

A Practitioner's Guide to the Levels 1 and 2 Numeracy Benchmarks





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Preface

Purpose

This document provides a framework and suggestions for adult literacy practitioners' ¹ work with Levels 1 and 2 Numeracy Benchmarks. The complete Numeracy Benchmarks are outlined in *The Circle of Learning: Saskatchewan Adult Literacy Benchmarks - Levels 1 and 2* ².

This guide can be used as a framework for education work – it helps practitioners put theory into practice. The ideas, authentic examples and applications you'll find in this guide may be used directly, but also can be modified and adapted to suit the individual needs of learners ³ and practitioners.

The relevant background information in this practitioner's guide compliments the Benchmarks training the Saskatchewan Literacy Network is currently offering to literacy practitioners throughout the province.

Overview

This practitioner's guide has been divided into five sections:

1. The **Introduction** provides a theoretical background of what numeracy is and how it differs from mathematics. You'll learn about the Numeracy Benchmarks, and some relevant information about the unique characteristics of adult learners and what motivates them to learn.
2. The **Learners** section further explores adults as learners and issues such as math anxiety.
3. The **Practitioners** section:
 - discusses what it means to be a numeracy practitioner;
 - addresses anxieties that some practitioners may have about numeracy;
 - describes a process to identify numeracy skills that adult learners may already possess, and;
 - discusses how to use the Benchmarks for comparison and evaluation between Level 1 and Level 2.

1 In this document, the term practitioner is all-inclusive. It refers to everyone who is involved in adult literacy program delivery, whether paid or volunteer: instructors, co-ordinators, program planners, office support workers, etc.

2 For purposes of brevity and ease of reading, this document refers elsewhere to The Circle of Learning Levels 1 and 2 Adult Literacy Benchmarks as Circle of Learning or Levels 1 and 2 Benchmarks or Literacy Benchmarks, and/or simply as Benchmarks.

3 The term learner refers to adult literacy students, regardless of the type of educational program they attend: formal/non-formal, group/individual etc.



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4. The **Supports for Learner Success** section provides suggestions for instruction, including technology, math manipulatives and materials to use as resources.

Throughout this document there are 'Something to think/write/talk about' sheets that encourage practitioners to reflect, think and write. These questions can prompt practitioners to create, develop or evaluate their own essential understanding and model a process that can then be used with learners. It is hoped that these question sheets can also help learners become more self-directed and better prepared to determine what they want to learn and how they can learn it.

5. The **Appendix** - Please take the time to explore the appendix as it is full of practical numeracy teaching material.

History of the Resource

The following provides a history of initiatives in the Saskatchewan literacy field that shaped the development of this 'Practitioner's Guide to the Levels 1 and 2 Numeracy Benchmarks'. In creating this document, the Saskatchewan Literacy Network and Project Management Team and Review Committee members responded to larger changes in the Saskatchewan literacy field.

The Beginning...

In October 1998, the Saskatchewan literacy community expressed their tutor training needs at a forum of literacy coordinators in Saskatoon. A follow up questionnaire was sent to practitioners to further identify topics to be included in the resource. Feedback made it clear that the resource needed to address questions and issues such as:

- What levels will the resource be aimed at?
- What are the most efficient means to obtain optimum use of resources in a project of this nature?
- How does one develop a resource that helps tutors manage a situation where:
 1. there is no set curriculum to follow;
 2. learners are at different stages of understanding and;
 3. learners have different experiences and backgrounds?

Development of the Level II Numeracy Kit

In response to these questions (above), the Saskatchewan Literacy Network (SLN) developed the Level II Numeracy Kit in 2001. It was designed as a "train the trainer" resource. The resource had eight themes (SLN, 2001, pp.1-2):



Processes

1. Problem Solving/Reasoning/Decision Making
2. Communication and Representation
3. Relevance and Connections

Content

4. Number and Number Sense
5. Data: Data Analysis, Probability and Statistics; Graphing
6. Fractions, Decimals and Percentages
7. Geometry: Spatial Sense and Measurement
8. Algebra: Patterns and Functions

Rationale for the Revision

Since 2001, there have been several initiatives that have affected the delivery of literacy and Adult Basic Education. These initiatives resulted in changes in programming and delivery processes and contributed to the need to develop 'A Practitioner's Guide to the Levels 1 and 2 Numeracy Benchmarks'. Some of these initiatives are discussed below.

