory Certificate I level, a folio of evidence could be collected through a combination of the following: records of teacher observations of students’ activities, discussions, and practical tasks; occasional samples of students’ written work; pictures, diagrams, models, etc. created by students.

At Levels I, II and III, a folio of evidence could be collected through a combination of the following: records of teacher observations of students’ activities, oral presentations, practical tasks, etc.; samples of students’ written work; written reports of investigations or problem solving activities; student self assessment sheets, reflections, or journal entries; pictures, diagrams, models created by students. (Adult, Community and Further Education Board, 2002, p. 220).

Moderation is a central feature of assessment. It is carried out by giving practitioners the opportunity to meet to discuss how assessment tasks and learners' performances fit into the curriculum, that is, with which learning outcome(s), at which level(s). It is to occur internally, regionally and statewide. The CGEA document says the following about moderation:

Moderation is a central component of the quality management systems which guarantee the integrity of accredited curricula.

Moderation ensures the consistency and validity of course credentials.

In the CGEA, moderation by teachers of a selection of assessment tasks/activities and student responses helps to ensure consistency in interpretation of learning outcomes and the relevant levels. This is done by coming to a shared understanding of learning outcomes, assessment criteria, and assessment processes and practices. (Adult, Community and Further Education Board, 2002, p. 25)

Development and Implementation

The current version of the CGEA is its third incarnation. The first version was published in 1992. The CGEA has to be reviewed and re-accredited every five years. In the first review and re-accreditation process, in 1997, the numeracy stream was changed significantly; the traditional math strands were the organizing structure in the first version, but in the second version the organizing structure was changed to represent the purposes for using math. The next and most recent review and re-accreditation, in 2002, changed very little. The 2002 version is in use today, and will be in use until the end of 2006.

The most recent re-accreditation was "overseen by a 15-member reference committee" and informed by:

- meetings and consultations which were held with key stakeholders and practitioners in Victoria and interstate
- a review of the Certificates which resulted in a paper, Reaccreditation of the Certificates in General Education for Adults (CGEA) Review and Consultations: Summary Paper
- a bulletin board discussion on the ARIS website (Adult, Community and Further Education Board, 2002, p. 8).

Several theories, philosophies and principles guided the CGEA's development. Particularly relevant to numeracy is the guiding philosophy of critical numeracy and principles of lifelong learning (Adult, Community and Further Education Board, 2002, p. 7). As well, underpinning the CGEA is the concept that skills development occurs best when it is achieved within social contexts and for social purposes. This is translated, in the following way, into the four purposes for using math (Table 22):

Table 22. *Contexts and Purposes for Using Numeracy*

Social context	Corresponding numeracy domain
Personal, family and social life	Numeracy for Personal Organisation focuses on the numeracy requirements for the personal organisational matters involving money, time and travel. (parallel literacy domain: literacy for self expression)
Workplace and practical situations	Numeracy for Practical Purposes addresses aspects of the physical world to do with designing, making and measuring. (parallel literacy domain: literacy for practical purposes)
Education and training contexts	Numeracy for Knowledge is introduced at level II and matches the Reading and Writing domain of Knowledge. It deals with mathematical skills needed for further study in mathematics, or other subjects with mathematical underpinnings and/or assumptions. (parallel literacy domain: literacy for knowledge)
Community and civic life	Numeracy for Interpreting Society relates to interpreting and reflecting on numerical and graphical information of relevance to self, work or community. (parallel literacy domain: literacy for public debate)

(retrieved May 13, 2003 from <http://www.aris.com.au/cgea/about/module/nandm/modnm1a.html>. Literacy domains from Adult, Community and Further Education Board, 2002, p. 63)

The writers of the CGEA state a theory of learning math. They quote Clements and Ellerton (1992) to support their statement that “mathematical knowledge is not acquired merely by listening to teachers or performing abstract repetitive tasks” instead, mathematical knowledge 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 (p. 4 of Ellerton & Clements). (Ellerton & Clements, p.4, quoted in Adult, Community and Further Education Board, 2002, p. 213)

The CGEA is also based on the four further education principles of Bradshaw (1999): multiplicity, connectedness, critical intelligence and transformation (quoted in Adult, Community and Further Education Board, 2002, p. 13).

Comments on Australian Frameworks

B. Marr, a member of the Numeracy Team of the NRS, has said that “the numeracy section of the NRS was written in unseemly haste - 3 days of meetings of 3 years for the literacy” (personal communication, May 14, 2003). This is confirmed by Johnston,

The tool [i.e., the NRS] was first developed as a mechanism for language and literacy, and it was only towards the end of the development process that a team of adult numeracy practitioners was recruited to write the numeracy components. (2002, p. 41)

Johnston comments further on numeracy in the national reporting system:

There are (at least) two problematic features of the NRS. Firstly, there is the slippage between its self-description as a ‘reporting mechanism’ and its inevitable use as an assessment tool. The second problematic feature, which it shares with the Training Packages, is the reliance on a competency based framework. While CBT has a certain appeal with its belief in the possibility of itemising all the skills necessary for a complex activity in clear, unambiguous outcomes, in reality it usually leads to one of two quite different, unsatisfactory scenarios. On the one hand, there is the impossible list of precise tasks, where the elements lack any connecting theory: a scenario we know all too well from students who have failed in just such an approach to mathematics itself. On the other hand, there is the list of competencies so gloriously wide that no two assessors will have the same interpretation (2002, p. 4)

In practice what the NRS seems to be doing, at least for numeracy, is giving teachers and programs a resource for thinking about numeracy, and a chance to develop tools that suit their own needs, but can be seen to conform with the broad intent of the competencies. (2002, p. 42)

One consequence of having national requirements for reporting has been that teachers and managers have been more inclined to use pre-existing courses that were already mapped to NRS, so that they do not have to try to map their own to the NRS. In some ways this may work as a safeguard of standards. It may also work to diminish the number of courses specifically tailored to local needs and communities. Clearly the NRS is something that teachers and trainers must currently work with, and in many ways it is a more sophisticated tool than they have previously had at their disposal. Whether it can work as a fair reporting tool, how and to what extent it is being used as an assessment tool, needs further research. (2002, p. 42)

Johnston also comments on the CGEA:

It sets out what is to be done, but gives the teacher the professional choice of how and when to do it. Finally, being a framework rather than a prescriptive curriculum, the GCEA is seen to allow for a program broad enough to cater for all needs, an essential for the teaching of the very disparate groups of students across WA [Western Australia]. (2002, p. 35)

Several comments on the CGEA are available in a research report by Marr et al (1998). Marr reports that the first version of the numeracy and mathematics stream of the CGEA was met with quite a bit of frustration. Users found parts of it vague and unworkable (Marr et al, 1998, p. 2). Before it was re-accredited in 1997, it underwent significant revision, changing into much its current form. This 1997 version was well-received, and only minor changes were made for its most recent re-accreditation, in 2002. Marr et al (1998) studied how the 1997 version was received by teachers, co-coordinators, and learners. It is reasonable that these responses to the 1997 version would be similar to the responses to the current, 2002 version. Marr et al report on practitioners' initial responses to the numeracy and mathematics stream of the CGEA, and on their feelings after using the curriculum for a year. They found mostly positive responses at both points in time. The positive responses "can be grouped into four main categories: philosophical agreement, appreciation of guidance and direction, appreciation of structure and appreciation of clarity" (Marr et al, 1998, p. 3). Practitioners' concerns with the revised curriculum were specific (e.g., the difficulty of determining if a task was at the highest or second-highest level, the difficulty of finding real applications for skills at the highest level, feeling that a few things were missing), rather than in the form of wholesale frustration and fear, which had been the common reaction to the previous version.

Among teachers' specific concerns were:

- not enough time was allocated for studying a level's learning outcomes (Funders had begun to interpret the 'nominal hours' indicated for each level as the numbers of hours that would be funded.),
- they would like more teaching resources, teaching/learning activities, and assessment tasks included in the document,
- they would like better layout to eliminate constant flipping of pages,
- too many learners plateau at the second-highest level, and
- they need time to do paperwork (Marr et al, 1998, teacher analysis, pp. 26-27).

