

Numbers Talk

A Cross-sector Investigation of
Best Practices in LBS Numeracy

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Ensure that the learner realizes that math is a process. Math is like grammar or auto mechanics or weaving in that it is just a box of tools that help us all function. It is not about being smart; it is about being better equipped. My role as an instructor is like the "Snap-On Tool" man for garages. I don't teach a better way of fixing cars, just how to use the tools in a smarter way.

LBS Numeracy Teacher, November, 2000

Numeracy is about expanding the lens through which we view the world...it's about thinking mathematically, making connections. A narrow focus on what skills are needed for the workplace now will get you nowhere.

Dr. Marian Small

from the *Summary of Proceedings of the Numeracy Roundtable*, March 2000

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Acknowledgements

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Near the beginning of the project Dee Goforth was an excellent reference person with regard to the development and refinement of the project questionnaire, which many of you completed.

On that note, I wish to thank all of you across the sectors of the province who took the time to read, write, and return the questionnaire regarding your program's best practices in numeracy. The questionnaires became a province-wide, sector-wide snapshot of what you are all doing successfully in your LBS numeracy programs.

I thank those teachers and learners who allowed me to visit their sites. They shared a great deal of useful information with me about what works well in their programs, adding much to the reading and interpretation of the questionnaires.

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Acknowledgements

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Finally, I wish to acknowledge the contribution of the College Sector Committee members and the northern LBS college teachers for their feedback during the meetings we had throughout the project. This provided me with valuable collaboration much needed in a project such as this.

It is my sincere hope that you will find this manual to be a positive, readable, interesting overview of adult numeracy programming, both inside and outside of Ontario.

*Barbara Glass
Canadore College, North Bay, Ontario*

The mandate of the Numeracy Best Practices project was to produce a manual of relevant research and best practices with reference to adult numeracy programming, both in LBS and elsewhere in the world. This manual, *Numbers Talk*, is meant to be a readable, informative document containing input from both abroad and within Ontario. Recognition of what is working well here in LBS and awareness of what other countries are addressing in their adult numeracy programs provides a comparative basis for further development in LBS numeracy programming.

The project was intended to involve and benefit all three sectors of LBS across Ontario: community-based, school board and college programs, as well as administrators and policy makers involved in LBS. One of the most challenging parts of the project was establishing contact with numeracy practitioners across all of the sectors. With more than 200 funded anglophone LBS programs in the province, this was indeed an undertaking. The methodology of the questionnaire and its distribution is discussed in more detail in the **Common Denominators** section of this manual.

The findings of the project questionnaire show definitively that LBS numeracy programs across all sectors recognize and value the characteristics of adult learners. Program environment and delivery attempt to address many strategies for teaching adult learners. While best practices specific to numeracy are not always stated, practices related to effective adult education abound.

While the responses of the project questionnaire provided insights into best practices in LBS numeracy, the international research allowed an interesting comparison of adult

numeracy programming throughout many parts of the world including the United Kingdom, the United States, Tasmania and Australia. The definitions of numeracy worldwide speak to the growing understanding that numeracy is a tool through which people communicate, just as language is. Communicating through skills in numeracy is based largely upon numeric symbols, rather than alpha ones, but both literacy and numeracy require a significant degree of confidence and critical thinking in order to communicate effectively and to accurately interpret incoming information.

Near the end of this manual are two evaluation forms in the **Transformations** section. One is a self-evaluation form for LBS numeracy programs, while the other is an evaluation form for this manual, **Numbers Talk**. Programs completing the self-evaluation form will have the opportunity to reflect on their strengths in delivering numeracy in LBS, as well as considering areas in which more attention may be beneficial. Individuals completing the evaluation of the manual will provide essential feedback for future endeavors into project publications such as this. Recommendations from the project questionnaire for future directions in LBS numeracy programming are also included in the **Transformations** section.

The items found under **Data Management** include the project questionnaire, a practitioner contact list, and a reference list.

We need to find out what we already know about numeracy teaching and what we want to learn about numeracy teaching. Then we can set out to learn it!

Numeracy – Best Practices and Innovations Bulletin, Spring 2000.

Numeracy Equals...

Definitions of Numeracy Based on Current Research

To be numerate is to have and be able to use appropriate mathematical knowledge, understanding, skills, intuition and experience whenever they are needed in everyday life. Numeracy is more than just being able to manipulate numbers.

As students become increasingly numerate, they should develop more confidence and therefore feel more comfortable when they confront the mathematical demands of everyday life.

Numerate Students – Numerate Adults
Department of Education, Tasmania, 1995

Numeracy Equals... Definitions of Numeracy Based On Current Research

Before delving into the concept of numeracy, consider its counterpart, “innumeracy”. What does that term bring to mind? The American mathematician John Allen Paulos (1988) defines innumeracy as “*an inability to deal comfortably with the fundamental notions of numbers and chance.*” If someone is “innumerate”, then, what is it that she/he can not do? Write cheques? Calculate tips? Interpret statistics in the news? Calculate a batting average? Measure the floor area of a room? These activities, and so many others encountered in day-to-day living, involve the ability to “deal comfortably” with numbers and their applications.

If one agrees that being “innumerate” implies an inability to deal with quantitative situations arising in everyday life, then being numerate must logically imply a level of competence in dealing with just such situations. Numerate individuals possess a level of comfort with and understanding of numbers and computation which enables them to deal effectively with common quantitative situations related to everyday life.

Now, if that seems to be a cumbersome description of numeracy, consider the 1959 definition of numeracy in the United Kingdom's Crowther Report:

[Numeracy involves] an understanding of the scientific approach to the study of phenomena – observation, hypothesis, experiment, verification ... the need in the modern world to think quantitatively, to realise how far our problems are problems of degree even when they appear as problems of kind.

Fortunately, the definition(s) of numeracy have become more clearly defined since 1959.

How many definitions of numeracy are there? There may not be a finite answer to that question! Despite the variety of ways in which numeracy is defined, common factors do

Numeracy Equals... Definitions of Numeracy Based On Current Research

prevail in those many definitions. The words “mathematics” and “everyday life” are among those often appearing in definitions of numeracy. Could one then consider numeracy to be the essential mathematics necessary to make sense of everyday life situations? In a 2000 presentation to the Literacy and Basic Skills (LBS) Numeracy Working Group, John Stanley of the MTCU offered the perception that, *“Numeracy is the bridge between mathematics and the world”*. Implicit in that is the notion that “mathematics” as such is not readily connected with the everyday-life world, but that numeracy provides that connection.

In keeping with the perception that numeracy can be viewed as a bridge for travelers on the adult education path, following is a selection of recent definitions of numeracy, some more colourful than others. These thought-provoking excerpts represent various international voices including those from Australia, Tasmania, the United Kingdom, the United States, and Canada.

Australia

To be numerate is to use mathematics effectively to meet the general demands of life at home, in paid work, and for participation in community and civic life. (Australian Association of Mathematics Teachers, 1998)

Tasmania

To be numerate is to have and be able to use appropriate mathematical knowledge, understanding, skills, intuition and experience whenever they are needed in everyday life. (Nurate Students – Nurate Adults, 1995)

United Kingdom

[Numeracy implies] an ‘at-homeness’ with all those facets of mathematics that enable a person to cope with the practical demands of everyday life...an ability to understand information presented in mathematical terms – for instance a graph, chart or table. (Mathematics Counts, 1986)

Numeracy Equals... Definitions of Numeracy Based On Current Research

International Life Skills Survey, Numeracy Working Group

[Numeracy involves] the knowledge and skills required to effectively manage the mathematical demands of diverse situations...numerate behaviour is observed when people manage a situation or solve a problem in a real context. (International Life Skills Survey, as quoted in Noss's New Numeracies for a Technological Culture, 1998)

Canada

It's the ability to put numbers together with a minimum of effort and the ability to look at those numbers and see if they make sense. (Ron Dunkley, Toronto Star, Sept. 24/00)

Today's numeracy is being able to make intelligent judgments about numbers. (Ed Barbeau, Toronto Star, Sept. 24/00)

And for a more symbolic representation, below is an adaptation of a definition of numeracy first suggested by Lisa Hagedorn of the Ottawa-Carlton District School Board:

Numeracy = (Computation + Confidence) x Context

All of those definitions above imply a purposeful connection between numbers and everyday-life situations and, importantly, an ability to distinguish between instances where the numbers make sense and where they do not. For example, "Have I received the right change for a purchase?", or "What should the GST be on an item costing \$1000?" Seven dollars? Seventy dollars? Even seven hundred dollars? Yes, even seven hundred dollars! This author, and certainly most numeracy educators, have seen some hypothetical businesses make phenomenal profits as a result of learners putting the decimal in the wrong place in a calculation such as the one above. When asked, "Does the answer make sense?", many learners recognize that on a \$1000 purchase, \$700 tax is totally unreasonable. Part of the object of numeracy instruction, then, must be to help the learner automatically and consistently ask him/herself, "Does the answer make sense?" In other words, numerate

Numeracy Equals... Definitions of Numeracy Based On Current Research

thinking includes a good dose of common sense and the self-confidence to question numbers and calculations in everyday situations.

In addition to the terms “mathematics” and “everyday life”, the notion of mathematics as a means of communication pervades many commentaries on numeracy. Although not a working definition of numeracy, Lynn Arthur Steen (1990) of St. Olaf University makes a valid observation:

Numeracy is to mathematics as literacy is to language. Each represents a distinctive means of communication that is indispensable to civilized life.

Australian numeracy educator Betty Johnson (1994) also encapsulates this:

...just as to be literate is to have a capacity for dealing with language in some way, so to be numerate could be seen as having a capacity for dealing with mathematics in some way.

If mathematics is a means of communication, then the scope of our mathematical discussions is a function of the concepts of mathematical “grammar” we can comfortably and accurately use. In other words, the degree to which one is “numerate” is a reflection of one’s ability to send, receive and analyze number-based correspondence.

The communication skills associated with literacy may be refined into such categories as listening, speaking, reading and writing. This facilitates the creation of a more manageable framework for delivering those literacy skills. Similarly, the concepts and skills associated with numeracy necessarily become much further qualified. Different “categories” or “subdivisions” of numeracy emerge to allow for the creation of a manageable, sensible

Numeracy Equals... Definitions of Numeracy Based On Current Research

framework for delivering numeracy education. In a general sense, Steen identifies five categories of numeracy, each linked directly to its use or application. These include practical numeracy, civic numeracy, professional numeracy, numeracy for leisure, and cultural numeracy. Similarly John Dingwall, in his March 2000 report, *Improving Numeracy in Canada*, identifies five purposes for numeracy: everyday-life, community, work-related, personal organization and further learning.

Both Steen's and Dingwall's categories of numeracy can be readily translated into the strands, themes or domains of the various international delivery frameworks for adult numeracy, including that of LBS. (The following section of this manual presents those various frameworks.) Whatever term is used, these subdivisions of numeracy remain necessarily linked to the "everyday-life" application or goal to which the numeracy skills are being applied.

The current concept of numeracy, then, refers not only to the ability to confidently compute and interpret numbers in everyday situations but also encompasses the usefulness and "essentialness" of numbers as a vehicle to communicate vast amounts of information related to everyday life. The "math memos" of life include bills, cheques, measuring tasks, interest rate information, and statistics, to name only a few. The ongoing task of LBS numeracy practitioners is to open (or re-open) the lines of number-based communication and help learners realize that the language of numbers is composed of patterns and sensible applications to real-life, not just an unending list of seemingly inconsistent rules to be memorized by rote. Then, Paulos's "innumerate" citizen will begin to cross the bridge into the attainable and essential destination of numerate thinking.