1. Basic Education Program Review (1999)

In 1999-2000, Advanced Education, Employment and Labour, (called Post-Secondary Education and Skills Training at the time), conducted a formal evaluation of literacy and ABE programs and services in the province. The results of the evaluation led to several actions, including the formation of three working groups to develop:

- a provincial framework for intake and assessment;
- a provincial literacy strategy; and
- a vision for redesigning ABE.

The work of these groups and implications for this document are discussed below.

2. Intake and Assessment Framework for Basic Education and Related Programs for Adults (2003)

This framework was created with a reference group consisting of representatives from community-based organizations, public institutions, career and employment service delivery organizations and the provincial government. The initial assessment framework articulates:

- the guiding principles for the development and delivery of quality initial assessment and intake services;
- a provincial initial assessment model;
- baseline standards for data collection;
- protocols for information gathering and sharing; and
- processes for the implementation and evaluation of the model.

(Saskatchewan Learning, 2003, p.5)



3. The Circle of Learning: Saskatchewan Adult Literacy Benchmarks (2006)

A need for provincial literacy Benchmarks has been identified by practitioners and learners for many years. The work of the Provincial Literacy Steering Committee (2001-2004) and the ABE Redesign Task Team (2001- present) re-affirmed this need. The Literacy Steering Committee identified development of literacy Benchmarks as a goal in their action plan and they supported the establishment of a Benchmarks development team.

The ABE Redesign Task Team included development of literacy Benchmarks as part of the redesign process. In all work done in literacy (Levels 1 and 2) and Adult 10 (Level 3) programs⁴, there has been consistency in the application of guiding principles, development processes, implementation strategies and sustainability planning.

A partnership was formed between the SLN, Advanced Education and Employment, (now Advanced Education Employment and Labour), and the Saskatchewan Literacy Commission (now the Office of Literacy), with funding support from the National Literacy Secretariat, now the Office of Literacy and Essential Skills, and the province, to develop Saskatchewan Adult Literacy Benchmarks, Levels 1 and 2.

In 2003, development of the Benchmarks began with the formation of a Project Management Team, then hiring of a project manager and the formation of a provincial advisory committee. Two groups of pilot projects were run and the document was finalized. Implementation of the Benchmarks began throughout the province in 2007. It is essential that instructional approaches, philosophies, resources and sample tools in the A Practitioner's Guide to the Levels I and II Numeracy Benchmarks support the learning outcomes in The Circle of Learning.

4 Refer to Basic Education Redesign. Phase 1: Planning and Foundations at <http://www.aeel.gov.sk.ca/abe/> redesign for a definition of ABE and a description of the foundational work related to the redesign process and conceptualization of literacy benchmarks.



Introduction

What is Numeracy?

Numeracy ... is more than an ability to do basic arithmetic. It involves developing confidence and competence with numbers and measures. It requires understanding of the number system, a repertoire of mathematical techniques, and an inclination and ability to solve quantitative or spatial problems in a range of [real life] contexts. Numeracy also demands understanding the ways in which data are gathered by counting and measuring, and ... in graphs, diagrams, charts and tables.

(National Strategy, United Kingdom Department of Education and Skills, 2005)

Numeracy and mathematics, although related, are not the same thing. Mathematics is pure and theoretical with a subject- based context: it is abstract. Numeracy, on the other hand, takes mathematical knowledge and applies it to everyday life.

Numeracy is grounded in purpose, use, or application in life: it is contextual. Because adult learners have varied life experiences, the contexts for numeracy (personal or family, community, workplace and further training) shape how learners use numeracy. When a learner can take math content and apply it in a context that is specific to him, such as installing baseboards at work, then that person is working with numeracy.

One analogy used by the Ottawa-Carleton District School Board in their practitioner training course (2005) was that if math is a menu, numeracy is the meal. "Numeracy takes from math what it needs, and uses what it has taken in ways that are suitable for a variety of purposes."