Ontario has mostly felt that a curriculum is inappropriate for adult basic education – that learners have such diverse needs that a curriculum would be too restrictive. A finding of Marr et al reveals that this may not be the case for all curricula:

It is clear from the responses [from teachers] to questions regarding planning of courses, use of outcomes and assessment, that the document has not proscribed a particular approach to teaching and learning, but has allowed for a variety of methodologies. Teachers who reported using a learner centered approach in the past found it compatible with using the new document. They were still able to design courses around the needs and interests of their students within this competency based framework. This was especially important to teachers who have worked for some time in the community education sector where this tradition is strong and highly valued. They did not feel that their philosophical approach to teaching and learning had been constrained or compromised by the document. (Marr et al, 1998, summary of conclusions from the survey of teachers, n.p.)

In a more recent paper, Marr comments on the current use of the CGEA's 'nominal hours':

A curriculum like the CGEA was devised within a Competency-Based Training framework, originally underpinned by the ideals of flexibility. Students should be able to take the time they need to work towards the required outcomes. Unfortunately, newer financial considerations demand efficient return for dollars invested in education - measurement of achievements in specified time frames. 'Recommended hours' were attached to curriculum 'modules', and have now become the funded hours per student, per module. 'Completion rates' not only measure individual students' achievements, but also influence the 'success' and funding of the program. Such considerations take us a long way from the underpinning philosophy of the original frameworks, and, in my opinion, demand a fresh look at the issue of depth and breadth in the curriculum. (Marr, 2001, p. 7)

In a different article, in 2001, Smith comments on the categories of the CGEA's numeracy stream having made to parallel the categories of the literacy stream: "In practice, these genres simply do not fit as well in numeracy as they do for describing writing."

Chapter 7

Discussion

For the most part, consideration of the frameworks in this report does not provide us with simple answers. For example, it does not reveal an existing framework that is clearly suited to replace ours in Ontario. Instead, it compels us to ask and begin answering questions that will help us to clarify the purpose and context of a framework (or frameworks) for adult numeracy education in Ontario, and broaden and update our idea of the possible structure and content of such a framework (or frameworks). In Part One of this chapter, I begin a discussion of possible answers to these questions. In Part Two, I make recommendations regarding the features of an effective framework document.

Part 1: Questions to Explore

Some of the questions below were posed to guide my research, and the others were generated by my research. They suggest, to borrow a phrase from Merrifield, Coleman and McDonogh (2001), ‘issues and opportunities’. I have begun to explore the issues and opportunities here, and I hope their exploration will continue beyond this report.

1. What is a framework for? What purpose does it serve?

A system’s documents usually cite one or more of the following reasons for having a framework:

1. to facilitate accountability to funders,
2. to facilitate consistent recognition and/or formal accreditation of learning across a system, and
3. to support teaching and learning.

Other purposes exist (e.g., to support program improvement), though the three above were cited most often in the frameworks in this report. How these purposes are fulfilled is explored in subsequent questions in this discussion.

2. How are the contents of frameworks organized?

Frameworks for adult numeracy education can be sorted into three categories, according to their content and its organization:

First Category – contents are presented in the following order: whole numbers first, then fractions, then decimals, then percents, and then, in a variety of orders: ratio and proportion, measurement, data, geometry, signed numbers, algebra

for example, the framework underlying the TABE in the USA, and those in many adult math workbooks;

Second Category – contents and structure reflect the ‘parallel strands’ model common in current K-12 math curricula (learning begins at the lower levels of traditional math strands, and spirals up through increasingly complex activities in each strand), with some or no modification for use with adults

for example, the Adult Numeracy Core Curriculum in England and the matrix of numeracy learning outcomes in Ontario;

Third Category – math and numeracy are presented in a unique framework, developed expressly for adults

for example, the CGEA in Australia, and, possibly, the math elements in Equipped for the Future in the USA (when they are complete).

Two frameworks that are in the same category (i.e., that have similar structure and content) are not necessarily to be used in the same way or to fulfill the same purpose. If one were asked to look at only the structure and content of the frameworks in this report, and, from that, identify which were developed to support accountability to funders, and which were developed as curricula to support teaching and learning, one's task would not be straightforward. Ontario's matrix of learning outcomes is quite similar to England's Adult Numeracy Core Curriculum (both in the second category), but the Ontario framework is not meant to be used as a curriculum. It is more of a reporting system. Another example is the 'Mathematical Knowledge' section of Australia's national reporting system, whose content is much like that of other jurisdictions' curricula. What most conclusively distinguishes a reporting system from a curriculum is not its contents or structure, but rather the instructions for how it is to be used, e.g., a curriculum is to be consulted before learning activities are begun, and a reporting system is to be applied after a course of learning has been followed (or, at least, determined).

To look at this situation in reverse: in practice, the role that a framework is to play in a system does not dictate its content and structure. For example, the United States and Australia both have reporting systems for adult education, but the United States' system seeks data on educational gain as only one of many measures, and defines gain in terms of test scores and only fleetingly in terms of skill descriptions, while Australia's reporting system gathers data on educational gain only, and describes in great detail students' skills, knowledge and strategies at each level.

Though there is variation, in practice, of which types of frameworks are used in which ways for which purposes, not all combinations are equally successful.

3. *Can one framework fulfill all purposes, or is it better to have a separate framework for each purpose?*

One framework is sometimes used to fulfill all purposes, but few frameworks are this flexible. Frameworks that are used only for the purpose(s) for which they were developed will be more successful. If multiple uses/purposes are considered throughout a framework's development process, then the resulting single framework may work. But, if a framework is developed to be used in one way to fulfill one purpose, and then after it has been developed, is also used in a different way to fulfill a different purpose, it may not be effective in fulfilling this second, unanticipated purpose.

In jurisdictions where a single framework is used, there are some difficulties. However, it is not clear to what extent the difficulties are due to circumstances outside the frameworks (e.g., limited professional development for users), or to the contents of the framework (e.g., a K-12 curriculum), and not just to the fact that a single framework is being used. It is possible that the right framework, based on research and experience in adult numeracy education, and accompanied by careful professional development, could satisfy all purposes. However, such a framework has not yet been developed. (The *Equipped for the Future* Assessment Framework, when it is complete, will come the closest, but even it operates in conjunction with the its country's national reporting system.)

Most jurisdictions have more than one framework. Users seem most satisfied in systems of two frameworks, where one framework (i.e., a reporting system) is used to meet the

accountability requirements of funders, and another framework is used to support both instruction and accreditation (e.g., a curriculum or set of content and performance standards).

In this case, the relationship between the multiple frameworks in a system must be negotiated and explained. For example, Australia has one framework in its reporting system and another in its most commonly used curriculum (the CGEA); how the two frameworks connect is explained in regularly negotiated ‘translation agreements.’ Also, the United States is currently working to match up the benchmarks on the performance continuum of *Equipped for the Future* with the ‘functioning level descriptors’ of its reporting system.

4. Can we use K-12 curricula as frameworks for adult numeracy education?

In some frameworks, the organization of content into levels corresponds to a K-12 curriculum. One argument for using a K-12 curriculum is that it represents context free skills, which teachers and learners can take to their own contexts – that it will be a more powerful tool for being abstracted. This may not be true in practice, as research has shown: “[...] it would be wrong to assume that school mathematics is more readily transferable than street mathematics. In their research on proportionality, Nunes and her colleagues found the opposite to be true: ‘both flexibility and transfer were more clearly demonstrated for everyday practices than for the school-taught proportions algorithm’ (Nunes et al., 1993, p. 126).” (Coben 2000, p. 40).