Communicating via numbers is indispensable to civilized life. After all, money talks!

Basic Operations...

Current Research on Adult Numeracy Programming

Relatively speaking, there isn't much research on adult learning in numeracy, but we do know there is low participation in programs and that there are barriers to participation such as gender, so we must determine how to bring people in.

John Dingwall

from the *Summary of Proceedings of the Numeracy Roundtable, 2000*

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Research specific to adult numeracy programming is a growing entity. More countries are recognizing the importance of numeracy and literacy programming for adults and some have made it a significant national priority. The efforts of such countries have resulted in the creation of detailed, well-organized documents outlining the frameworks or models of program design and the underlying philosophy.

In March 2000, a group of educators from across Canada were invited to attend a *Numeracy Roundtable* at Queen's University in Kingston, Ontario. In her welcoming remarks Christiane Dodge, Director of the National Literacy Secretariat, conveyed her hope that participants “learn more about the issues, challenges and future directions of numeracy work in order to develop, deliver and promote it across Canada”. The resulting *Summary of Proceedings* (2000) of the *Numeracy Roundtable* outlines a number of key questions posed and the collective responses of the participants. The questions for discussion were grouped into eight categories: Factors for Success—Challenges and Problems; Accountability and Testing; Workplace/Partnerships; Teacher Education; The Role of Technology; Professional Development Networks and Conferences; Curriculum Development Priorities; and Research Priorities.

Events such as the *Numeracy Roundtable* enable educators from a number of institutions and agencies to pool their resources, both literally and figuratively, to increase awareness of issues relevant to adult numeracy programming. In addition, the Roundtable may provide groundwork for the creation of a national strategy and framework for adult numeracy education in Canada.

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The focus of this research section is to report on existing and emerging frameworks in the area of international adult numeracy education. It is organized into two sections, each attempting to address one of the following questions:

What strategies promote the effective delivery of numeracy training to adults?

and

What are the principles of best numeracy practice in adult education?

A large part of the research for this project involved Internet searches and subsequent follow-up in the form of emails, letters, and telephone calls. Undertaking research on the Internet, for the generation that has primarily accessed print-based sources, is in itself a challenge at times! The wealth of information provided in any search, even with narrow criteria, can be overwhelming. A distinct advantage, though, of Internet-based research, is the ready access to international studies, publications, and related websites.

Research on adult numeracy reveals that some countries have invested considerable time and expertise in creating numeracy education definitions, guidelines and strategies for implementation. These countries principally include Australia, the United States, the United Kingdom and Canada. In addition to the national Australian framework, programming and guidelines from the Australian state of Tasmania are extensive.

The Tasmanian work resulted in a 1995 numeracy policy document entitled, *Numerate Students-Numerate Adults*. Although the target audience of that publication is “math” teachers in general, not just adult educators, the content links closely to the national

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Australian model and addresses many of the same issues around numeracy curricula as have been identified both in the Australian and American work. Here in Ontario and in other provinces, provincial standards and outcomes for adult numeracy training have been developed, but provincial efforts have not yet been articulated at the national level.

With reference to both questions posed earlier, the effective strategies and best practices for adult numeracy programming are necessarily linked to the frameworks in place to deliver the adult numeracy curriculum. As a result, in deriving an answer to those questions, the frameworks of the Australian/Tasmanian, American, British (U.K.) and Canadian (Ontario) models are discussed here. Certainly common strands in all those models exist; all have similar definitions of numeracy, and all have created themes related to numeracy content and delivery, not unlike the component learning outcomes that are in place in Ontario LBS programming. For clarity, the information regarding international themes in adult numeracy programming has been organized into chart form (see over - Table 1). For interest and efficiency of comparison, the Ontario LBS model has been included in the chart even though it is not a “national” representation.

What strategies promote effective delivery of numeracy training to adults?

Strategies for effective adult numeracy training must come from the thoughtful, informed development of themes for programming. A sensible, meaningful set of themes will assist in guiding practitioners to develop practical, reasonable, and applicable learning outcomes and related activities. While effective strategies for adult numeracy programming are not itemized as such in many of the current publications, it is obvious that the development of relevant themes in adult numeracy education is in itself an essential

Table 1: ***International Themes For Numeracy Programming***

Canada (Ontario)	United States	United Kingdom	Tasmania	Australia
Use Number Sense and Computation	Number/Number Sense Algebra	Number/Number System	Numbers in Everyday Life Relationships (Algebra) in Everyday Life	Numeracy For Personal Organization Numeracy For Knowledge
Use Measurement for Various Purposes	Geometry: Spatial Sense and Measurement	Measures, Shape and Space	Measurement in Everyday Life	Numeracy For Practical Purposes: Measuring
Solve Geometric Problems	Geometry: Perimeter, Area, Volume, Angles, Pi	Measures, Shape and Space	Space in Everyday Life	Numeracy For Practical Purposes: Design
Manage Data and Probability	Data	Handling Data	Chance and Data in Everyday Life	Numeracy For Interpreting Society: Data and Numerical Information
Self-Management Self-Direction	Relevance/Connections Problem Solving/ Reasoning/Decision Making Communication	(embedded in content themes)	Attitudes and Appreciation Mathematical Inquiry Choosing and Using Mathematics	(embedded in content themes)

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strategy. The creation of numeracy themes provides a basis for developing sound curriculum at various levels to meet the wide variety of goals of adult learners.

The comparison of the various adult numeracy frameworks in this research section is based on two general elements: the language used to itemize the themes in the frameworks, and the attention to processes and/or skills related to adult learning in numeracy. These would include reasoning, problem-solving, self-management, decision-making and communication, to name just a few. (Themes or strands refer to the general headings of numeracy content within each framework. In LBS documents these themes are sometimes referred to as “component learning outcomes”.)

Table 1 is organized to show a comparison of the themes that exist in five adult numeracy frameworks. What becomes apparent in reading across the table is that although the wording of the themes changes, the underlying content is similar across all these international models.

An interesting comparison of two of these international approaches to numeracy education resulted in a workshop at the July 2000 *Adults Learning Mathematics* conference in Boston, Massachusetts. The workshop was entitled, “Learning Outcomes: Skill or Function?” It involved co-facilitators Dave Tout, a well-known Australian adult numeracy educator and Tom Ciancone, a veteran LBS numeracy practitioner from Toronto. Their workshop addressed two different approaches for establishing numeracy programming: skills-based outcomes (Ontario-LBS) and outcomes focusing on the social purpose and use of mathematics (Australia). Further in this research section the relationship of each of these approaches to the other international models is explored.

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When looking specifically at the language used to derive the content strands or themes in the Ontario LBS model (see Table 1) it is apparent that each begins with a verb: “use”, “solve” and “manage”. This implies that not only is content important but also the ability to do something with it. The verbs begin to indicate a link between knowledge and application but fall short of clearly stating the purpose for learning the associated content, i.e. the application. In the LBS *Level Descriptions Manual* (2000) produced by the Ontario Literacy Coalition, the use of effective application is emphasized, even though it is not clearly stated in the actual themes.

Practitioners should remember that...they should focus on only those outcomes, features, and performance indicators that are relevant to a learner and his/her goal. The applications of the skills are to be relevant to the learner's goals, and to become more complex and applied to a greater variety of situations as the learner advances through the [LBS] levels.

Traditionally in LBS programming, in any subject area, practitioners have formally or informally addressed process skills such as time management, organization, concentration and memory skills, to name just a few. Also within the recent, *Level Descriptions Manual* (2000), a variety of process skills have been grouped into a separate domain known as “Self-Management and Self-Direction”.

The skills in the domain of self-management and self-direction complement the other learning outcomes in the domains of communications and numeracy. The features of this domain contain the elements that surround and support learning. They are not intended as a curriculum or a list to be ‘covered’ within a program. Rather, they are elements that may help or hinder a person's ability to work toward a learning goal.

Progressing toward a learning goal is closely linked to the development of the affective and process skills addressed in the Self-Management and Self-Direction domain in the LBS model. Learning to communicate effectively, whether via words or numbers, is enhanced

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considerably when the programming model and the practitioners promote the inclusion of process skills in their everyday teaching.

Like the Ontario LBS themes, the American numeracy themes developed by Adult Numeracy Network (ANN) are really a list of the content areas in numeracy to be addressed. The word choice in the American themes still appears to emphasize the content (number sense, geometry, algebra), rather than the application. However, the standards document from the ANN, like the LBS *Level Descriptions Manual*, emphasizes the great importance of relevant applications in numeracy teaching, with particular attention to workplace applications. The Ohio Mathematical Planning Committee reports on the ANN standards in its publication, *Adult Numeracy Themes* (1996)

Adults need to see connections in math – connections within the domain of math itself, connections to other disciplines, and connections to real life and work situations. Math takes on greater meaning and understanding when it is directly applied in the workplace or in real-life situations...When math is taught in context, adults understand that there is a practical application for that skill. Teachers may need to become more knowledgeable about the world of work in order to offer relevant math curricula.

The ANN document also recognizes the language of mathematics as a communication tool and makes reference to “understanding, expressing and conveying ideas mathematically”. Once again the ability to communicate confidently not just through words but through numbers emerges as a crucial outcome in numeracy education.

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Research from the United States that led to the ANN content standards for adult numeracy also resulted in the inclusion of 3 separate “process” themes in the numeracy standards, somewhat analogous to the LBS Self-Management/ Self-Direction domain. Specifically these process themes are entitled Relevance/Connections, Problem-solving/Reasoning/Decision-making, and Communication. The inclusion of these process themes in the American framework, distinct from the content themes, was partly derived from the input of adult learners themselves. An additional section on Competence and Self-Confidence was also added and includes subtopics on implications for learning, math anxiety, small group learning, approaching mathematics, and teaching math with the use of computers. The feedback elicited from adult learners that helped to form the process themes in the American research is summarized in the following excerpt from *Adult Numeracy Themes* (1996).

...Adult learners and stakeholder voices also gave us greater insight to affective issues...adults were asked what they need to know and be able to do to be productive citizens, workers, and parents. In addition, the adults were asked their opinions on how math instruction should be changed in the classroom.

By including process themes in its framework, the American model recognizes the importance of generic processes and thinking skills such as problem-solving, decision making and communication to a holistic curriculum. There is also clear recognition through the Competence and Self-Confidence section that adult learners have needs and prior experience that greatly influence their progress in becoming numerate.

Some of the most recent recognition of the needs of adult learners with respect to literacy and numeracy education comes from the United Kingdom. In February 2001, the U.K. published the new *Adult Numeracy Core Curriculum* (2001). From this document comes a statement of the U.K. strategy for adult numeracy programming. It includes:

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...national standards of adult literacy and numeracy to ensure consistency, a core curriculum to clarify what teachers should teach to enable learners to reach those standards, a new system of qualifications to measure achievement against the standards, and improved quality and diversity of learning opportunities to meet the needs of a wide range of learners...

The numeracy themes of the United Kingdom model include number systems, measures, shapes and space, and handling data – see Table 1). While again the focus on application of skills is not overtly stated in these general numeracy themes, the critical importance of context and application in teaching numeracy to adults is stressed throughout the *Adult Numeracy Core Curriculum* document. In addition, it lists possible contexts for using numeracy skills including citizen and community, economic activity (paid and unpaid work), domestic and everyday life, leisure, education and training, and in social roles.