If a learner has had past negative experiences with math and numeracy, they may feel more positive if the context and purpose is the primary focus rather than doing purely theoretical mathematics exercises. **For adult education, context is the driver for learning and is unique to every learner.** The principles and philosophy of the Circle of Learning state, **"When theory is applied to real-life situations, the learning becomes relevant, learner centered, and holistic, and the educational experience is enhanced for everyone."** (SLN, 2006, p.7)

Practitioners can find out from learners what task they want to be able to do and in what situation and this can help establish the content that they need to cover. Alternatively, practitioners may begin with the content and then identify the contexts in which the content is applied and match that to learners' needs. Whether you are a mechanical engineer, a coach in your community, a hairdresser, or a construction worker, numeracy can include any kind of math.



The following examples offer practitioners mathematical content that learners can apply in specific situations. The chart illustrates the difference between numeracy and mathematics and also shows the interconnectedness between context and content.

| Numeracy | Mathematics |
|---|--|
| Context: purpose/task/situation | Content |
| Level 1 Examples | |
| Doubling a recipe. | Write equivalent fraction by multiplying by a form of one. Adding fractions. |
| Reading a rain gauge. | Using measurement and understanding a scale. |
| Administering medicine. | Read a table of values to find the amount that corresponds to the mass or age of the child. |
| Mixing drywall mud to patch holes in walls. | Write ratios and solve proportions. Measure amounts in units for volume and mass. |
| Level 2 Examples | |
| Deciding which phone plan is the most affordable. | Writing an equation in two variables that represents the relationship between the two. Solving equations written in two variables given one variable. |
| Mixing herbicides in a sprayer on a farm. | Calculating area and using ratio and proportion to mix necessary amount for spraying. |
| Planning a trip. | Calculating time, knowing distance and speed, using algebra or ratio and proportion. Budgeting for fuel, meals, accommodations, and time. |

What are Benchmarks?

Benchmarks⁵ are, "Points of reference that serve as a basis for evaluation or comparison."

(SLN, 2006, p. 2.)

⁵ See Appendix B: Levels 1 and 2 Numeracy Benchmarks.



Benchmarks outline learning outcomes and are a tool to measure and evaluate learners' skills and knowledge.

When teaching numeracy, the Benchmarks can help identify what the learner will need to learn in order to do what they desire. For example, does a learner have a need or interest in installing flooring, reading a bus schedule, calculating the discount on a sale item, or applying for a job? Do they already possess the skills to do these tasks and if not, what do they need to learn to meet their goal?

The Benchmarks compare skill levels and decide what level the learner is at. The following scenario demonstrates how the Benchmarks assist both learners and practitioners.

Scenario:

David currently holds a shipping and receiving position for a company. He is responsible for:

- counting items received from suppliers and cross referencing those to an order form by quantity and part number.
- compiling orders from a purchase order or packing slip, cross referencing quantity and part number.
- packing shipments in the most effective and protective fashion.
- tracking and recording inventory.

He is very familiar with the product as he has worked in this position for three years. Due to a retirement, the inside sales position is opening up and David would like to apply. Some of the duties of that job include understanding billing and sales tax to create itemized invoices with a computer program. He wants to improve his numeracy to apply for this job.

The following chart demonstrates how the Benchmarks would use 'real life' situations as an initial evaluation tool and for goal setting. The chart lists the duties in David's current job. The middle column correlates the applied mathematical content with each duty. The last column is for aligning what it is that David is doing in the context of his workplace with Numeracy Benchmarks. These charts ⁶ are looking at numeracy in isolation, although all aspects of the job could be looked at in this fashion and could include communication, interpersonal and lifelong learning skills.