Though recent children’s curricula are excellent for their contexts, they are not well suited to adult numeracy education for several more reasons:

- The children they are created for will be studying (all subjects) for approximately 1080 hours a year for twelve years (Sticht, 2002, p. 1), while adults are in literacy programs for much shorter times, in the USA for an average of 50 to 100 hours in total (Sticht, 2002, p. 1).
- “Although adults need to fill gaps in their own prior learning, most often they do not need the long-term sequential curriculum that children do” (Osborne, 1996, p. 5)
- The K-12 curriculum is for all learners, of all abilities, while learners in adult literacy often have ‘special needs’ that respond to different content and teaching strategies (Sticht, 2002, p. 2).
- A teacher in the K-12 system usually works with the same grade for a year, or several years, and so can develop expertise with that part of the curriculum. One literacy teacher cannot be expected to use competently all the parts of a K-12 curriculum that would be needed for his or her students
- K-12 work such as the *Principles and Standards for School Mathematics* developed by the National Council of Teachers of Mathematics in the United States, are “[...] a comprehensive foundation recommended for all students, rather than a menu from which to make curricular choices” (National Council of Teachers of Mathematics, 2000, p. 29), a feature which it shares with similar documents, and which may make it

inappropriate to be used as the ‘menu’ that is more suited to adult numeracy education.

- “We also know that the biological and cognitive development of children in the K-12 system follows a different course from that of adults from post-adolescence to middle age to senescence.” (Sticht, 2002, p. 2).
- “[...] the ordering of complexity of tasks by the type of operation performed may not be as clear with adults as it may be with children. Such ordering in school-based assessments is predicated on traditional school curricula, where more advanced topics are learned at higher grades. However, adults are known to use a lot of invented strategies, perhaps more so, and more efficiently so, than children. Multiplication or division problems, which can prove relatively hard for some young people, may be solved by (seemingly simpler) strategies, such as by repeated addition or repeated subtraction; complex numbers may be broken down in ways that ease mental load, and so forth. In addition, adults’ familiarity with everyday contexts, such as with monetary entities, facilitates their performance with some seemingly advanced concepts. For example, specific landmark values of fractions and percents, such as $\frac{1}{2}$, $\frac{1}{4}$, 50% or 25%, are familiar to many people; as a result they may be easier to manage than expected, violating curriculum-based ordering of difficulty.” (Gal et al, 1999, p. 19)
- It is often inefficient or misleading for a teacher to describe an adult numeracy task in the language of a K-12 framework. For example, a difficulty with Ontario’s matrix of learning outcomes (which is based on a grade school curriculum) is that when practitioners turn to it 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 the matrix of learning outcomes. Often, what their learners have learned is described by widely scattered elements in the matrix, so the process doesn’t situate the learner’s achievement in a framework, but atomizes and blurs it. 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. This is an instance of what O’Donoghue (2003) identifies as “the tension between mathematics and numeracy in adult mathematics education,” and relates to the question he asks, “how does a numeracy curriculum for adults differ from a basic mathematics curriculum for adults?” (p. 4).

5. How should we distribute skills and knowledge through the levels? What is easier, and what is more difficult?

Right now, there are contradictions from framework to framework that indicate there is only limited agreement on which tasks, skills, knowledge and performances are at higher levels than others. For example, at the lowest level in England’s Adult Numeracy Core Curriculum, using given strategies is emphasized (“Adults can generate results which make sense and use given methods and given checking procedures appropriate to the specified purpose”), while at the lowest level of Australia’s national reporting system, it is expected that a student will use his or her own methods (“uses informal procedures relying heavily on context, personal experience and prior knowledge”).

A second example of different perceptions of difficulty is how the size of numbers at each level is controlled (or not). Are larger numbers more difficult to handle than smaller numbers? The variation among frameworks can be seen in the three charts below, progressing, from left to right, from most restricted to least restricted:

England's Adult Numeracy Core Curriculum		Ontario's Level Descriptions for Numeracy		Australia's CGEA - Numeracy and Mathematics Stream	
Entry Level 1	numbers up to 10	Level 1	numbers up to 100	Intro. Level	size of numbers should be relevant and familiar
Entry Level 2	numbers up to 100	Level 2	numbers encountered in everyday life	Level 1	not specified
Entry Level 3	numbers up to 1000	Level 3	numbers encountered in everyday life	Level 2	not specified
Level 1	numbers, including large numbers	Level 4	not specified	Level 3	not specified
Level 2	not specified	Level 5	not specified		

Sometimes the terms used to describe a skill change (sometimes getting more linguistically sophisticated) as the levels get higher, without necessarily describing something more difficult. In Australia's reporting system, for example, one might wonder how 'locating' information (what learners at levels 1 and 2 do) is easier than 'selecting' information (what learners at level 3 do).

The adult numeracy researchers who collaborated to create the numeracy items for the Adult Literacy and Lifeskills Survey of 2002 stated that, "[b]ecause of the scarcity of research on adults' use and application of numeracy, there is little empirical knowledge that helps with defining what aspects make a numeracy activity or task more difficult or complex." (Gal et al, 1999, p. 17). This state of affairs led them to develop their own scale to determine the complexity of a numeracy task. This scale is described in Table 23 on the next page:

Table 23. Complexity Factors—Descriptions of Levels
(Adult Literacy and Lifeskills Survey)

Level 1	Level 2	Level 3
Mathematical Information/Data		
<p>Information or answer required based on:</p> <ul style="list-style-type: none"> familiar real life activities, very concrete Whole numbers in the range to 1,000s benchmark fractions (1/2, 1/4) decimal fraction or percentage for a half only (0.5 and 50%) very simple whole number relations and patterns standard monetary units common everyday measures for length (whole units) simple, common 2D shapes simple graphs, tables, charts with few parameters and whole number values time (dates, hours, minutes) simple whole number data or statistical information simple localized maps 	<p>Information or answer required based on:</p> <ul style="list-style-type: none"> common real life activities large whole numbers in the range to millions simple whole number rates and ratios whole number relations and patterns other benchmark fractions: 1/3, 1/4 1/10,.... common decimals, like 0.1, 0.25 to 2 decimal places common whole number percents, like 25% and 10%. other everyday standard measures for length, weight and volume, including common fraction and decimal units more complex 2D shapes, common 3D shapes graphs, tables, charts with common data including whole number percents more complex data or statistical information including whole number percents common types of maps whole number scales in 1s, 2s, 5s or 10s 	<p>Information or answer required based on:</p> <ul style="list-style-type: none"> all types of rational (and some irrational) numbers including directed numbers formal mathematical information such as formulae all kinds of measurement complex shapes or combinations of shapes complex graphs, tables or charts complex data or statistical information Complexity of Type of Operation/Skill
Type of Operation/Skill		
<p>a simple or straight forward activity or process that involves:</p> <ul style="list-style-type: none"> a simple arithmetical operation locating/identifying data making straight forward measurements comparing or sorting values following or giving straight forward directions 	<p>a more complex activity or process that involves:</p> <ul style="list-style-type: none"> more complex applications of the normal arithmetical operations such as calculating with rates, ratios, percentages, etc estimating and rounding off making and interpreting measurements converting between standard measurement units giving a simple explanation of a mathematical process 	<p>complex activity or process that involves:</p> <ul style="list-style-type: none"> more abstract and generative reasoning or explanations more advanced mathematical techniques and skills e.g. indices and square roots algebraic techniques generating, organizing, graphing and interpreting grouped data extrapolating data converting between non-standard measurements
Expected Number of Operations		
<ul style="list-style-type: none"> one operation, action or process 	<ul style="list-style-type: none"> Application of two or three steps, sometimes the same or similar operation, action or process 	<ul style="list-style-type: none"> integration of several steps covering more than one different operation, action or process
Plausibility of Distractors		
<ul style="list-style-type: none"> no other mathematical information is present apart from that requested, no distractors closed question. not open-ended 	<ul style="list-style-type: none"> there is some other mathematical information in the task that could be a distractor the mathematical information given or requested can occur in more than one place may need to bring to the problem simple information or knowledge from outside the problem. fairly closed question 	<ul style="list-style-type: none"> more complex, open-ended task mathematical information given or requested appears in several places. other irrelevant mathematical information appears necessary information may be missing, so outside information or knowledge may need to be brought in
Type of Match/Problem Transparency		
<ul style="list-style-type: none"> The activity or operation required is clearly apparent and specified in little or no text, using objects and/or photographs or other clear, simple visualizations. Locating obvious information only 	<ul style="list-style-type: none"> The activity can rely on text, using clear, simple sentences, and/or visualizations where some translation is required or where there is a need to locate information from a number of sources within the text/activity. 	<ul style="list-style-type: none"> The activity is embedded in dense text where considerable translation is required or where values may need to be derived or estimated from a number of sources within or even outside the text/activity.