Further investigation of the U.K. standards reveals that the content is expressed in terms of three generic outcomes: understanding and using mathematical information, calculating and manipulating mathematical information, and interpreting and communicating mathematical information. Such verbs as read, specify, describe, generate, present and explain encompass the scope of learning at each level within the curriculum. These descriptions of the overall levels and the accomplishments integral to those levels are analogous to the LBS level descriptions in the *Level Descriptions Manual*.

Not surprisingly, the notion of communicating via mathematics appears in the U.K. standards as well, as noted above. At the higher level of the curriculum the relevant outcome states that the learner can *“present and explain results clearly and accurately using numerical, graphical and written formats appropriate to purpose, findings and audience”*. (*Adult Numeracy Core Curriculum*, 2001). The reference to the audience is

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a clear indication of the importance of enabling learners to communicate effectively via mathematics—helping them to discern what mathematical phrases need to be present in what kind of logical order to facilitate the most effective understanding from their audience. It is not unlike knowing which linguistic phrases need to be present to formulate sensible, comprehensible sentences. Being misunderstood is equally detrimental through numbers as through words.

To summarize thus far, the themes of the United Kingdom, the United States, and the Ontario-LBS model are worded in a way that emphasizes the content within each framework (number sense, measurement, geometry, etc.). All three models recognize the importance of applied learning to adult numeracy teaching. In addition to the actual numeracy content, the Ontario-LBS and American models address process skills as distinct themes such as self-management, problem solving, reasoning and communication.

Table 1 demonstrates that considerable effort has been devoted to developing effective adult numeracy programming by each of the international voices. In recent years the Australian research and programming related to adult numeracy education has been well received by other nations with similar goals for adult education. Reference to both the overall Australian numeracy themes as well as those that have been developed in Tasmania are included in Table 1.

Development of the Tasmanian themes, as mentioned in the previous section of this manual, is not exclusive to adult numeracy teaching. Rather, as the title implies, the Tasmanian policy document *Numerate Students – Numerate Adults* (1995) emphasizes the importance of integrating numeracy into all subject areas in elementary and secondary

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education in an effort to produce ongoing generations of numerate adults. The Tasmanian philosophy addresses numeracy as opposed to just mathematics education in its school system and clearly makes the distinction between the two. There is also significant discussion of definitions of numeracy and numerate behaviour as presented in this excerpt from (*Numerate Students—Numerate Adults* (1995)).

People can not, then, be divided neatly into two groups, the numerate and the innumerate, for nearly everyone is numerate to some degree. Most people, by the time they leave school, can do things like gauge the speed of oncoming traffic accurately enough to cross the street safely; make sure they receive the correct change at the supermarket...when they do so they are exhibiting a degree of numeracy, slight but real. When faced with tasks more difficult than these, some people may become frustrated. On the other hand, some people immerse themselves joyfully in things mathematical. They face the mathematical demands of everyday life with confidence and enthusiasm. Most people lie somewhere between the extremes described above.

The Tasmanian philosophy emphasizes that numerate behaviour varies from person to person. At the same time it also acknowledges that confidence and enthusiasm, two affective elements, are key items in the communication tools of numerate people.

The language of the Tasmanian themes extends the wording of the United Kingdom, American and Ontario-LBS themes. Each of the Tasmanian themes adds the term, “in everyday life” to the identification of the numeracy content: Numbers in Everyday Life, Space in Everyday Life, etc. Adding the term, “in everyday life” neatly marries the content associated with numeracy to the context of its use.

Like its American and Canadian counterparts, the Tasmanian adult numeracy framework includes three process themes: Attitude and Appreciations, Mathematical Inquiry, and

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Choosing and Using Mathematics. These process themes are infused into all of the five content themes.

While the Tasmanian themes seem closely linked to those in the Australian framework, the actual wording of the Australian numeracy themes goes one step further. Each theme in the Australian model states the purpose for learning the associated content, as outlined below in a quote from the *Adult Numeracy Down Under* website.

Rather than learning outcomes having the maths strands (number, space and shape, data, measurement and algebra) as their organizing structure, the purposes or functions to which the maths may be put, are given prominence. The learning outcomes still ensure that the skills and knowledge of the maths strands are included but they are arranged under a different structure. The learning outcomes are organized into four different categories, or domains, according to different purposes and functions of using mathematics.

Each of the four categories, or themes, begins with the words, "Numeracy For...", i.e. Numeracy For Personal Organization, Numeracy For Practical Purposes, to state just two. Such attention to purpose in the wording of the themes speaks to the underlying philosophy of the Australian adult numeracy voice. Numeracy implies not just "uncoverage" of mathematical content but links that content to the real reason for doing the math, the purpose of each area of quantitative communication in everyday living. The wording of the Australian themes contributes significantly to answering the question often asked by learners, "Why do I have to know this?"

While the Australian model does not address processes within numeracy programming as distinct themes, those processes are embedded within the broader guidelines for the Australian Certificates in General Education for Adults (CGEA). The CGEA is comprised of various streams for adult education including the General Curriculum Options, of which

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numeracy is a part. The explicit wording used in the numeracy themes (such as Numeracy For Personal Organization) implies that the numeracy being taught is relevant to the real world and incorporates problem solving, reasoning and many other process skills. In addition, the numeracy stream refers to communication skills as part of the assessment for each learning outcome.

A comparison of these five overall frameworks for adult numeracy education, (Canada-Ontario LBS, United States, United Kingdom, Tasmania, and Australia) makes it apparent that each opens the door to effective strategies for programming, the most obvious being the need to link content and skills to real-life context and applications. Each recognizes the importance of process skills and attitude in becoming and remaining numerate. The necessity of communicating via mathematical expression, reasoning and deduction is addressed across all the models as well.

While the content included in each framework is quite similar and consistent with the definitions of numeracy discussed in the previous section of this manual, the way in which the numeracy content is translated into themes for programming varies significantly within these international models. The wording of the Ontario LBS, United Kingdom, and American themes emphasizes the content necessary in numeracy programming. The Tasmanian themes begin to make the link between content and everyday application. The Australian themes are worded in a way that clearly states the purpose for which the content is addressed. While the underlying definition of numeracy from all those countries recognizes the imperative link between math and everyday life situations, the wording of the Australian themes most clearly links the content with the actual reason (or application) for learning particular numeracy skills.

Basic Operations Current Research On Adult Numeracy Programming

What are the principles of best numeracy practice in adult education?

Best practices specific to adult numeracy delivery really have yet to emerge in a significant, well-documented form. Considerable information exists around frameworks, themes, and outcomes for adult numeracy programming, but the specific best practices for adult numeracy education are only just becoming apparent as new programming frameworks are being implemented. What does exist and can be identified is that programs such as those in Canada-Ontario, Australia, United States and the United Kingdom have been based on solid principles for the development and delivery of adult education. It is naturally hoped that this will result in the emergence of best practices specific to adult numeracy education, given further implementation time and effective program evaluation.

The ANN standards, as reported by the Ohio Mathematical Committee's *Adult Numeracy Themes* (1995), contain a discussion of implications for learning and teaching. The information and approaches offered are really suggestions for best practices in programming. Below are some excerpts from that section on implications for teaching and learning as they apply to both content and process themes.

1. *Math must be taught in the context of real-life and workplace situations. When math is taught in context, adults understand that there is a practical application for that skill.*
2. *Learner-centred approaches to teaching ensure that learners see the relevance of what they are learning. Math learning for adults should be relevant to their own personal goals.*
3. *Interdisciplinary approaches to teaching are essential. Math should be an integral part of other content areas.*

Basic Operations Current Research On Adult Numeracy Programming

4. *New math learning should be linked to previous learning. Linkages should be made with other math concepts and skills as well as with other prior knowledge.*
5. *Concepts should be taught before rules.*
6. *Reasoning and problem-solving should be integrated into all teaching.*
7. *Learners must be provided with opportunities to work in groups...working together provides learners opportunities to hone personal qualities such as self-esteem, sociability, self-management, integrity and honesty.*
8. *The focus on mathematical communication should be increased. Teaching mathematical communication is integral to the success of math reform efforts...teachers need to use a variety of approaches, models, and manipulatives and have the students involved in talking about their work with each other on a frequent and regular basis.*
9. *Teachers need to be comfortable presenting math concepts using a variety of strategies and approaches. Teachers need staff development where they can share with each other successful teaching strategies.*
10. *Success needs to be built into the adult education classroom. Adults need to have success early on and often when they begin a math class. This success enables them to develop confidence in their ability to do math, which in turn paves the way for further positive math learning experiences.*

Some of the suggested practices listed above are echoed in John Dingwall's 2000 paper, *Improving Numeracy In Canada*. That paper contains a section entitled, "What Works Well: Success Factors", Some of those success factors, as identified by Dingwall's research, are summarized:

Basic Operations Current Research On Adult Numeracy Programming

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

At the beginning of this research section, reference was made to the Numeracy Roundtable held in March 2000 at Queen's University. In the concluding remarks at that event, Christiane Dodge stressed the importance of the participants focusing on the needs of the learners in developing programs, policies, and curriculum for adult numeracy education. The need common to all numeracy learners is the need to acquire sufficient background skill and familiarity with the language of numeracy to carry out everyday quantitative activities with confidence. Learners are then well on the road to communicating ideas and information not only through words and punctuation marks but also through the numbers and symbols of mathematical language. Yes fragments, run-ons, and spelling errors will still occur in the language of numeracy, but the numerate learner will be able to detect some of those errors, make more informed decisions related to quantitative issues, and communicate that knowledge confidently.

Congruent Figures

An Annotated Bibliography of Current Research and Practice

Despite great differences in structure and form, both mathematical language and natural language are powerful tools for description, communication, and representation. Numeracy is especially important for a nation expecting to compete in a global economy fueled by information technology. Whereas natural language is redundant, ambiguous, and concrete, mathematical language is concise, precise, and abstract. Full expression of our thoughts and visions requires the richness of both natural and mathematical language. Like yin and yang, numeracy and literacy are the entwined complements of human communication.

Lynn Arthur Steen, St. Olaf College
From the article *Numeracy*, 1990

Congruent Figures

An Annotated Bibliography

Below is a list of some useful websites and print-based resources related to adult numeracy programming, organized alphabetically by heading. Some items pertain to learning activities while others refer to articles or publications of interest, with the appropriate web address included. It is not meant to be exhaustive but rather a concise presentation of the many potentially helpful and interesting resources available, particularly those that were useful in compiling this manual. At the end of this manual an additional list of references provides a further compilation of relevant resource materials.

Recently Lisa Hagedorn, of the Ottawa-Carlton District School Board, completed an entire MTCU/NLS project devoted exclusively to finding appropriate resources for delivering numeracy to LBS learners. It is comprehensive and includes a detailed evaluation of many resources addressing needs identified by the Ottawa-Carlton LBS instructors. For a copy of this resource manual, please contact the Ottawa-Carlton District School Board.

Adult Education Resource and Information Service (ARIS)

<http://sunsite.anu.edu.au/language-australia/aris/>

Australia is an international voice in adult numeracy education. This site gives an overview of recent developments in numeracy and literacy education in Australia. It is a “one-stop” information service for materials, resources, articles and related links in numeracy and literacy. One particularly interesting link is to ANAMOL, the Adult Numeracy Assessment and Materials On-line Project.