⁶ See Appendix C: Aligning with the Benchmarks



| Numeracy | Mathematics | Benchmarks |
|--|--|---|
| Context: purpose/task/situation | Content | Aligning with the Benchmarks... |
| What David does ... as a shipper receiver | What David uses ... as a shipper receiver | Am I at Level 1 or 2? |
| Counting items received from suppliers and cross referencing those to an order form by quantity and part number. | Counts whole numbers. Adds and subtracts whole numbers. Recognizes patterns in part numbers. Classifies product using part numbers. | Level 1 Level 1 Level 1/2 Level 2 |
| Compiling orders from a purchase order or packing slip, cross referencing quantity and part number. | Counts whole numbers. Adds and subtracts whole numbers. Recognizes patterns in part numbers. Classifies product using part numbers. | Level 1 Level 1 Level 1/2 Level 2 |
| Packing shipments in most effective and protective fashion. | Estimates. Identifies and understands the capacity of 3-dimensional objects. Identifies and understands the volume of the items to be shipped. Uses sense of spatial relations to solve problems. | Level 1 Level 1 Level 1 Level 2 |
| Tracking and recording inventory. | Counts. Collects data. Records data. Understands maximums and minimums in inventory. Sees patterns and relations between time of year and demand for certain product. | Level 1 Level 1 Level 1 Level 2 Level 2 |



This same process can be done with the job David wants to apply for. Using the Benchmarks tool we have listed what David will do at the new position and identified the mathematical applications in those workplace tasks. The following chart determines levels and suggests what can be taught. Any gaps between the content at his current position and the desired position will be the basis for a learning plan.

| Numeracy | Mathematics | Benchmarks |
|---|--|--|
| Context: purpose/task/situation | Content | Aligning with the Benchmarks... |
| What David does ... as an inside salesman | What David uses ... as an inside salesman | Am I at Level 1 or 2? |
| Take orders from customers using part numbers. | Translate verbally spoken numbers to written. | Level 1 |
| Use part numbers to identify product. | Use numbers as a classification system. | Level 1 |
| Use computer software to input prices and generate invoices. | Use algebraic thinking in finding a total for 3 of 1 kind of item, 2 of another. | Level 2 |
| Include customer discounts. | Use multi-stepped calculations and percents to calculate discounts. | Level 2 |
| Include appropriate taxes. | Use percents in multi-stepped equations. | Level 1/2 |
| Calculate shipping costs based on mass and time for delivery. | Measure mass on a scale, estimation, use a calendar. Algebraic calculations. | Level 2 |

Some of the content that is required for the job as an inside salesman is already part of David's skill set acquired through his job as a shipper/receiver. These skills need to be recognized and do not need to be part of the learning plan. The Benchmarks process is important to take learners through so that they can see how they already possess certain numeracy skills. Using the Benchmarks document with the learner can help you both determine the skills and knowledge that need to be built on.



What are Adult Learning Principles?

“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: link[ing] 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.”

(Dingwall, J., 2000)

Adults approach learning in very different ways than young people do, and their reasons and motivations for learning can be varied as well. Adults tend to seek out learning opportunities in order to make life changes. Learning is relevant and purposeful for adults. In other words, learning is more problem based or context driven as opposed to the memorization of facts and content. The learning is a means to an end, not an end in itself.

It needs to be recognized that adult learners come with a wealth of diverse backgrounds and experiences. An adult learner’s past life experience creates different stages of understanding and varying dispositions towards learning and numeracy.

Imel’s principles of adult education are outlined in Basic Education Redesign –Phase1: Planning and Foundations (Saskatchewan Post-Secondary Education and Skills Training, 2002, p. 17) and in The Circle of Learning. These guiding principles are:

- Involve learners in planning and implementing learning activities.
- Draw upon learners’ experiences as a resource.
- Cultivate self-direction in learners.
- Create a climate that encourages and supports learning.
- Foster a spirit of collaboration in the learning setting.
- Use small groups.

In conversation with Lynda Richards (May 2008), a Saskatchewan adult learner, she spoke about what she believes is important for practitioners to know when working with adult learners.

“A lot of times adult learners bring baggage and labels with them thinking they are stupid. Adults have knowledge and specific learning styles. Learners may not have identified their learning styles. They do these things but aren’t looking at them through a lens of numeracy.”



Lynda's suggestions for a supportive adult program include the following:

- Build a rapport with learners and find out what they have for a support system.
- Create comfort.
- Identify learning styles of the learner and teach them about how they learn.
- Take the end goal and break it into smaller goals so that learners can reflect back and feel success thereby being motivated to keep going.
- Help learners to recognize the skills they already have from life experiences such as being "just" a stay at home mom.



Something to think/write/talk about...



- How do I think numeracy and mathematics are related?

- How do I provide a relevant context for numeracy learning?