This scale may be useful to consider when developing a framework for adult numeracy education, though it should be kept in mind that the scale was not developed for educational purposes.

The performance continua of the United States' Equipped for the Future Project have had significant amounts of time, expertise and resources put into their development, so they may, as well as anything can currently, propose benchmarks along the progression of skill and knowledge in adult numeracy development. They were not yet available when this report went to press.

6. How many levels should there be in a numeracy framework?

The issue of levels is fundamental and problematic; Coben has written about “the vexed question of levels” (2001, p. 142). The number of levels in existing adult numeracy frameworks has most often not been determined by an idea of how adult numeracy is best divided up for learning, but rather by a need to make the framework mesh with other parts of the education system. The ‘other parts’ may be high school credit courses, a K-12 curriculum, a training system, or the number of levels in the parallel literacy framework. There is quite a variety in the resulting number of levels. For example, the USA’s reporting system has six levels from a bottomless level one to high-school equivalent. Ontario’s matrix of learning outcomes span five levels (which is on the high side for number of levels in a framework), from a bottomless level one to grade nine equivalent (a separate framework is used for the higher levels). Australia’s CGEA uses four levels to cover beginner to grade eleven equivalent. England’s Adult Numeracy Core Curriculum has three entry levels, and then two regular levels in its main framework. Its Entry Level 1 is not bottomless; below it there is a separate pre-entry framework, consisting of ‘milestones’ (eight learning outcomes that are not ordered in difficulty). Most large-scale frameworks include elementary school levels and high school levels in the same framework. In Ontario, we might consider the benefits and difficulties of merging our lower and higher-level frameworks (only the lower-level ones were described in his report).

Regret has been expressed in several places that learners’ achievements are not recognized by a system until they have completed an entire level. Conversely, complaints are heard when a system has many levels, too. Quasi-formal recognition of progress within a larger level might be a useful compromise.

In deciding how many levels a framework will have, one must balance the need to connect to a larger system, with the need to maintain internal coherence and ease of use.

7. Does each level in a framework contain the same amount of knowledge and skills?

Usually it does not, and when this is done by design, it can be very effective. Frameworks sometimes have one or two particularly demanding levels. For example, Level 3 in the Ontario Framework contains a lot of skills and knowledge to be learned, compared to the levels below it. Similarly, the fourth level of England’s framework (called Level 1) contains much more than the levels below it do. It seems advisable to

consider creating “thinner” lower levels in order to register the small though significant gains made by novice numeracy learners.

Frameworks can acknowledge that learners at the lowest levels have different needs from learners at the higher levels. For example, lower levels may have different assessment procedures. This occurs in England, where, at the lower levels, learners show that they have met the requirements of their level at least 50% through standardized evaluation, and the rest through other means. Compare this to learners at the two highest levels, whose achievement is measured 100% by a national test. Another example is in Australia, where, though learners at all levels are assessed on “a folio of evidence,” the folios of learners at the introductory level may contain different kinds of evidence than the folios of learners at higher levels (Adult, Community and Further Education Board, 2002, p. 220).

8. How is a numeracy framework different from a literacy framework?

A numeracy framework may need different topic sub-divisions from its sister literacy framework. In some cases, a numeracy framework has been structured to parallel a system’s literacy framework, and has worked reasonably well. Attempting to have parallel structure for its own sake though, without careful thought as to whether the literacy framework’s structure is meaningful for numeracy, can force awkward conceptualizations onto numeracy that defeat any advantage hoped for by keeping the structures the same. Numeracy does not necessarily break down easily into the same sub-categories as literacy does – nor perhaps even the same number of levels. It is recommended that a literacy framework’s structure be used for a numeracy framework only when it can be shown to suit numeracy – otherwise it should not be done.

Also, a numeracy framework has two roles to play, that a literacy framework perhaps doesn’t: (1) as a tool to promote the teaching of adult numeracy, and (2) as a research tool.

(1) A numeracy framework can be a tool to promote the teaching of adult numeracy.

A numeracy framework can do the work of explaining what numeracy is, and be used to advocate for its teaching and learning. For example, Scotland writes about its proposed curriculum framework: “the framework should begin to put right the low priority given to numeracy in programmes” (Scottish Executive, 2001, p. 27). A framework whose purpose is to support teaching and learning will be more effective in raising the profile of numeracy than one whose purpose is to support accountability.

A numeracy framework can speak to administrators, and encourage them to set up or expand the numeracy components of their programs. Practitioners are drawn to literacy – most feel they know what it is, are themselves ‘literate’, and know how to teach it. The same may not be said of numeracy. The term ‘numeracy’ is only beginning to become familiar, and many practitioners are not confident in their own math skills, nor do they understand that numeracy can be something other than the math that they learned in grade school. A framework can show practitioners and learners that math can be studied in the form of

useful, interesting numeracy tasks that illuminate parts of the everyday world. Closely related to this, Johnston writes of Australia's CGEA:

The curriculum document itself also acts as a professional development tool, including a large amount of background documentation. This is seen as to some extent making up for a chronic lack of system professional development. (2002, p. 32)

(2) A numeracy framework can be used as a tool for researching.

In the relatively young field of adult numeracy education, a framework to support instruction and assessment processes, conceived as a proposition to which users are asked to respond, and whose shape is modified regularly in response to this input and to other relevant developments, would help to expand the knowledge base of adult numeracy.

Since adult numeracy education is in its early stages, that which programs can be held accountable for is not clear. Using a framework in the above-mentioned way would move toward clarifying this.

9. How can we best use frameworks in assessment and evaluation?

This depends on the purpose of the assessment and evaluation is being carried out (e.g., to fulfill accountability requirements to funders, to support instruction) (National Research Council, 2002, p. 51). For assessment and evaluation to support teaching and learning, research recommends that it be formative, and a natural part of a learner's course of study. For accountability purposes, assessment results from many students must be quantified and totaled. These different purposes require different assessment tools and methods.

The types of assessment that are used with the frameworks in this report range from standardized tests based on K-12 curricula, through assessment of portfolios that contain several different kinds of evidence, to anecdotal reports from teachers observing learners in real-life situations. No single kind of assessment can be recommended at this point; instead, more general advice can be given:

(1) Assessment should be appropriate.

“The essence of good assessment [...] is that it is appropriate for the context, purpose, and interpretation made or needed. It is also very important to recognize that assessment has to be fully linked with the learning and teaching goals of a program and reflect (for teachers, students, and policymakers) what is valued in a student's performance and learning.” (Cumming & Gal, 2000, p. 316)

(2) Standardized multiple choice tests are not recommended.

“Many of the assessments used today, such as standardized multiple choice tests, have reinforced the view that the mathematics curriculum should be constructed from lists of narrow, isolated skills that can be easily disassembled for appraisal. The new vision [...] requires a curriculum and matching assessment that is both broader and more integrated.”

(Mathematical Sciences Education Board, 1994, p. 9, quoted in Cumming and Gal, 2000, p. 327)

(3) Learners may show their skills more readily in speech than on paper. Cumming and Gal write, “[a]dult Numeracy assessment should recognize that adult learners may perform at quite different levels in oral mathematical discussions than on written tasks” (2000, p. 328). Therefore, numeracy assessment might usefully consider the assessment techniques used in the listening and speaking domain of literacy education.

(4) “One type of assessment alone (e.g., a standardized test) will not be sufficient to inform all assessment or evaluation requirements of learners or a program.” (Cumming & Gal, 2000, p. 328)

(5) Moderation is effective (see explanation of moderation in Chapter 6) in developing common interpretations of assessment tasks and performance.