Adults Learning Math Newsletter

<http://www.alm-online.org/Newsletters/ALM-Newsletter.htm>

This electronic newsletter, published three times per year, contains a variety of items related to adult numeracy education. It includes papers, articles, announcements, book reviews and other entries relevant to adults learning mathematics. The editorial staff consists of representatives from Australia, the Netherlands, and Denmark.

Adult Numeracy Core Curriculum

<http://www.basic-skills.co.uk/resources/>

In the late winter of 2001, the United Kingdom published its new curriculum documents for adult numeracy. The entire document is available at this site, as well as links to other features of the new standards and guidelines for adult basic education in the United Kingdom.

Adults Numeracy and Maths On-line Project (ANAMOL)

<http://sunsite.anu.edu.au/language-australia/numeracy/anamol/index.htm>

Similar to the Canadian *Alphaplus* site, *ANAMOL* is an Australian site dedicated to providing a forum for adult numeracy practitioners to exchange information, resources and opinions. Links include *Teaching Ideas* and *Conversations About Teaching*.

Congruent Figures

An Annotated Bibliography

Adult Numeracy Network

<http://www.std.com/anpn/>

This American site, somewhat analogous to Alphaplus here in Canada, is devoted exclusively to numeracy. It includes a numeracy discussion group to which more than one LBS practitioner subscribes. The direct link to the resources and learning activities page is: <http://www2.wgbh.org/MBCWEIS/LTC/CLC/numintro.html>. Such activities as, "About Today's Date" and "Puzzle of the Month", are currently posted, to name just two. It would be worthwhile to spend further time investigating the learner activities and resources available here.

AlphaPlus Centre

<http://www.alphaplus.ca/mainframe.htm>

This is the site familiar to many LBS practitioners. A wealth of items from Ontario and abroad form the comprehensive collection of resources, materials, links, discussions and current events in the world of numeracy, literacy, and English language acquisition. The discussion site, AlphaCom, provides a subscription to many groups and topics related to adult literacy and numeracy. Recently, a link to AlphaRoute has been established on this site. To quote the site itself, "*AlphaRoute was designed to provide distance or alternative delivery of literacy programs to adults across Ontario*". Learning activities mirror the outcomes and levels of the Ontario LBS program. Both a tour of the AlphaRoute site and registration as a learner are available.

Demonstrations Ontario - Ready to Use LBS Demonstrations

<http://demonstrations.alphaplus.ca>

Produced in part by AlphaPlus, this site contains links to 3 valuable demonstrations resources: Demonstrations Bank, Demonstrations Board and Demonstrations Builder. The Bank contains over 100 ready to use provincial demonstrations for LBS programming, while the Board contains “works in progress” – demonstrations posted by practitioners. The Builder allows the practitioner to create her/his own demonstration following the guidelines on the site. Also, a link to “About Demonstrations” is useful for those not familiar with the concept and role of demonstrations in LBS programming.

Framework for Adult Numeracy Standards

<http://www.std.com/anpn/framewk.html>

This American paper, authored in 1996 by the Adult Numeracy Network, was funded by the National Institute for Literacy and is subtitled, *The Mathematical Skills and Abilities Adults Need To Be Equipped for the Future*. It contains the research and methodology behind the creation of the adult numeracy content and process themes built upon the *Massachusetts Adult Basic Education Math Standards*.

Laubach Literacy

<http://www.laubach.org/home.html>

This site may be helpful in that it provides descriptions and order information for Laubach materials from the New Readers Press. Since many LBS programs use Laubach materials, this site provides an easy way to access information on-line about Laubach resources for numeracy and literacy.

Learning Connection

<http://www.learning-connection.com/index.html>

The Learning Connection is a site created by the one of the two school board sector LBS programs in North Bay. It is specific to LBS in that it offers activities in numeracy and literacy that are referenced to LBS levels, outcomes and themes. Some activities are currently available; others are under construction or revision.

Learning Outcomes Demonstrations Development Project

The school board sector, like the college and community-based sectors, undertook an MTCU funded project to develop demonstrations for field-testing in LBS. The project resulted in the development of several communications demonstrations. This publication reports on the issues related to the development and implementation of demonstrations in LBS, as well as providing the demonstrations created for the project.

Level Descriptions Manual

The *Level Descriptions Manual* is a product of the Ontario Literacy Coalition resulting from a funded project by the NLS/MTCU. It was released in early 2000 and provides “a learning outcomes approach to describing levels of skill in communications and numeracy”, as stated on the front cover of the manual. Also included is a section on the Self-Management/Self-Direction domain. The purpose of this manual is to complement the *Working With Learning Outcomes* (1998) publication from the MTCU.

Congruent Figures

An Annotated Bibliography

Math in Daily Life

<http://www.learner.org/exhibits/dailymath/>

This site provides a text-based commentary on some applications of numeracy in everyday situations including savings and credit, home decorating, population growth etc. Some hands-on activities are included. Learners with a sufficient reading level may find these applications to be an interesting supplement to text based work, and practitioners could borrow from the scenarios to illustrate concepts in class. Most applications relate to LBS 5 topics.

Math Forum

<http://forum.swarthmore.edu/>

The Math Forum is an extensive site with many links including Student Centre, Teachers' Place, and Parents and Citizens. It is not directed specifically at adult educators but it has some interesting generic information. The link to "Ask Dr. Math" offers explanations to universal frequently asked questions in mathematics at a variety of levels. Also, there is a section on "classic" problems that could be suitable for group work or "Problem of the Week" activities. Most material relates to LBS 4 or higher

Math, Numeracy, Resources and Discussions

<http://www.Mathgoodies.com>

Much time could be spent at this site by both practitioners and learners. It is a source of interactive lessons, puzzles, homework help, message boards and much more. The homepage provides links to both topic specific resources and generic items such as Real World Connections, Parents Place, and Teacher Talk, to name just a few. Adult learners, their teachers, and their children will all benefit from visiting this interesting site.

Congruent Figures

An Annotated Bibliography

Math Word Problems For Children

<http://www.mathstories.com/>

Don't be misled by the name. Though some of the worksheets available on this site are aimed at elementary school children, many are suitable for use with learners of any age. The worksheets contain not just answers but solutions at the bottom of each page. The content and level of the worksheets varies as they are updated from time to time. This site is a great source of supplemental word problems for numeracy practitioners.

More Questions

This publication from May 2000 (funded by MTCU) is the LBS Demonstrations project from the college sector. It includes eight demonstration activities, five for numeracy and three for communications. There is detailed reporting on the development and field-testing of those demonstrations and the related findings. in the college sector

National Adult Literacy Database

<http://www.nald.ca/>

NALD is a comprehensive, Canadian site for adult educators devoted to adult literacy/numeracy from Canada and worldwide. The audience to whom NALD applies includes literacy/numeracy practitioners, volunteers, and administrators. It includes events, newsletters, articles, resource lists and more. It is easy to navigate and also provides a forum for literacy discussion. At times there are adult education-related surveys posted directly on the site. By searching the "Numeracy" link, a vast number of relevant articles and publications can be accessed.

Numeracy – Best Practices and Innovations Bulletin

In the spring 2000 the Ontario Literacy Coalition, with funding from the NLS/MTCU, published this first of three bulletins dedicated to promoting numeracy in Ontario. Its focus is on LBS but it contains many interesting items that relate to the larger picture of numeracy and the issues related to it such as math anxiety, math biographies, and science literacy.

Numeracy Kit

<http://www.nald.ca/Province/Sask/SLN/Resource/newords/numeracy.htm>

The Saskatchewan Literacy Network has produced a kit for basic numeracy learning and instruction. It includes a tutor training workshop outline as well as materials and resources for teaching. The kit is based on the numeracy standards created by both the American group, ANN (Adult Numeracy Network) and the National Council of Teachers of Mathematics (NCTM). Order information is available at the site.

Numeracy/Mathematics CD Roms

<http://www.neufeldmath.com>

Neufeld Learning Systems Inc. provides this website to preview its collection of mathematics software. Compact discs are available for a variety of topics, and previews of any CD may be downloaded and reviewed. Worksheets to support the CDs can also be viewed here.

Congruent Figures

An Annotated Bibliography

Ohio Mathematical Planning Committee

<http://archon.educ.kent.edu/Oasis/Resc/Educ/numthe.html>

In response to the development of standards for adult numeracy programming, this paper investigates each of the seven content and process themes developed by the Adult Numeracy Network (see above). Included under each theme is a description of the theme as well as a commentary on the related implications for teaching and learning.

Quantitative Literacy Bibliography

<http://www.stolaf.edu/other/ql/publ.html>

From 1940 to 1999, this site includes a chronological list of many publications related to numeracy (quantitative literacy). The content of most entries is summarized in a short paragraph. This site would benefit someone undertaking research related to numeracy or someone interested in the historical perspective of numeracy education.

Science and Numeracy Special Collection

<http://literacynet.org/sciencelincs/>

This is a site originating from the Literacy Information and Communication System (LINCS), a cooperative electronic network. It is affiliated with the American organization NIFL (National Institute for Literacy). This Science and Numeracy Special Collection contains a link to a student/learner section that contains many interactive activities suitable for all levels of LBS learners.

Worksheets for Learners

<http://www.worksheetfactory.com>

For basic academic skills in both numeracy and literacy, this site allows the user to create practice worksheets. Some topics are downloadable for free; others must be purchased but a free trial is available. The worksheets can be somewhat customized in terms of the level of difficulty and appearance of the worksheet itself.

Common Denominators

Best Practices in Ontario's Literacy and Basic Skills Programs

I think that we are often tempted to think that the logical way to bring reality into the classroom is on pieces of paper, through facsimiles of bills, copies of newspaper articles, copies of shopping catalogues and the like. And whilst I'm not saying that we should abandon this practice, I think we should also remember that many people's reality is not found on two dimensional printed pages – it is three dimensional. The things they really deal with on a daily basis, those they use at home, are real objects, things which can be touched and felt and held in the hand; they have weight, size, capacity, height, length, value.

What better way is there to begin to weave students' own natural language into the mathematics learning, than by using these objects in the class as a starting point for discussion – using the real thing.

Beth Marr

From the article:

*Digging below the surface of our teaching practice –
Maps for teachers and students of mathematics, 1995*

During the late fall of 2000, questionnaires were distributed to funded LBS programs across all sectors: community-based agencies, school boards, and colleges. (A copy of the questionnaire can be found in the **Data Management** section.) The purpose of the questionnaire was to elicit best practices in a variety of areas of LBS numeracy programs from levels 1 through 5.

This section summarizes the responses from those questionnaires. Of the approximately 200 funded LBS agencies in the province, responses were received from 32 programs. Of those 32 programs, 7 were from the school board sector, 9 from the community-based sector, and 16 from the college sector. The respondents represented numeracy practitioners working with learners from levels 1 to 5 of LBS.

Many useful, interesting practices were reported through the questionnaires. It became apparent that overall, LBS numeracy practitioners base their teaching/facilitating on guiding principles of adult education. While some parts of the questionnaire referred to specific numeracy issues, others referred to more general program areas. A consistent approach emerged where the characteristics of the adult learner are recognized, valued, and addressed.

Following is the summary of responses, organized by the headings or questions that appear in the questionnaire. It should be noted that some suggested practices apply more to one particular learning environment than another. Some practices, for example, are well-suited to a one-on-one tutoring session but those same strategies would not necessarily apply to a learner in a more traditional classroom setting. Also, since the ideas shared through the questionnaire and reported here cover all LBS levels, some

strategies are necessarily more appropriate to certain levels than to others. Finally, some suggested practices overlap more than one area reported below. In that case, that practice may have been referenced in more than one place in this section, but perhaps with a slightly different emphasis.