- How do I use the Benchmarks as the standard for measuring progress in a learner's numeracy program?

- How do I incorporate adult learning principles in a learner's numeracy program?

- How do I cultivate learner self-directedness in a learner's numeracy program?

Notes and Ideas...



Learners

Who are Adult Learners?

“An adult learner is someone who wants to increase the literacy skills that are needed for everyday life such as reading, writing and number skills. An adult learner is someone who commits to literacy learning or is part of a literacy program.”

What Adult Literacy Learners Would Like YOU to Know (from the Movement for Canadian Literacy):

- Adult Learners are people just like you in many ways.
- They have hopes and dreams for themselves and their children but less opportunity to realize them because of difficulty with reading and writing.
- Learners talk of poverty, family obligations, abuse, learning disabilities, and not getting the help they needed at school as some of the reasons they missed out on their education as children.
- The learners we spoke to want the opportunity to take control of and responsibility for their education now as adults.
- “People confuse literacy with intelligence. We need to show that there are different kinds of smarts (‘street’ or ‘people smarts’, not just ‘book smarts’).”
- “If you can’t read you have to be fully engaged and aware all the time! People with literacy problems have had to find other ways to cope everyday; it’s a type of genius.”

Learners want the world to see them as:

- Unique individuals with different goals and dreams, apart from their shared literacy needs.
- Lifelong learners - people with skills and strengths they are building on.
- Parents involved in their children’s education.
- Workers who want to improve their skills.
- Activists on behalf of literacy and other issues in their communities.
- Voters and taxpayers.
- Active in the pursuit of their goals.
- Competent to succeed in life.

(Retrieved, April 12, 2008 from: The Saskatchewan Literacy Network, <http://www.sk.literacy.ca/learners/adultlrn.htm>.)



Social Perceptions and Myths of Mathematics

"We've probably all been at a restaurant with a group of people who want to pay individually when one bill arrives. You find yourself in the position of trying to determine how much each person owes. What happens? You look over the bill and you say, "I'm no good at math" and you proceed to pass it to the next person who immediately responds the same way you did. Eventually and usually with some hesitancy, one person takes ownership over the bill and calculates the individual costs or divides the total by the number of people at the table. Did you notice how quickly people say that they were no good at math? Did anyone say, I'm no good at reading or I can't read? When and why is it acceptable in our society to say we're no good at math? We'd be embarrassed to declare that we're no good at reading yet it's quite acceptable in our society to say that we can't do math!"

(Deb Russell, Retrieved May 10, 2008 from <http://www.math.about.com>.)

Many people experience math anxiety. They may believe they are just not capable of math and that it is difficult. Or, their anxiety may derive from fearing failure and not experiencing much success in math class. Others may justify their personal struggles with math and numeracy as being caused by heredity - "My mom was never good at math and neither am I."

Mathematics is viewed as a highly theoretical and rigid field where facts and procedures have to be memorized and there is only one right way to solve the problems. However, mathematics is a dynamic and a creative field.

The attitudes and perceptions toward math and numeracy are powerful and can enable or disable people. It seems to be socially acceptable to admit to not being 'good at math'. Yet, the same would not be true of reading. Perceptions are what create reality.

Math Anxiety

"If we can control our anxiety by recognizing its symptoms and coping with them, we can go far. How far do we want to go? Not far enough to become engineers or mathematicians, perhaps. But surely far enough so that our fear of math no longer makes decisions for us."

(Tobias, 1995, Chapter 8)

Math anxiety is very real for many people. Many have experienced math as a test-laden school subject that is highly theoretical and not useful in everyday life. Learners may not recognize that they are numerate as there is a difference between the mathematics they use everyday and "school math", or in other words, between numeracy and



mathematics. If a learner studying numeracy lacks self efficacy i.e. the belief that they can be successful, they may experience math anxiety when faced with tasks that involve math.

The role of the practitioner in minimizing the learner's anxiety is to help the learner recognize the places and everyday tasks where numeracy is used.

People carry out tasks in everyday life that require them to be numerate and yet, they may not be confident of the skills they already possess. Looking at context first and not content, can offer learners the opportunity to reflect on the informal mathematics they do everyday. It can be empowering and confidence boosting, build self esteem and increase motivation if practitioners emphasize the real life numeracy and math skills a learner possesses. A checklist ⁷ of everyday tasks that involve numeracy can be used as a springboard to show the learner that he is already numerate.