Finally, a framework will be stronger if it is accompanied by a mechanism for being assessed itself. Because adult numeracy education is a relatively young and developing field, any framework might be considered a proposal, and would benefit from users’ responses to what it proposes. Thus, a framework should have in it a mechanism for collecting and integrating assessment of itself – perhaps simply an e-mail address or Web discussion through which users could give their feedback and ask questions. It would be ideal if it were possible to hold regular moderation sessions whose results, where appropriate, would feed back into future versions of the framework.

The above is not a comprehensive approach to assessment, but simply suggestions collected from the frameworks in this report. As Gal et al wrote in 1999, “While Numeracy is viewed as a vital skill area, its conceptual boundaries and the methods for assessing it have not received much scholarly attention so far” (p. 3). Very recently, however, numeracy assessment has received scholarly attention, in a 2003 publication (which had just come out as this research was coming to an end) *Rethinking Assessment: Holistic Adult Numeracy Assessment*, by Marr, Helme and Tout.

10. How might we develop and implement a framework?

An approach is implicit in the title of this section: that the development of a framework and its implementation are best planned together as one continuous process. Rather than a small group of people creating a document that is then presented as a ‘fait accompli’ to a large group, it is believed that a better document will result, and implementation will be more thorough, if several representatives of all stakeholders are involved in some way in the development process. As Cumming & Gal write:

It has been shown that a top-down process of change has a limited chance for achieving a measurable impact on a complex field such as mathematics education (Lindquist, 1994). A top-down change may not work at all in a majority of adult education programs, those based on local and independent management, on volunteer operations, or that emphasize learner-based approaches. An open, multipronged and long-range approach is needed that assumes that many players with equal stakes are involved in and can affect the change process. (2000, p. 329)

This kind of consultation takes time. Most people who have done it agree on this, and on the fact that the investment of time is worth it. For example:

- In the conclusion to their 1996 review of eleven statewide adult learner competency and assessment systems in the United States, Kutner et al make three specific suggestions for anyone developing such frameworks: “(1) Involve all state and local stakeholders. (2) Recognize that developing and implementing a learner competency and assessment system will take time. (3) Provide local staff with sufficient opportunity for professional development” (p. 16).
- “One of the most important lessons of the K-12 efforts is that standards-setting works best when everyone is part of the process. This takes time. NCTM [National Council of Teachers of Mathematics] has been at work on standards for more than a decade.” (Stites, 1999)
- Much of the Equipped for the Future work was done through “[...] an iterative field and expert review process.” (Stein, 2001, p. 15)
- “Adult learners, adult educators, and adult education policy makers must continue to engage in building accountability systems that recognize the many, varied contributions education can make in the lives of adult learners.” (Bingman, 2000, p. 18)
- The Movement for Canadian Literacy leads five other national literacy organizations in recommending a Pan-Canadian Literacy Strategy, with, as one of its guiding principles, “stakeholder involvement: policies and programs at national, provincial and local levels must be developed and implemented in consultation with the literacy community.” (2002)

If teachers are involved in the development process, then perhaps they will have shared the responsibility for the detailed information management and hard decision-making that are part of creating a framework, and will feel a share of the responsibility for seeking the best possible results in using it. Teachers and policy-makers will appreciate that each others’ roles involve complex intellectual activity. Administrators can learn from the lesson mentioned in the report on England’s report on the field tests of their new curricula and national tests:

The first and most important lesson of the Pathfinders has been that harnessing the enthusiasm and commitment of teachers of literacy, language and numeracy to the new teaching and learning infrastructure provides a passport for success. (Department for Education and Skills, 2002, p. 27)

Involving teachers in the development may mean that they will not need to be “won over”; they will have engaged with the framework from its beginning, understand how it came to be the way it is, and feel partly responsible for it. However, Osborne provides a realistic reminder by referring to Fullan (1991), who

[...] warns against the naiveté of believing that involving some teachers in the organization and development of innovation will “increase acceptance by other teachers” (p. 127). Even when change comes from within, it may feel just as intrusive as change coming from the government for teachers who were not involved

at the early stages. They may even resent the developer teachers for getting special treatment. (Osborne, 1996, pp. 54-55)

So, it may be the case that the benefits of involving teachers in the development process are more that they will help to make a better framework, and less that all teachers will adopt more readily whatever framework is produced.

Learners, too, have a valuable contribution to make to the development of a framework. In the United States, Bingman (2000) writes of the Workforce Investment Act and the national reporting system: “[...] learners have a different perspective on performance than the authors of WIA” and “their perspectives should be taken into account at the policy level” (p. 1). Developers in England report ‘learning a lesson’ about their national qualifications: “it is important that these reflect the needs of learners and providers, not just the administrative arrangements of awarding bodies and regulators” (p. 1).

In practice, there are several examples where authorities brought out frameworks within one to two years, with little consultation with stakeholders in the programs. At the other extreme, there is the United States’ wide ranging and long term development of the elements of *Equipped for the Future*. The *Equipped for the Future* performance continua have been determined by consultation with stakeholders at all levels, including learners, and will be the result of at least ten years of research and development when they are complete. Documentation about the development process of the *Equipped for the Future* project is detailed and available for download from the internet (e.g., *Equipped for the Future Research Report: Building the Framework, 1993-1997* by J. Merrifield (2000), available at http://www.nifl.gov/lincs/collections/eff/eff_publications.html); it is an example of how the work put into a single framework’s development can be expanded to benefit the field.

In case this sounds like an all-consuming undertaking, it is helpful to note Kutner et al’s advice: Do not “assume that the entire system needs an overhaul.” Instead, “systematically and honestly evaluate the current functioning of [the] system to identify areas in which the programs excel and areas that would benefit from change” (1996, p. 17 of appendix).

11. What resources can we use as we develop a framework?

During the development process, clearly stated guiding theories or principles can help significantly in managing the issues that arise. Theories or principles to guide the following would be helpful:

- how the framework will divide numeracy into sub-topics, and why this is appropriate,
- how the framework will divide numeracy into levels, and why this is appropriate,
- how the framework is to be used, and why this is a worthwhile and efficient way to use it,
- how the framework relates to learning and teaching adult numeracy, and
- the philosophy behind the framework’s development process.

For example, some of the theories and principles cited by the creators of the frameworks in this report are:

- in the United States:

Four conceptual threads have shaped the EFF [Equipped for the Future] framework in important ways:

- a purposeful, constructivist approach to learning;
- rooting education in the context of people's lives;
- an emphasis on application, not just possession, of skills;
- a view of adult development as transformative rather than additive.
(Merrifield, 2000, p. 9)

- in Australia, underpinning the CGEA is the concept that skills development occurs best when it is achieved within social contexts and for social purposes. Also, the CGEA states that mathematical knowledge is: "something that learners construct through actively seeking out and making mental connections" (CGEA, 2002, p. 213), and that the CGEA is based on the four further education principles of Bradshaw (1999): multiplicity, connectedness, critical intelligence and transformation (quoted in CGEA, 2002, p. 13).

- in Ontario, five principles underlie the learning outcomes approach that is behind the framework: (1) a results-based focus, (2) program accountability, (3) learner-centered services, (4) adult education principles, and (5) linkage with the broader education and training system (Literacy and Basic Skills Section, 1998, p. 5).

As well as supporting the development process, principles or theories can help users to understand the framework; they should be explicitly and concisely explained in the document that contains the framework.

Obviously, the frameworks of other jurisdictions are also helpful. One can learn about them through this paper, and/or consult them directly on-line. One can learn even more from the people who created them. Specifically, the people and documents that are part of the United States' *Equipped for the Future* project, Australia's CGEA, and the works-in-progress in Scotland and Ireland are informative.

Kutner et al recommend that adult basic education programs "base change on research" (1996, p. 17 of appendix). This is difficult to do in this case, because there is only a small body of research directly into adult numeracy. Coben writes, "The nub of the problem is that there is no consensus as to what constitutes knowledge in adult numeracy. Without this, any attempt to construct a universal curriculum is flawed" (2001, p. 139). As well, Coben writes, "Far too little is known about how adults learn mathematics and how best to teach it" (2001, p. 141). Having said this, we must acknowledge that the research base is growing, and conditions point toward it continuing to do so, perhaps at an even faster pace. Coben's 2003 review of research on adult numeracy is very helpful.