Initial Assessment and Interview

Initial assessment tools vary within LBS programs, as does the interview process accompanying the assessment. Through the questionnaire, many programs identified the *Common Assessment of Basic Skills* manual (*CABS*), as an excellent tool for assessing new learners. The *CABS* binder was produced by Literacy Link Eastern Ontario and released in 2000. It is available by contacting LLEO at (613) 389-5307.

Many features of the intake and assessment processes in LBS are common across sectors. This section reports on the general guiding principles that programs use, as opposed to identifying specific assessment tools. The *CABS* manual offers more specific strategies and assessment tools for programs wishing to investigate new methods.

- ❖ Stress that the initial assessment is not a test.
- ❖ Only go as far with the initial assessment as the comfort level of the learner dictates.
- ❖ Assure the learner that she/he is in control of the assessment process.
- ❖ Allow the assessment to demonstrate what the learner does know, rather than what she/he does not know.

Common Denominators

Best Practices in Ontario LBS

- ❖ Stress that the assessment is used to help the learner access the skills needed to achieve her/his goal.
- ❖ Give the assessment in two or more stages for the learner who is visibly nervous.
- ❖ Use “can-do” cards to assess learners. The cards have various skills noted on them on them. The learner looks through the cards and puts them into three piles:
 - things I can do
 - things I can not do but want to do
 - things I do not want to do

This is very non-threatening. It does not look like a test. The learner has control over the assessment. The idea of “can-do” cards comes from [ALBSU – Numeracy Training](#), published in the 1980’s from the Adult Basic Education department of the Toronto School Board.

- ❖ Have the results of the assessment available as soon as possible.
- ❖ Use the results of the assessment, in concert with the learner’s goal and timeline, to create an individualized training plan.
- ❖ The assessment should allow the learner to be exempt from some modules if she/he demonstrates adequate proficiency.
- ❖ Talk to the learner about goals, educational history and any learning difficulties, particularly related to numeracy.
- ❖ Ask the learner what she/he wants to learn.
- ❖ Mention a few of your own anxieties to put the learner at ease.
- ❖ Treat the learner as an equal.
- ❖ Show the new learner that current learning methods may be different from those of her/his previous experiences, i.e. computer-aided, individualized learning, videos, etc.
- ❖ Emphasize the individualized support available to the learner.
- ❖ Show the learner examples of supplies required, i.e. books, pens, etc.

Program and Classroom Environment

The adult learning environment has a great influence upon the success of the adult learner. The questionnaires reported many similarities in the physical arrangements and details of the classroom. Many common strategies also exist in LBS programs in terms of the affective environment and efforts to put learners at ease, especially during their first few days.

- ❖ Use an orientation process where possible. This is often more feasible if there is a group of learners beginning at the same time.
- ❖ Introduce a new learner to an established one (peer mentor), preferably pairing learners with similar interests, goals, etc.
- ❖ Arrange tables in pairs facing each other, in a U-shape, or a circle.
- ❖ Establish a conference room—not just a classroom.
- ❖ Assign particular classroom tasks immediately, i.e. changing date on blackboard, passing out newspapers, etc.
- ❖ Post classroom norms in the classroom (those developed by former learners).
- ❖ Address problems immediately.
- ❖ Display of work, photos, articles, etc. in the classroom.
- ❖ Use a variety of learning modes: large group, small group, one-one-one, and class discussions.
- ❖ Showcase everyone's strengths in day-to-day learning, from which others can draw.
- ❖ Have an assistant in the classroom, especially for students at the lower levels.
- ❖ Ensure that the learner does not need to wait for an extended period of time to talk to an instructor.
- ❖ When possible, provide interactive workshops on generic skills

Dealing With Math Anxiety

The issue of math anxiety permeates adult numeracy education, particularly at the early levels of study. Practitioners can do much to alleviate this stress, as noted by the feedback reported below.

- ❖ Ensure that the learner realizes that math is a process. Math is like grammar or auto mechanics or weaving in that it is just a box of tools that help us all function. It is not about being smart; it is about being better equipped. My role as an instructor is like the “Snap-On Tool” man for garages. I don’t teach a better way of fixing cars, just how to use the tools in a smarter way.

- ❖ “Math anxiety” is mainly due to the lack of understanding of the word, “mathematics, or math”. This word has already implanted a black mark onto the adult learner. The word, “math” is to be carefully explained to the learner as “using numbers to express”, and relate those expressions to the learner’s everyday experience. In order to be able to play the piano, one has to learn the musical notes. In order to learn to express by numbers, one has to learn the meaning of numbers and signs.

- ❖ Disspell the notion that, “Math is for smart people.”
- ❖ Use a lot of review materials as “self-tests” to build confidence.
- ❖ Use practice tests before the “end” test at levels 3 and 4.
- ❖ Give many small tests to ease anxiety about bigger tests.
- ❖ Give un-timed tests; allow retakes.
- ❖ Encourage estimating as a tool to solve a problem and check the feasibility of an answer.

- ❖ Spend the majority of time setting the learner up for success; emphasize what the learner has done correctly.

- ❖ Use lots of patience.
- ❖ Keep in mind that instructors’ attitudes “rub off” on learners!

- ❖ Use games and role-playing to mimic situations, i.e. cash drawers in a store.
- ❖ Let the learner see the fallability of the instructor from time to time. This gives her/him confidence in knowing that she/he doesn't always need to be perfect.
- ❖ Allow learners to talk about their math anxieties; allow them to voice their insecurities.
- ❖ Use common words like "add, take-away" while concurrently introducing math terminology like "addition", "subtraction".
- ❖ Admit to the learner that certain concepts are difficult and that many others have struggled before them.
- ❖ Mark work with any colour but red ink!
- ❖ Use deep breathing, lots of laughter, and coffee breaks.
- ❖ Bring an enthusiastic, "math is fun and useful" approach into the classroom.
- ❖ Provide a "Problem of the Day" (or week), preferably based upon a relevant application.
- ❖ Keep reminding the learner that, *"This is only math."*

Addressing Various Learning Styles

In any classroom, the learners bring every possible learning style to the table. In LBS there is significant awareness of this and efforts to address various learning styles are in place. Some programs offer learners the opportunity to formally discover their learning style through a workshop experience, and others encourage awareness of learning styles incidentally through their programming.

Common Denominators

Best Practices in Ontario LBS

- ❖ Distribute and discuss a questionnaire during the intake process to help the learner identify and understand various learning styles. Instructors are encouraged to use this information in their instruction and approach.
- ❖ Work out questions on the board, giving visual and oral support. This has the added bonus of allowing other students to follow along without having to ask questions. While the work may be at a higher or lower level than others, all get to listen in on the topic. This may help most when the work on the board is just beyond a learner's current topic, giving her/him a taste of what lies ahead.
- ❖ Maintain variety during the day/lesson – some individual work, pairs, large group, discussion.
- ❖ Use concrete materials when possible.
- ❖ Make numeracy part of a whole-language/continuum approach.
- ❖ Use models and/or drawings to meet kinesthetic learning needs.
- ❖ Display charts or posters of math rules.
- ❖ Allow instructors the opportunity to share what works and what does not.

Connecting Real-life Experiences With Numeracy

The overwhelming principle in effective adult numeracy education lies in connecting the numeracy content with real-life situations. There are many ways in which this can be accomplished, though it is admittedly easier at the lower levels where concepts are less abstract and more readily applied. Some learners, when they have seen connections in their early numeracy work, may be more willing to “accept” the basis of higher-level numeracy concepts even when a really relevant application is more difficult to create.

Common Denominators

Best Practices in Ontario LBS

- ❖ Use web sites such as HRDC's Essential Skills to link required workplace skills to academics.
- ❖ Relate the learning to the learner's goal, be it independence-, employment-, or education-related.
- ❖ Example: $10 - 2 = 8$
Reading out "ten minus two equals eight" is meaningless. This following alternate interpretation relates to the learner's real-life experience, and therefore means something to her/him: "You have \$10 and you spend \$2, so the result is that you have \$8 left".
- ❖ Try role-playing that relates to everyday situations, i.e. serving, cooking, banking, etc.
- ❖ Ask the learners to bring in their own chequebooks, budgets, shopping lists, bills, receipts, flyers, etc. to use as relevant learning aids in class.
- ❖ Use worksheets/assignments that depict real situations experienced by particular workers in a particular field.
- ❖ Use tape measures, graduated cylinders, wallpaper borders, money, various containers, blocks, etc. – materials that come from real-life, not just "math" materials – to teach numeracy concepts.
- ❖ Use demonstration activities based on workplace materials and/or information provided by employers, essential skills profiles, etc.

Teaching Strategies

This section contains anecdotal strategies sometimes paraphrased and sometimes reported directly as they appeared in the questionnaires. In particular this section elicited great enthusiasm from practitioners, though not a large number of responses. These reported strategies encompass many levels and offer some interesting insights into different approaches used in delivering numeracy instruction.

Common Denominators

Best Practices in Ontario LBS

- ❖ Use drills, flash cards, board work, oral exchanges, etc. to promote variety and to address all the learning styles.
- ❖ Make teaching a personal, interactive experience; this allows the learner to feel valued.
- ❖ Facilitate peer tutoring when it is appropriate.
- ❖ Prepare handouts that illustrate common errors in numeracy learning; discuss these in class.
- ❖ Place value: use bundles of straws in groups of 10; use loonies, ten-dollar bills, hundred-dollar bills on a place-value chart. This can be extended to decimals using dimes and pennies.
- ❖ Basic facts: Explain these in a real-life context, i.e. $2 \times 3 = 6$. Reading out “*two times three equals six*” does not make it easy for the learner to understand. In a real-life context, there are two packages of tomatoes, each pack having three tomatoes. One pack of three and another pack of three, that is, two times the three, and you get six tomatoes!
- ❖ Equivalent fractions: Again, use a real-life context to explain the problem. If you divide a pizza into 8 pieces and then eat 4, you’ve eaten one half. If you divide it into 12 pieces and then eat 6 pieces, you’ve still eaten one half, so

$$\frac{4}{8} = \frac{6}{12}$$

- ❖ Percents: use a chart.

<i>part</i>	<i>percent</i>
<i>whole</i>	<i>one hundred</i>

This leads to the use of a proportion:

$$\frac{\textit{part}}{\textit{base}} = \frac{\textit{rate}}{100}$$

- ❖ Geometry: many concepts are more easily understood through the use of concrete materials, and by relating the concept to design, carpentry, etc. A learner will have much deeper understanding of perimeter, area, volume, circumference, diameter, radius, etc. if she/he has had the opportunity to actually make and record measurements related to those concepts.
- ❖ Area and volume: explain this by diagrams and grids and use concrete materials whenever possible. Write out steps for the 'long way' of converting units, rather than just moving the decimal point. Short cuts are okay if a learner knows the 'long way' of solving a problem.
- ❖ Solving equations: use the analogy of a teeter-totter for, i.e. with reference to balancing both sides. A great visual aid for this is an equal-arm balance, where concrete materials can actually be added and subtracted from each pan to achieve balance. It also illustrates imbalance when we don't "do the same thing to one side as we do to the other".
- ❖ Solving equations: when the equation consists of one fraction equal to another fraction, it is best to use cross-multiplication to solve, rather than trying to multiply each side by a common denominator.

For example:

$$\frac{a}{100} = \frac{3}{5}$$

$$\begin{aligned} 5a &= 3 \times 100 \quad (\text{cross-multiply}) \\ 5a &= 300 \end{aligned}$$

rather than

$$(100)\frac{a}{100} = \frac{3}{5}(100)$$

- ❖ Solving equations: use the 'unwrapping' approach, i.e. SAMDEB is BEDMAS in reverse. We 'unadd' (subtract), 'unmultiply' (divide), 'unsquare' (square root), etc.

Common Denominators

Best Practices in Ontario LBS

- ❖ Signed numbers (integers): refer to a thermometer, or to elevations, or even to debits and credits in budgeting.
- ❖ Have learners write out a set of rules for a particular operation to reinforce that method, and to allow the learner to refer back to it later.
- ❖ Use small or large group workshops to address interesting or difficult topics, even if it is only feasible once in a while. We sometimes do this for generic topics like problem-solving, “Math Tricks”, or test-taking skills.
- ❖ Keep language simple, especially when addressing a new topic; the ‘math’ vocabulary can be introduced incidentally when the learner is confident with the concept.

Resources

As mentioned in the annotated bibliography earlier in this manual, a comprehensive catalogue of numeracy resources is available through the Ottawa-Carlton District School Board, as a result of an MTCU/NLS project completed by Lisa Hagedorn. What appears below are just some of the specific items in use by LBS numeracy practitioners, as reported in the questionnaire.

Print-based

- ❖ Breakthrough to Math (New Readers Press)
- ❖ Math Stories (New Readers Press)
- ❖ Math for the Real World (New Readers Press)
- ❖ Life Skills Mathematics (Educational Design)
- ❖ Goals (Toronto School Board)
- ❖ Fundamentals of Mathematics (Harcourt, Brace, Jovanovich)

- ❖ Mathematics GED (Gage)
- ❖ Preparing for Exit-Level Math Tests (Educational Design)
- ❖ Math Skills for the Workforce (Steck-Vaughan)
- ❖ Number Sense (NTC/Contemporary)
- ❖ Math Skills That Work: A Functional Approach for Life and Work (NTC/Contemporary)
- ❖ Galactic Multiplication and Division (IBM)
- ❖ Number Power: The Real World of Adult Math (Contemporary Books)
- ❖ Numbers in Our Lives (Australian publication – see website)
- ❖ CABS –Common Assessment of Basic Skills (Literacy Link Eastern Ontario)
- ❖ ESL materials discussing numbers, time, money

Multimedia

The websites listed here are reviewed in the annotated bibliography of this manual, found in the **Congruent Figures** section. It should be noted that this list is not exhaustive, but simply represents some of the resources currently being used in LBS programs.

- ❖ www.worksheetfactory.com - for basic math worksheets
- ❖ www.alphaplus.ca - Adult Literacy and Numeracy, particularly related to LBS
- ❖ www.nald.ca – National Adult Literacy Database
- ❖ www.drmath.com – the Math Forum
- ❖ www.Mathgoodies.com - mathematics lessons, worksheets, activities and more
- ❖ <http://demonstrations.alphaplus.ca> - demonstration activities for LBS
- ❖ Microsoft Excel for “Managing Data and Probability” concepts.

- ❖ When available, computer software that supplements the actual text being used can provide good supplemental activities.
- ❖ CD-ROMs: Animated Math, Success Maker, Mathematics for Middle School, Measuring Up
- ❖ Skills Bank 4 educational software (Bank Corporation)
- ❖ PLATO educational software

Concrete Materials and Manipulatives

The benefits of incorporating hands-on activities in numeracy teaching, whether formally or incidentally, can not be overemphasized. Some LBS instructors make use of a variety of concrete materials in their numeracy programs, as evidenced by the list of materials included below. There is a difference, though, between applying numeracy skills to real-life situations and using hands-on materials to teach concepts.

Numeracy learners of any age need the opportunity to manipulate materials that support the concepts being studied. Fractions, for example, are often difficult for learners to understand. When learners can participate in directed and experimental activities using cardboard fraction bars, their understanding of the concepts and operations involved with fractions increases significantly. The learner's ability to retain and transfer that knowledge to an applied situation or problem then improves as well. When a learner can "do", she/he is more able to understand. It would never be expected that a student in a carpentry program, for example, would master the use of a skillsaw just by reading about it. Similarly, numeracy learners deserve the

opportunity to have as many hands-on experiences as possible in their program, but unfortunately the background and time required to create relevant, manipulative activities often interferes with the effective, consistent use of concrete materials in LBS numeracy programs.

Below is a list of items that LBS numeracy practitioners have identified as useful in facilitating hands-on, manipulative learning activities in their programs. It is not meant to be exhaustive but rather representative. For those interested, catalogues of materials are available from educational suppliers. Pre-made materials and accompanying activities can be very useful but are, of course, more expensive than instructor-created activities made from materials found in the classroom or home.

- ❖ Straws, cut up and bundled for place-value; block-ten blocks, centicubes
- ❖ Measuring tapes, triple beam balance, bathroom scale, pan balance, measuring spoons, measuring cups, containers of various sizes and shapes
- ❖ Clocks, watches and stopwatches
- ❖ Twist ties to investigate circumference, diameter and radius
- ❖ Fraction bars, or coloured cardboard circles cut into different numbers of pieces, to illustrate equivalent fractions
- ❖ Play-money, cash drawers, old cheques, bank withdrawal/deposit forms
- ❖ Various items from the classroom, household or industry to illustrate shapes, area and volume, both metric and imperial

Learning Activities

It is apparent through the questionnaire that learning activities used in LBS programs include both traditional “math” practices as well as a number of adult-oriented numeracy activities. Both have merit, depending upon many factors including the nature of the content being addressed, the background of the learner, the learner’s goal, the staffing of the program, and the availability of resources.

- ❖ Encourage/lead discussions about everyday numeracy: dates, times, ages money, cooking, construction, rearranging class space, attendance, etc.
- ❖ Analyze data from the Statistics Canada website.
- ❖ Apply knowledge of measurement by actually doubling or tripling recipes, and then preparing that meal.
- ❖ Facilitate presentations by learners, though many learners need much support to do this.
- ❖ Try partner or small group problem-solving, i.e. “Problem of the Week”.
- ❖ Create and solve word problems; share those with a group or class to validate the problems.
- ❖ Incorporate workplace-related word problems, i.e. calculating tips then dividing the tips among staff.
- ❖ Create a bingo game with cards based on concepts learned, i.e. multiplication bingo, fraction bingo, etc. Learners can help create these too.
- ❖ Play board games such as Yahtzee, cribbage, chess, checkers, Battleship, math puzzles.
- ❖ Use current events materials (newspapers, magazines, etc.) to apply a calculation of percent, ratio, etc.

Common Denominators

Best Practices in Ontario LBS

- ❖ Support learners in helping with their children's homework.
- ❖ Have learners attempt a demonstration activity after completing one or more modules. The demonstration must integrate the skills acquired in those modules. Wherever possible, the activities in the demonstration should reflect the learner's goal.
- ❖ Drill and practice, but not ad nauseum!

Monitoring Learner Progress

The practices outlined below summarize much similar input from a number of the questionnaires. Again, it should be remembered that some practices lend themselves better to particular levels or sectors of LBS, while others are universally applicable in the LBS programs.

- ❖ Make a list (with the learner) of all the parts or steps related to a comprehensive topic or concept. Although the learner may take some time to master the concept, she/he can see progress through the individual parts.
- ❖ Maintain much discussion with the learners and check (though not necessarily grade) their assignments frequently.
- ❖ Ask the learner to scan any modules from which she/he has been exempted as a result of the initial assessment. The learner may find a small part of the module that she/he needs to review.
- ❖ Provide learners with record sheets (tracking cards) showing the modules and "average" timelines for completion of the modules. The instructor has the same tracking sheet on which to record completed activities/tests and grades.
- ❖ Review tracking sheets weekly and give the learners extra help or reminders if they are not making adequate progress.

Common Denominators

Best Practices in Ontario LBS

- ❖ Monitor progress partly by considering the number of times the instructor's help is needed over a period of time.
- ❖ Encourage learners to take responsibility for documenting their work and keeping a file of assignments, test, demonstrations, etc.
- ❖ Give mini-quizzes throughout the unit or module.
- ❖ Incorporate ongoing hands-on activities: finding masses using scale balances, measuring items in the classroom, etc.
- ❖ Arrange daily conferences with the learner and maintain a progress checklist for each learner.
- ❖ Encourage learners to keep weekly learning logs; this aids both in monitoring and allowing the learner to see her/his own accomplishments.
- ❖ Schedule weekly staff meetings in which observed problems or concerns are raised.

Summative Evaluation

The evaluation strategies and testing methods reported in this section are not standardized across all LBS programs. At this time, individual programs utilize evaluation practices suited to their clientele and the levels of LBS programming that are delivered.

- ❖ Provide a pre-test for practice and then a post-test at the end of each module, or have the learner do a practical demonstration.
- ❖ Continue to explore opportunities for integrating demonstrations along with other evaluation strategies.
- ❖ Give an endtest after each module. If the learner does not achieve the minimum passing grade, allow a re-take following further review.

- ❖ Give learners a completion test at the end of each level to review and consolidate skills and concepts. Alternatively, a demonstration activity could be incorporated at the end of each level.
- ❖ Try to assist the learners interactively in a holistic way, i.e. fractions, decimals, ratios, and percents are really a conversation tool to help express relationships. Try to assess and reinforce the learner's ability to do this and then make use of some additional tools if required. It is a hard process to encapsulate in a bullet because there is a lot of 'feel' to it.

Demonstrations

In recent years, the LBS program has promoted the development of "demonstrations". These culminating activities are intended to involve learners in real-life tasks that incorporate the skills and knowledge of several modules or units of study. The demonstration, if properly created, can be a useful method of evaluating a variety of both numeracy and literacy outcomes. Over 100 ready-to-use demonstrations are available at the AlphaPlus website (<http://demonstrations.alphaplus.ca>) as noted in the **Congruent Figures** section of this manual.

The formal use of demonstrations in Ontario LBS programs has met with varying degrees of enthusiasm amongst practitioners and learners. Some learners and teachers find demonstrations to be a relevant, efficient way to evaluate a number of skills through one activity. In the college sector demonstrations report, *More Questions* (2000), the following observations were made.

While learners at the field-testing site were initially reluctant to use demonstrations, once they actually started working with the activities, they liked them. The learners clearly recognized how they linked to and supported their goals.

Many programs have been using demonstrations for a quite some time, though perhaps not calling them by that name. Recently there have been sectoral projects dedicated to the creation of valid demonstrations available for use in LBS programs. Also, a website has been created (DemonstrationsOntario) to promote the sharing and field-testing of potential demonstration activities. *More Questions* (2000) also includes two clarifying definitions that are worth noting.

*Learning Activity – An activity that resembles as closely as possible a real-life application related to the learner's goals, and that gives the learner an opportunity to **develop** a number of integrated skills related to their goals.*

*Demonstration Activity – An activity that resembles as closely as possible a real-life application related to the learner's goals, and that gives the learner an opportunity to **apply** a number of integrated skills related to those goals.*

Below are some of the practices in LBS programs related to the use of both informal and formal demonstrations.