While we give the research base time to grow, we can inform our process of framework development with research in related areas (for example, adult learning, mathematics

learning, cognition, literacy policy, curriculum studies, assessment and evaluation), and stay connected to the sources of new ideas and research about adult numeracy (e.g., the Adult Education Resource and Information Service of Language Australia).

Though K-12 curricula (for example, the *Principles and Standards for School Mathematics* of the United States' National Council of Teachers of Mathematics (2000)) are not recommended for use in adult numeracy education exactly as they are, they can be helpful as references.

Documents describing the systems that the Literacy and Basic Skills Program must, or would like to, mesh with are essential – as is a realistic description of the context in which the framework will be used (e.g., the limited amount of time that practitioners have for paperwork, the funds available).

Several of the books and articles in the list of references for this report would also be helpful.

12. What lies beyond development and implementation?

In reporting on efforts in the United States to create statewide learner competency and assessment systems, Kutner et al write, “[N]othing is ever done” it is “a continuous process” (1996, p. 17).

Two important considerations in this ‘continuous process’ that lie beyond a framework’s initial implementation are: revisions to the framework and on-going professional development. In most jurisdictions it is not explicitly stated if or when a framework will be revised. Australia is an exception to this, in that its CGEA is reviewed, modified where necessary and re-accredited every five years. As stated earlier in this discussion, plans and means for revision may lead to a stronger framework. Moderation can be a means of gathering information about the strengths and weaknesses of a framework – it is also a mode of professional development. Of course, it is primarily a way to improve the validity and reliability of learner assessment results across a system (see passages on moderation in Chapter 6 of this report), but it also ‘tests’ the framework itself, and increases practitioners’ understanding of it.

Managed carefully, revising a framework and conducting on-going professional development need not mean constant, stressful change, but healthy, reasonably-paced growth.

Part 2: Features of an Effective Final Document

It would be unfortunate if a lot of careful research and valuable resources were put into the development of a framework, only to have its effectiveness compromised by hasty or illconsidered presentation of the final product. Investment in a clear and usable presentation is invaluable. Below are recommendations related to this.

Format

A printed document that contains and explains a framework is still the basic format. As well, presenting the entire framework (in all its detail) on a poster is recommended. Having a navigable version of the framework on the internet is important (e.g., www.nrs.detya.gov.au for the National Reporting System in Australia). As well, a downloadable pdf version is a good idea. A CD ROM version may also be considered.

The remainder of the recommendations for the features of a final product will refer to a printed document; transferring the spirit of these recommendations to a Web site or poster format is fairly straight-forward.

Frameworks are usually too big to fit on one letter-sized page, so they must be divided up and presented over several pages. This requires that navigational tools be built into the document. Informative headers and footers, dividers with tabs, and a clear, detailed table of contents and index are helpful.

The best way to break up a framework for presentation across several pages depends on how it is to be used. It is most common for the levels to head the columns, and the sub-categories of numeracy to head the rows. It is recommended that the document contain this layout, and the reverse, as well as others. Within each layout, it is recommended that the same unit of information be kept on each page. Where the framework is described level by level, this might mean leaving white space at the bottom of pages that describe lower levels (which may contain less), and using a smaller font on pages that describe higher levels to keep all the information on one page (Ontario's Level Descriptions do this well). Also, in some layouts it is advisable to use two-page spreads to advantage (e.g., England's Adult Numeracy Curriculum, America's Equipped for the Future Content Standards).

It is interesting to note that England's Adult Numeracy Core Curriculum is the only numeracy framework in this report that is published in its own document, separate from the system's literacy framework. All other numeracy frameworks are published in one document together with the literacy framework. This separation is attractive because it would allow the numeracy framework to develop at its own pace, but separation from the literacy framework might mean that the numeracy framework is less well-distributed, and might imply more of a separation between literacy and numeracy than is constructive.

Distribution

Every person who is expected to use the framework should have a hard copy of the document. This may be an expensive proposition, but it is difficult to recommend anything else, even when the document is available for download from the internet. England's curriculum is available free – a copy was even mailed to Canada for free. Australia's NRS and CGEA must be purchased – even by users (often this is done with program funds). Though a spiral-bound document with a sturdy cover is recommended, perhaps to save money, a unbound version on three-holed paper with pre-printed tabs could be published, and practitioners could supply their own binders (this has been done with Australia's CGEA).

Terminology

Each document's terms reflect the creators' philosophies, and adopting this common terminology is one of the most important tasks of the documents' users. Most frameworks have at least a co-purpose of facilitating conversation and understanding among practitioners, processes that require the framework's terms to be precise and consistently used. For example, if something is first called a "skill," it shouldn't be referred to later as a "competency" or "ability." In the context of frameworks for adult numeracy education, it is not poor style to use the same word many times. Meticulous editing of the document that contains the framework can help to achieve this.

One cannot assume that central terms, even when used consistently, will be understood. Though most are everyday words, they are given specialized meanings, not only in the field of numeracy, but in each framework. For example, consider the term 'domain': in Ontario's Level Descriptions, all of numeracy is a 'domain' (the other two domains of adult basic education are Communications, and Self-Management and Self-Direction); in Australia's CGEA, a 'domain' is a subdivision of numeracy (the four domains are numeracy for practical purposes, numeracy for personal organization, numeracy for interpreting society, and numeracy for knowledge) (p. 214)). As well as one term meaning different things in different frameworks, the same things in two frameworks may be known by different terms. For example, what are sometimes known as math strands (e.g., number sense, measurement, geometry, data) are called 'component learning outcomes' in Ontario's framework, and 'curriculum elements' in England's framework. Explaining important terms in the introduction to a framework, and including a glossary with it, will help users to understand.

Some terms in a numeracy framework have been used to maintain common terminology with a system's literacy framework. For example, the titles of the four categories of learning outcomes in Australia's CGEA numeracy curriculum were chosen to echo the four categories in its literacy curriculum, and the terms 'Features' and 'Performance Indicators' that name the subdivisions of the numeracy framework of the Level Descriptions in Ontario were chosen to echo the four categories in its literacy framework. Sometimes these terms are ill-fitting when applied to numeracy. It may be advisable to weigh the advantages of having parallel terminology between the two frameworks against the disadvantages of having ill-fitting headings in the numeracy framework. Of course, this point will be moot if the process of developing a numeracy framework establishes that numeracy should be subdivided differently from literacy.

The framework document will be referred to countless times, so it needs to have a simple, short name. One difficulty with Ontario's matrix of learning outcomes is its lack of a simple title. The matrix appears in a document called 'Working with Learning Outcomes,' a title that did not lend itself to be used to refer to the framework. So the table that presented the framework came to be called 'the matrix,' which was handy in the circles in which it was known, but it was not official or ubiquitous, so was not ideal. A solid 'handle' for a framework is helpful.

Include a section called 'Introduction to this document'

State that the purpose of the document is to present the framework, to be consulted often – to get dog-eared. First time users should definitely read the introductory parts, and regular users will probably find it useful to revisit them regularly. State that the framework is to be used in a variety of ways, so it is presented in several different layouts in the document. Also, identify the other formats that the framework is presented in, outside the document (e.g., a poster, a Web site) and give access information.

Include a section called 'Understanding the framework'

Explain the purpose(s) of the framework. Explain the structure and underlying principles or theories, and define the terms used. Explain where the framework was shaped by practical considerations, and where it was shaped by a theory or principles.

Include a section called 'Using the framework'

Identify the potential users of the document, and describe how each type of user might use the framework. Some potential users are administrators, tutors/teachers/instructors, learners, government staff, materials developers, researchers, employers, social services staff. For example: administrators may use the document when assessing learners, to collect program data, to design courses, to conduct professional development, to propose development projects; teachers may use the framework when assessing learners, planning instruction, setting goals, discussing with colleagues. Then, still more specific examples of use would be helpful.

Include a glossary

Define in a glossary any math terms, other specialized terms and acronyms that are used, and explain any theories, principles, philosophies or approaches that are mentioned.