- ❖ Encourage learners to complete practical tasks that provide evidence of increased confidence and skill. A learner may show the instructor an actual cheque, completed correctly and signed, to pay an amount arrived at by adding up bill. The instructor may photocopy the cheque and the bills to show the skills the learner used, some of which were directly practiced in class.
- ❖ Use shopping flyers to provide a basis for demonstrations involving a variety of skills across more than one level.
- ❖ Investigate the CABS (Common Assessment of Basic Skills) binder. Some of their assessments can be used as demonstrations – excellent material!

Common Denominators

Best Practices in Ontario LBS

- ❖ Act as a pilot program for demonstration activities created from MTCU/NLS funded projects. This provides ready-made demonstrations on which both instructors and learners can provide feedback. The demonstrations are then available to other LBS programs after the pilot is complete.
- ❖ Allow the learner to perform a number of measurements as demonstrations, using both metric and imperial systems.
- ❖ Use cooking/baking demonstrations to show an understanding of fractions.
- ❖ Have learners create histograms as a demonstration, using information available from the Internet, i.e. from the Stats Canada website.
- ❖ Create a comparison shopping activity as a basis for a numeracy demonstration.
- ❖ Allow learners to incorporate home building projects (making a bookcase, building a fence, etc.) into a useful, measurable demonstration.

Best Practices - In Conclusion

This section has provided a snapshot of the best practices in adult numeracy programming and delivery in Ontario LBS agencies. It is apparent from the comments in the questionnaires that LBS numeracy practitioners are aware of the nature of the adult learner and attempt to provide an environment in their program that allows the learner to assimilate numeracy skills and apply them to real-life situations as much as possible.

The extent to which programs make use of alternate resources such as multimedia tools and concrete materials depends on the size of the program, the facilities available, and the learner/instructor ratio. The use of concrete, manipulative materials is invaluable in teaching numeracy to learners of any age. Informally this seems to occur frequently in some programs, but few programs have the resources to create and

Common Denominators

Best Practices in Ontario LBS

implement formal activities based on the use of manipulative materials. Creating such activities is time-consuming but well worth the effort in terms of learner achievement, understanding, and interest.

Adult learners in LBS benefit from an environment dedicated to their needs as mature students. Whether their goals are related to the independence of managing their own shopping and banking, gaining improved employment, or continuing on to further education, LBS programs provide support and encouragement in a learner-centred, adult-oriented atmosphere.

Transformations

Recommendations for Future Directions

Self-evaluation Form for LBS Numeracy Programs

Evaluation Form for the *Numbers Talk* Manual

Success needs to be built into the adult education classroom. Adults need to have success early on and often when they begin a math class. This success enables them to develop confidence in their ability to do math, which in turn paves the way for further positive math learning experiences. All individuals benefit from positive feedback, but it is particularly important that adults who have experienced failure in math class previously now find success in the adult education classroom.

Ohio Mathematical Planning Committee
Adult Numeracy Themes, 1996

Recommendations Linked to LBS Programming

The final section of the Numeracy-Best Practices questionnaire gave LBS numeracy practitioners an opportunity to make suggestions and comments regarding any aspects of LBS numeracy programming that they felt could benefit from further support or development. From those who commented in this section, similar themes emerged; some related directly to numeracy and others related to the larger program environment. Below are summaries of four common recommendations offered in the questionnaires.

1. Professional Development

Provide ongoing, paid professional development for LBS numeracy practitioners.

In his report *Improving Numeracy In Canada* (2000), John Dingwall comments on the subject of staffing and training in adult numeracy programs.

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

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

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

Undoubtedly professional development can be useful in the context of organized activities in a workshop or conference. In addition, it is often the incidental, informal sharing of ideas and the opportunity for networking that benefits participants (and therefore learners) in professional development settings. Teachers, like other professionals, can gain much from each other just by exchanging information about strategies that work well in their programs. This is particularly true of numeracy instructors who may have originally been hired based on their qualifications to teach literacy but who now find that they are teaching numeracy as well. Even veteran practitioners trained in numeracy can benefit from discussing practices and ideas with colleagues, and the newer members of the profession benefit from the experience of their seasoned counterparts.

2. Integrating Numeracy and Literacy

Develop stronger links between numeracy and literacy in LBS programming.

When literacy and numeracy are connected, the learner gains a broader sense of the necessity for communicating effectively both through words and numbers. When possible, learners can be given integrated assignments or activities in which they use both numeracy and literacy skills appropriate to their level of study. Sometimes this can be accomplished through a formal demonstration, but it can also be accomplished through day-to-day learning activities that encompass a smaller number of skills. Simply explaining to the rest of the class the answer to the “Problem of the Week” is a strategy that allows a learner to communicate verbally about a particular method used to complete a numeracy task. Some practitioners advocate the use of “math biographies”, where learners are asked to reflect upon and write about their prior experiences with math and numeracy. The integration of numeracy and literacy allows both to be explored as vehicles for communicating effectively.

3. Recognition for LBS Learners

Implement a province-wide, sector-wide system that provides recognition for the achievements of LBS learners.

In response to the questionnaire, one school board LBS instructor captured the importance of better educating the public about the LBS system. Learners need and deserve better recognition for their LBS accomplishments, particularly once they leave the LBS program and seek employment, training, or further education.

While learners are in the program their efforts are repeatedly applauded as they proceed through one or more level. Some programs provide certificates for learners at the completion of each level, but these are not standardized across the province. After a learner leaves the program, recognition of her/his work in LBS is limited. In the words of the school board respondent mentioned above:

...employers, credit program teachers and the public are not aware of this [LBS] system. We need materials, preferably official government publications, that explain and legitimize this system to learners and the public at large. Acceptance of this system will be limited until it has the trappings of being official, not temporary or in draft form.

4. *Evaluating Learning Activities and Demonstrations*

Evaluate and re-evaluate learning activities and demonstrations, both by learners and instructors.

There is a need for ongoing evaluation and re-evaluation of learning activities and demonstrations used in LBS numeracy programs, both by learners and instructors. To some extent this has been addressed through funded projects where demonstrations have been piloted. Although numeracy instructors regularly review and update the learning materials used in their programs, it is apparent both from the questionnaires and from talking with LBS instructors that there is a varying degree of comfort surrounding the use of demonstration activities. Some programs endorse and encourage the use of demonstrations as a valid form of evaluation while others find it impractical. A general observation is that demonstrations seem more readily accepted and used at the lower levels of LBS programming.

Understandably, demonstrations are more difficult to implement at the higher levels for interconnected reasons. One is that higher-level demonstrations, in order to address a number of different skills and a wide body of knowledge, must be quite comprehensive. Such demonstrations require the practitioner to devote a significant amount of time to their creation and evaluation. Again, this has been partially addressed by MTCU/NLS funded projects across all sectors that have resulted in a number of field-tested demonstrations available for use by LBS practitioners. What must now follow is an opportunity for numeracy practitioners not involved in the field-testing to review those demonstrations and, if necessary, modify them according to the needs of their learners.

The second reason that some programs find demonstrations cumbersome is that the learners themselves, again most frequently at the higher levels, find the demonstration

activities time-consuming and distracting from their regular work, as opposed to supporting their regular work. This is particularly true of college-bound learners who often face a large workload in multiple subject areas as well as time constraints imposed by both their sponsoring agency and the schedule of post-secondary programming deadlines. Some practitioners maintain that paper-based testing for college-bound learners is most valid and necessary because the learners will face such tests repeatedly in the post-secondary setting, and so test-taking skills should be enhanced during the learners' time in LBS.

If the widespread use of demonstration activities is to be consistent across all levels and sectors of LBS numeracy programming, practitioners need to be given the opportunity to see why their current evaluation practices should be augmented by the use of demonstrations. While some programs have embraced and implemented demonstrations wholeheartedly, others are reluctant to do so based on some or all of the reasons discussed above.

“Niteracy or Lumeracy?” Some Reflections on Integrating Literacy and Numeracy in Adult Basic Education

Literacy has been promoted for some time as the major component of adult basic education, or re-education. The need to read and write – to communicate effectively through words – has taken great priority in many countries of the world in recent years. There are numerous Canadian and international organizations devoted to literacy.

Transformations

Recommendations for Future Directions

The profile of numeracy as a separate entity from literacy has emerged in more recent years. Organizations devoted to numeracy, as distinct from literacy, have begun to develop. The language of numeracy is gaining recognition as a means of communicating, as is the importance of critical, reasoned thinking that goes hand in hand with being numerate. More and more, the need to be numerate as well as literate is at the forefront of adult basic education.

There is a balance between integrating numeracy and literacy on a holistic program level while still allowing numeracy to develop and retain an identity distinct from literacy. On a national level, several countries have articulated standards for both literacy and numeracy programming as reported in the research section of this manual. While those national frameworks acknowledge the need to integrate literacy and numeracy to some extent, they do allow numeracy to retain its own identity as a separate subject area with separate themes and learning outcomes.

Naturally, literacy and numeracy have some common themes – both are process-oriented; both involve some of the same generic skills such as organization and decision-making. The great connection between communicating through words and communicating through numbers should be observed, explored and expanded upon by LBS learners and practitioners. But numeracy also needs some public relations work in Ontario, in Canada, and internationally. Here in Canada there are excellent organizations such as NALD and Alphaplus where numeracy and literacy resources, discussions and information are readily available. But lacking in Ontario, and Canada, is a central, accessible repository for issues, resources, and discussions devoted entirely to numeracy – one that propounds, promotes and supports both the success of numeracy learners and the professional development of numeracy practitioners.

Language across the curriculum has gained great support in recent years, and similarly now numeracy across the curriculum is an emerging as a valid approach to adult basic education. Despite the widely accepted notion of emphasizing language across the curriculum, language and literacy have retained a definition and identity distinct from numeracy or any other subject area. Most educators agree that the emphasis on language must infuse all subject areas since both academic studies and real-life situations require a solid grasp of the English language. The same may be said of numeracy, but there is a point at which integration of the two may be to the detriment of the learner. In order to obtain a deep, lasting and transferable grasp of either literacy concepts or numeracy concepts, the learner needs solid instruction in the basics of both, not just at the early levels, but all the way through to LBS 5 and beyond. In order to retain and increase the learners' ability to make informed, reasoned decisions about mathematical information presented to them, to think critically, they must continue to be provided with the tool and skills necessary to make those informed decisions.

The necessary tools are the numeracy skills and knowledge that lead to a deep and lasting understanding, and this thought must be kept at the forefront of programming policies and guidelines. Would anyone learn to drive a car by taking a course on "Modes of Transportation"? No, that prospective driver needs instruction in the skills and rules specific to driving a car, in order to both be safe and to have a lasting understanding of the rules of the road. Once those basic driving skills are in place, the "Modes of Transportation" course may have a useful, beneficial place in that driver's broader education but always with reference to that first basic driver education course.

Numeracy and literacy learners, too, need the basic "rules of the road" before they can progress to the freeway and later the exit-ramps into employment, society, or further

Transformations

Recommendations for Future Directions

education. Adult educators and policy makers must ensure that casualties on the road to literate and numerate thinking are kept to a minimum by supporting the distinct nature of numeracy and literacy, while at the same time providing vehicles for merging the two when it is appropriate – when the learner has the confidence and knowledge base to handle the traffic patterns of integrated learning.

Numeracy and literacy are both essential communication tools. There is a balance between integrating the two in adult basic education programs while retaining the solid delivery of basic skills in each to promote lifelong understanding. Numeracy deserves its own identity, its own storefront display, as does literacy. Only when each is well understood and promoted on its own by learners and practitioners can there be an effective merging of the two.