Include 'crosswalks'

This is an American term used to refer to a relating of the levels of one system to the levels of another. One might picture two buildings placed side-by-side, with crosswalks allowing passage between them where their floors are at the same height. British Columbia has an 'articulation handbook' to identify equivalencies between systems.

Australia negotiates ‘translation agreements’ regularly between representatives of each system. A table describing these might be called an ‘equivalency grid.’

Include a section called ‘How this framework was developed’

Briefly describe who made the framework and how, and why it was done this way. More detail about the process would be interesting, but perhaps is best written up in a separate document, to which readers can be referred.

Include a section called ‘Evaluating this document’

Arising out of the description of the development stages will be the fact that the framework will be reviewed regularly, and users should be invited to contribute to this process through a variety of channels, as mentioned elsewhere in this report. How this process of reviewing and evaluating the framework can be considered research into adult numeracy education may also be explained.

Include a list of references

Include materials referred to in the document, and materials for further reading.

Closing

It is now, in the summer of 2003, a lively time for the Literacy and Basic Skills Program in Ontario to be reviewing its numeracy framework. Around the world, several governments and programs are planning to create their first frameworks for adult numeracy, others are almost finished this process, and still others are several years into a process of using and revising their frameworks. Here in Canada, our discussion may soon go national; the National Literacy Action Agenda of the Movement for Canadian Literacy calls for the federal and provincial governments to commit themselves to a “pan-Canadian literacy / basic education strategy”, including standards and accountability measures.

References

ABE Florida (accessed May 5, 2003). www.abeflorida.org

Adult, Community and Further Education Board (2002). *Certificates in General Education for Adults*. Melbourne: Language Australia.

Adult Numeracy Practitioners Network (now Adult Numeracy Network) (1996). *A Framework for Adult Numeracy Standards: The Mathematical Skills and Abilities Adults Need to be Equipped for the Future*.

Basic Skills Agency (2001). *Adult Numeracy Core Curriculum*. London: Department for Education and Skills.

Bingman, M. (2000). *Outcomes of Participation in Adult Basic Education: the importance of learners' perspectives*. Cambridge, MA: National Center for the Study of Adult Literacy and Learning, Harvard Graduate School of Education.

Bransford, J. D., Brown, A. L., Cocking, R. R., Eds. (1999). *How People Learn: Brain, Mind, Experience, and School*. Washington, DC; National Academy Press.

Brooks, G., Giles, K., Harman, J., Kendall, S., Rees, F., Whittaker, S. (2001). *Assembling the Fragments: A review of research on adult basic skills*. London: Department for Education and Employment. Research Brief retrieved May 8, 2003, from <http://www.dfes.gov.uk/readwriteplus/bank/AssemblingFragments.doc>

CASAS (2003). *CASAS and NRS Levels*. Retrieved May 6, 2003, from http://www.casas.org/Downloads/ftp2.cfm/CA_Benchmark_charts.pdf

CASAS (1998). *Assessing Adult Learners' Skills: Why CASAS Scaled Scores Are Better Than Grade Level Equivalents*. Retrieved May 6, 2003, from http://www.casas.org/Downloads/ftp2.cfm/Grade_level_vs_scaled.pdf

Center for Adult Learning Educational Credentials (2003a). *What's New? Mathematics*. Retrieved May 6, 2003, from http://www.acenet.edu/calec/ged/whatsNew_MM_A.cfm

Center for Adult Learning Educational Credentials (2003b). *Test Specifications*. Retrieved May, 2003, from <http://www.acenet.edu/calec/ged/specs-A.cfm>

Ciancone, T. (2000). Learning Outcomes: Skills or Function? In *Adults Learning Maths Newsletter* (9). England.

Coates, S., Fitzpatrick, L., McKenna, A. & Makin, A. (1995). *National Reporting System: A mechanism for reporting outcomes of adult English language, literacy and numeracy programs*. Canberra, Australia: Department of Employment, Education and Training and Australian National Training Authority.

Coben, D. (2003). *Adult Numeracy: Review of research and related literature*. London: National Research and Development Centre for Adult Literacy and Numeracy.

- Coben, D. (2001). Fact, fiction and moral panic: The changing adult numeracy curriculum in England. In G. FitzSimons, J. O'Donoghue & D. Coben (Eds.), *Adult and Lifelong Education in Mathematics* (pp. 125-153). Melbourne: Adults Learning Mathematics.
- Coben, D. (2000). Numeracy, mathematics, and adult learning. In I. Gal. (Ed.), *Adult Numeracy Development: Theory, research, practice* (pp. 33-50). Cresskill, New Jersey: Hampton Press.
- Communities Scotland (2003). *National Training Project for Adult Literacies Newsletter* (March 2003, Issue 13). Retrieved June 23, 2003, from <http://www.communitiesscotland.gov.uk/communities/upload/23a14.doc>.
- Condelli, L., Padilla, V., Angeles, J. (1999). *Report of the Pilot Test for the National Reporting System for Adult Education*. Washington, DC: Pelavin Research Center, American Institutes for Research. Department for Adult Education and Literacy?
- Cumming, J. & Gal, I. (2000). Assessment in adult numeracy education. In I. Gal (Ed.), *Adult Numeracy Development: Theory, research, practice* (pp. 305-333). Cresskill, New Jersey: Hampton Press.
- Department for Education and Employment (1999). *A Fresh Start: Improving literacy and numeracy* (The report of the working group chaired by Sir Claus Moser). London.
- Department for Education and Skills (2003). *A Guide to the National Tests in Adult Literacy and Numeracy: Giving adults the opportunity to prove their skills and gain a national qualification in literacy and numeracy*. Retrieved May 8, from <http://www.dfes.gov.uk/readwriteplus/NationalTestLeaflet>.
- Department for Education and Skills (2002). *Pathfinders: Lessons for success*. London.
- Department for Education and Skills (2001). *Skills for Life: The national strategy for improving adult literacy and numeracy skills*. Nottingham, England.
- Derrick, J. (2001). Report on the NATFHE/NIACE Conference on Basic Skills, May 9th, 2001. In *Signposts: London Pathfinder Newsletter*, (2). London. Retrieved October 6, 2003, from http://www.talent.ac.uk/upload/teacher_materials/337_1737590.pdf.
- Division of Adult Education and Literacy, Office of Vocational and Adult Education, U.S. Department of Education (2001). *The National Reporting System for Adult Education: Implementation guidelines*.
- Division of Adult Education and Literacy, Office of Vocational and Adult Education, U.S. Department of Education (1999). *Guide for the Development of a State Plan Under Title II (Adult Education and Literacy) of the Workforce Investment Act of 1998*.
- EFF Assessment Consortium (2002). *EFF/NRS Data Collection Project, 2000-2001: An interim report of the development of the EFF assessment framework*. Washington, DC: National Institute for Literacy.
- Ellerton, N. & Clements, M. (1992). Some pluses and minuses of radical constructivism in mathematics education. In *Mathematics Research Journal*, 4(2), 1-22.

Gal, I., van Groenestijn, M., Manly, M., Schmitt, M. J., and Tout, D. (1999). *Adult Literacy and Lifeskills Survey: Numeracy Framework: Working Draft*. Available: <http://www.ets.org/all/>.

Ginsburg, L. and Gal, I. (1996). *Instructional Strategies for teaching Adult Numeracy Skills*. Philadelphia: National Centre on Adult Literacy.

Hagston, J. (2002). *Aligning the Certificate in General Education for Adults (CGEA) to the National Reporting System*. Melbourne: ARIS.

Hartman, A. J. & Pugsley, R. (1999). A letter posted on the NIFL-4EFF 1999 discussion of the National Institute for Literacy on November 1, 1999. Retrieved October 14, 2003 from <http://www.nifl.gov/nifl-4eff/1999/0179.html>.

Keenan, C. (2001). *The NRS: What does it have to do with teaching?* Pennsylvania Staff Handbook. Commonwealth of Pennsylvania. Available: http://www.brown.edu/Departments/Sweaver_Center/Literacy_Resources/standards.html

Johnston, B. (2002). *Numeracy in the Making: twenty years of Australian adult numeracy*. An investigation by the New South Wales Centre, Adult Literacy and Numeracy Australian Research Consortium. University of Technology, Sydney.

Johnston, B. (1994). Critical numeracy? In *Fine Print*, Vol. 16, No. 4, pp. 32-36.

Kutner, M., Webb, L., Matheson, N. (1996). *A Review of Statewide Learner Competency and Assessment Systems*. Washington, DC: Pelavin Research Institute. Available from <http://www.air.org/publications/publications-set.htm>.

Literacy and Basic Skills Section (2000). *Common assessment in the Literacy and Basic Skills Program*. Toronto: Queen's Printer for Ontario.

Literacy and Basic Skills Section (2000). *Setting the Agenda: the Ontario literacy research strategy*. Toronto: Queen's Printer for Ontario.

Literacy and Basic Skills Section (1998). *Working with learning outcomes: Validation draft*. Toronto: Queen's Printer for Ontario.

Marr, B., Helme, S., Tout, D. (2003). *Rethinking Assessment: Strategies for holistic adult numeracy assessment*. Melbourne: Language Australia.

Marr, B., Wallace-Clancy, L., Smith, P., Halliday, P., & Goddard, R. (1998). *The evaluation of the effectiveness of the mathematics and numeracy stream of the certificates of general education for adults*. Unpublished report.

McGuirk, J. (2001). *Adult literacy and numeracy practices 2001: A national snapshot*. Australia: Department of Education Training and Youth Affairs.

Merrifield, J. & McSkeane, L. (2002). *Mapping the Learning Journey: NALA Assessment Framework for Literacy and Numeracy*. Cork, Ireland: National Adult Literacy Agency.

Merrifield, J., Coleman, U., & McDonogh, O. (2001). *Issues and Opportunities in Assessment*. Report prepared for Ireland's National Adult Literacy Agency. London: Learning from Experience Trust.

Merrifield, J. (2000). *Equipped for the Future Research Report: Building the Framework*. Washington, DC: National Institute for Literacy.

Movement for Canadian Literacy (2003). Federal Budget 2003: Literacy community still waiting for meaningful federal commitments. *Literacy Facts: An update on literacy-related events at the national level* (March 2003) 2003. Retrieved June 9, 2003 from <http://www.literacy.ca/public/litfacts/march03/page2.htm>.

Movement for Canadian Literacy (2003). *literacy.ca*, 5(3). Fall 2003.

Movement for Canadian Literacy (2003a). *Advancing Literacy in Canada: An Urgent Call to Action: Recommendations for the House of Commons Standing Committee on Finance*. Ottawa: MCL. Retrieved October 17, 2003 from <http://www.literacy.ca/govrel/advancing/cover.htm>.

Movement for Canadian Literacy, ABC CANADA Foundation, National Adult Literacy Database, Frontier College, Laubach Literacy Canada, Federation canadienne pour l'alphabetisation en français (2002). *Building a Pan-Canadian Strategy on Literacy and Essential Skills: Recommendations for the Federal Government*. Retrieved June 9, 2003 from <http://www.literacy.ca/govrel/building/cover.htm>.

National Adult Literacy Agency (2003). *Tutor Bulletin*, Summer 2003. Cork: NALA.

National Council of Teachers of Mathematics (2000). *Principles and Standards for School Mathematics*. Reston, Virginia: Key Curriculum Press.

National Institute of Adult Continuing Education (2001). *Skills for Life: The National strategy for improving adult literacy and numeracy skills: A final NIACE response*. Retrieved May 7, 2003, from <http://www.niace.org.uk/Organisation/advocacy/skillsforlife/Default.htm>

National Research Council (2002). *Performance assessments for adult education: Exploring the measurement issues, Report of a workshop*. Committee for the Workshop on Alternatives for Assessing Adult Education and Literacy Programs, R. J. Mislevy and K. T. Knowles (Eds.), Board on Testing and Assessment, Centre for Education, Division of Behavioral and Social Sciences and Education. Washington, D.C.: National Academy Press.

O'Donoghue, J. (2003). Mathematics or Numeracy: Does it really matter? In *Adults Learning Maths Newsletter* (18). England.

Organisation for Economic Co-operation and Development (2001). *The Well-being of Nations: The Role of Human and Social Capital*. Paris.

Osborne, A. (1996). *Recognizing and Accrediting the learning of adult literacy students: A case study of one community organization's work toward an equitable assessment of adult literacy learning experiences*. Master's Thesis, Queen's University, Kingston, Ontario.

- Perrin, B. (1998). *Findings and Implications of the Field Trials of Learning Outcomes: A provincial overview*. Toronto. Retrieved August 4, 2003, from <http://alphaplus.ca/opnhs/english/SiteList.asp?IndNm=99>.
- Qualifications and Curriculum Authority (2000). *National Standards for Adult Literacy and Numeracy*. London: Qualifications and Curriculum Authority.
- Scottish Qualifications Authority (2003). *Core Skills Framework: An introduction (Numeracy)*. Glasgow. Retrieved June 23, 2003, from http://www.sqa.org.uk/sqa/sqa_pageView.jsp?p_service=Content.show&pContentID=322&p_aplic=CCC&.
- Scottish Executive (2001). *Adult Literacy and Numeracy in Scotland*. Edinburgh. Retrieved June 23, 2003 from <http://www.scotland.gov.uk/library3/lifelong/alan-00.asp>.
- Secretary's Commission on Achieving Necessary Skills (1991). *What Work Requires of Schools*. Washington, D.C.: U.S. Department of Labor. Retrieved Feb. 2, 2003, from <http://www.wdr.doleta.gov/SCANS/whatwork>
- Secretary's Commission on Achieving Necessary Skills (1992). *Learning a Living: A Blueprint for High Performance*. Washington, D.C.: U.S. Department of Labor. Retrieved Feb. 2, 2003, from <http://www.wdr.doleta.gov/SCANS/lal>
- South African Working Group on Level Descriptors (2001). Development of level descriptors for the National Qualifications Framework. Retrieved June 24, 2003, from <http://www.saqa.org.za/publications/legsregs/notices/2001/not1247.html>.
- Smith, D. (2001). Adult Numeracy Teaching – An Australian Focus on Social Contexts. In *Proceedings of ALM-7, the Seventh International Conference of Adults Learning Mathematics – A Research Forum*. Cambridge, MA: National Centre for the Study of Adult Learning and Literacy.
- Stein, S. (1999). Equipped for the Future: The Evolution of a Standards-based approach to system reform. In *Focus on Basics*, 3(C).
- Stein, S. (2001). *Equipped for the Future Content Standards: What adults need to know and be able to do in the 21st century*. Washington, DC: National Institute for Literacy.
- Sticht, T. (1999a). *Testing and Accountability in Adult Education: Focus on Workplace Literacy Resources for Program Design, Assessment, Testing and Evaluation*. El Cajon, California: Applied Behavioral and Cognitive Sciences, Inc.
- Sticht, T. (1999, October 5). NLA Discussion: SCANS. *Message posted to National Literacy Advocacy Discussion List, Oct. 5, 1999*. available: <http://literacy.nifl.gov/nifl-nla/1999/>
- Sticht, T. (2001). *A Radical Idea: Let's treat adults as adults!* Research Note 6/9/01. Retrieved Nov. 17, 2002 from <http://www.nald.ca/fulltext/sticht/june01>.
- Sticht, T. (2001). *Reforming Adult Literacy Education: Transforming local programs into national systems in Canada, the United Kingdom and the United States*. www.nald.ca/fulltext/sticht/reformin.

Stites, R. (1999). A User's Guide to Standards-Based Educational Reform: From theory to practice. In *Focus on Basics*, 3(C).

Title II: Adult Education and Family Literacy Act, Workforce Preparation Act of 1998. United States. Available: <http://www.ed.gov/offices/OVAE/AdultEd/legis.html>

Wagner, D. A. (1993). *Myths and Misconceptions in Adult Literacy: A research and development perspective*. Philadelphia: National Centre on Adult Literacy.