Transformations Evaluation Form for LBS Numeracy Programs

In order to assist practitioners in evaluating many aspects of their LBS numeracy programs, the following pages (74 to 80) provide a self-evaluation package. Practitioners are encouraged to use this tool collaboratively in an effort to review and update their numeracy programming.

Transformations Evaluation Form for LBS Numeracy Programs

Program Environment

		yes	no
1.	Does your program staff meet regularly to discuss learner progress, attendance, and operational issues?	?	?
2.	Do your staff members have access to appropriate professional development?	?	?
3.	Is the prospective learner made to feel welcome and respected during all stages of her/his association with the program?	?	?
4.	Are guiding principles of adult learning/teaching evident in your program?	?	?
5.	Is the physical arrangement of the classroom conducive to learning, interaction and access to resources?	?	?
6.	Do all learners have equal access to resources?	?	?

Comments

Transformations Evaluation Form for LBS Numeracy Programs

Assessment/Placement

		yes	no
7.	Is each learner given an individual initial assessment to determine an appropriate starting point and possible ending point?	?	?
8.	Does the initial assessment and placement take into account the prior life and work experience of learners, i.e. through an informal interview with the learner?	?	?
9.	Is there a clear link for the learner between assessment results, placement and the learner's goal?	?	?
10.	Do opportunities exist for clarification/modification of the learner's goal during the course of her/his stay in the program?	?	?

Comments

Transformations Evaluation Form for LBS Numeracy Programs

Learner Profile

		yes	no
11.	Do learners have an opportunity to discover their predominant learning style?	?	?
12.	Does the program provide enough flexibility in pacing to accommodate a learner's specific needs?	?	?
13.	Are learners permitted to work in peer-helping groups?	?	?
14.	Does the program provide a variety of resources for numeracy that would accommodate different learning styles? (print-based, audio tapes, manipulatives, videos, CDs)	?	?
15.	Are resources available for special needs learners?	?	?

Comments

Transformations Evaluation Form for LBS Numeracy Programs

Teaching Strategies and Resources

	yes	no
16. Are learners made aware of strategies for dealing with math anxiety?	?	?
17. Is there use of real-life applications in teaching numeracy skills?	?	?
18. Are real-life applications linked to the learner's		
a) previous experience?	?	?
b) current interests?	?	?
c) goal?	?	?
d) workplace related skills, based on her/his goal?	?	?
19. Are resources appropriate to the		
a) age group of the learners?	?	?
b) cultural background of individual learners?	?	?
20. Are learners provided with strategies for reviewing, studying, and test-taking?	?	?
21. Are learners coached on reading strategies for solving math word problems?	?	?
22. Do learners become aware of various strategies for problem-solving, i.e. creating a matrix, making a diagram, guess and try, working backwards from the answer, estimate and verify, observe and learn, etc.	?	?

Transformations Evaluation Form for LBS Numeracy Programs

Comments

Transformations Evaluation Form for LBS Numeracy Programs

Learning Activities

		yes	no
23.	Are learning activities closely related to each learner's individual training plan?	?	?
24.	Do learners have access to a variety of activities and/or resources, i.e. print-based, audio-visual, computer-based, small group instruction, one-on-one instruction, peer-facilitation, etc.?	?	?
25.	Is there recognition that learners benefit from input regarding optional/preferred activities when appropriate?	?	?
26.	Are there cross-domain activities in place in your numeracy program?	?	?
27.	Do some numeracy activities provide a link to workplace skills?	?	?

Comments

Transformations Evaluation Form for LBS Numeracy Programs

Evaluation and Demonstrations

		yes	no
28.	Does the program provide for on-going assessment?	?	?
29.	Are on-going evaluation results discussed with learners?	?	?
30.	Is there a variety of evaluation methods in place?	?	?
31.	Does the program acknowledge learner achievement in numeracy, i.e. progression through LBS levels?	?	?
32.	Are there appropriate demonstrations in place to measure and document learner achievement?	?	?
33.	Do you include non-math based components in your evaluation of demonstrations?	?	?

Comments

Transformations

Evaluation Form for *Numbers Talk* Manual

This manual represents an initial effort to report on adult numeracy programming, both internationally and in Ontario LBS programs. Research, resources, and the results of the project questionnaire have been included. Further work of this nature will benefit from feedback elicited through this evaluation form. Your input is valued! Please mail or fax your response to:

Literacy and Basic Skills (ASD), Canadore College, Box 5001, North Bay, ON P1B 8K9
 fax (705) 495-7904

1. I am involved in LBS numeracy programming as (check all that apply):

- an instructor
 a program manager
 a volunteer tutor
 a program coordinator
 other (please specify) _____

2. The section(s) of this manual that most interested me are:

- Numeracy Equals** (Definitions of Numeracy Based on Current Research)
 Basic Operations (Current Research on Adult Numeracy Programming)
 Congruent Figures (Annotated Bibliography of Current Research/Practice)
 Common Denominators (Best Practices in Ontario LBS Programs)
 Transformations (Recommendations for Future Directions)

3. Please rate the manual on each of the following criteria: (5 is the highest)

Organization	1	2	3	4	5
Relevance	1	2	3	4	5
Clarity	1	2	3	4	5
Readability	1	2	3	4	5

4. I would be interested in seeing more information on:

5. Other comments and/or suggestions:

Thank you for taking the time to complete and submit this survey!

Data Management

Questionnaire for the Numeracy Best Practices Project

Practitioner Contact List

Reference List

Teaching numeracy is not necessarily about having resources. It's about thinking patterns, learning styles, understanding, confidence – these are important skills that can be transferred. This is what we're not articulating and translating into training.

Barbara Moreton

From the Summary of Proceedings of the Numeracy Roundtable, 2000

Numeracy Best Practices Project Questionnaire

Background

This project is funded by the MTCU and NLS. The goal of the Numeracy Best Practices project is to produce a manual of best practices for delivering numeracy instruction to adult learners in LBS levels 1 to 5 across all sectors of literacy/numeracy programming in the province. The manual will include:

- an annotated bibliography of resources for adult numeracy education
- a compilation of best practices as described by respondents to this questionnaire
- an evaluation form for the manual
- a self-evaluation form for programs delivering numeracy education to adult learners

Ways to Respond

By Telephone

Please forward to me (Barb Glass) your name, number and the preferred time(s) I can reach you.

Email glassb@canadorec.on.ca
 Telephone 705-474-7601, x5320 (Canadore College)

By Email

Please send to me your “best practices” as outlined in the questionnaire, along with the general information from questions 1 to 5.

glassb@canadorec.on.ca

By Mail or Fax

Please print and complete a copy of the questionnaire and send it to me at:

Barb Glass
Preparatory Programs
Canadore College
Box 5001
North Bay, ON
P1B 8K9

Fax: 705-474-2384

Timeline

Please attempt to forward your responses to me by **November 20, 2000**, so they may be considered for use in the manual.

Questionnaire

Part A - General Information:

1. In which community (town, city) in Ontario do you work?

2. What is your present responsibility in the field of Adult Numeracy Education? Check all that apply.

_____ Volunteer adult numeracy tutor

_____ Adult numeracy instructor

_____ Adult numeracy/literacy co-ordinator/administrator

_____ Network co-ordinator/personnel

_____ Other (please specify) _____

3. Which delivery sector are you from?

_____ Community-based Literacy

_____ School Board

_____ College

4. With which level (s) do you work?

_____ LBS level 1

_____ LBS level 2

_____ LBS level 3

_____ LBS level 4

_____ LBS level 5

_____ Other (please specify) _____

5. How many years have you been involved in adult education?

_____ Less than 5 years _____ 6-10 years _____ more than 10 years

Part B - Best Practices

This portion of the questionnaire addresses five general categories of information:

- ❖ Program Environment
- ❖ Learner Profile
- ❖ Teaching Strategies and Resources
- ❖ Learner Activities
- ❖ Evaluation, Assessment and Demonstrations

Best Practices apply to all of these four areas. Please respond to questions for which you can share some examples of what works well in your program. Keep in mind that your responses should be examples of best practice based on your experience with delivering numeracy education to adult learners in LBS levels 1 to 5.

The manual resulting from the Numeracy Best Practices project may include some of the best practices you describe on the following pages – that’s what the project is all about!

❖ Program Environment

What do you feel is a manageable learner/teacher ratio? Does it depend on the level of the learner?

What elements of your classroom environment contribute most to the success of your students? (location, set-up, bulletin boards, displays, etc.)

Is there a particular time of day when your numeracy classes/tutoring are most effective?

How do you assess the intake level of your learners? (paper-based, computer-based, etc.)

What effective orientation strategies do you use (related to numeracy) when the learner first begins?

❖ Learner Profile

How do you address various learning styles in your numeracy program?

How do you address learning disabilities in your numeracy program?

Are there specific activities/strategies you use to reduce the “math anxiety” experienced by many adult learners? Please describe.

How do you assist your learners in making connections between their real-life experiences with numeracy concepts (ex. money, measurement, etc.) and their classroom work?

❖ *Teaching Strategies and Resources*

As numeracy practitioners, we sometimes find a really effective way of explaining a particular concept to our learners. If you have any such activity or strategy that you feel works well with reference to a specific topic or concept, please describe it below. You are welcome to describe more than one!

Some numeracy programs make use of concrete, manipulative materials such as fraction bars, measuring tapes, scales, geometric shapes and figures, etc. If you use such materials, please list them and the concept to which the material relates.

What resources for students have you found to be most useful in your numeracy program? You may wish to list print-based material, websites, videos, CD Roms, etc.

What resources for instructors have you found to be most useful in your numeracy program?

How, if at all, do you use computer technology in your numeracy program?

❖ *Learner Activities*

Learner activities include a wide variety of things that learners do in order to reinforce numeracy concepts. Examples of learner activities could be drill and practice, giving a presentation, creating and solving word problems, and peer tutoring, to name a few. Describe one or more of the learning activities in your program that help learners to assimilate new concepts.

❖ *Evaluation, Assessment, and Demonstrations*

Assuming that initial assessment of the learner has taken place during his/her intake to your program, how do you monitor/evaluate the progress of your students:

- a) as they are working through a unit or module?
- b) at the end of a unit or module?

Please describe:

- a) any methods of assessment you have found to be particularly useful, i.e. assignments or projects related to a specific numeracy outcomes.
- b) any effective demonstrations you are using in your outcomes-based numeracy program.

❖ *Other Best Practices*

If you would like to describe any other features of your numeracy program that you consider especially beneficial to learners or practitioners, please do so.

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Practitioner Contact List

The following is a list of numeracy practitioners who provided contact information through the project questionnaire.

Mark Armstrong, Teacher
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Denise Blais & Mary Mills, Numeracy Tutors
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Numbers Talk

A Cross-sector Investigation of Best Practices in LBS Numeracy

In listening to the students in the CGEA [adult basic education] classroom I have become more and more aware of the importance played by their own unique views of themselves and their lives. I think that somehow these motivations, and past life experiences, can provide valuable clues for teaching. They tell us how the students see themselves; what they see as their role in life. I am suggesting that this positioning of self, coupled with a picture in their heads of what mathematics actually is, has a greater effect on what they take away from maths and numeracy classes than teachers might realize. These factors can cut across any visions that we, as teacher, might have of what is important in mathematics.

Beth Marr

From the article: *Making connections; listening to the voices of adult numeracy students*, 1994