Ways of Knowing

"... Alternative procedures are especially evident in adult education where students come to programs knowing computation methods that are easier for them to understand than the textbook algorithms. Some are unique procedures that they use at home or at work (Lave, 1988; Scribner & Stevens, 1989), while others are techniques that they learned in different countries (Schmitt, 2006; Zaslavsky, 1973). The goal for numerate behavior is to flexibly use procedures that lead to error-free results (are accurate) and take the least time and effort (are efficient)."

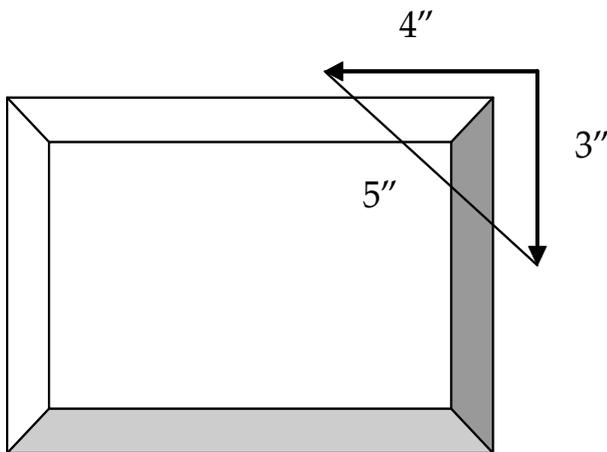
(Ginsburg, Manly and Schmitt, 2006, p. 29)

The perception that there is only one way to think of or do math is a myth, because rarely is there only one way to solve a problem. Depending on culture, career, or individual experiences, multiple intelligences and learning styles ⁸, mathematically correct thinking can be very different. The key idea to convey to learners is that there are several ways to approach a mathematical problem or in other words, you can be creative when doing and using mathematics.

For example, a carpenter will use a 3-4-5 rule to determine if a corner is in fact square or 90°. In doing so, the carpenter is using an application of the Pythagorean Theorem. He or she may not know it as such and quite frankly does not need to know that way to determine if a corner is square. This is the difference between theory and practice, mathematics and numeracy.

⁷ Appendix D: Checklist - How are you numerate?

⁸ See Appendix E: Multiple Intelligences and Learning Styles



When checking to see if a corner is square you can measure and mark 4 units from a corner in one direction, and 3 units in the other direction. The distance between those two marked points will be 5 units if the corner is 90° or square.

The Pythagorean Theorem states the hypotenuse squared is equal to the sum of the squares of the other two sides. So $4^2 + 3^2 = 5^2$ which means the 3-4-5 rule exists because of the Pythagorean Theorem.

A carpenter could also use the 9-12-15 rule!

It may be that adults do not remember the more formal mathematics they learned, if they learned it at all. Adults tend to develop strategies and methods for understanding the world around them and managing the use of mathematics.

"For adults, the context may well be the impetus for learning the mathematical content and will frame the application of that learning (e.g., "How many packages of cookies will I need to purchase so that each child at the party gets at least two?") The focus on applying mathematics in a context or having a social purpose to the use and application of the mathematics, provides motivation for learners to engage with and learn about mathematics. This leads us to conclude that it is the focus on, and prioritization of, context that differentiates an adult numeracy framework from a formal school mathematics framework."

(Ginsburg, Manly and Schmitt, 2006, p. 7)



Something to think/write/talk about...



- How do I help learners identify math in their everyday tasks?
- Why is it important to acknowledge learners' prior learning?
- How do I help learners recognize how they are already numerate and what their math skills are?
- Do I ever experience math anxiety? What does it feel like? What does it look like?
- How do I know when learners are experiencing math anxiety? What does it look like?
- How do I help learners deal with math anxiety?
- How do I encourage learners to see more than one way of approaching a numeracy skill or problem?

Notes and Ideas...



Practitioners

Being a Practitioner

" ... this is what the words 'educating' and 'facilitating' really mean: teaching another person to be in touch with what is already within, to bring up the wisdom that is ever present."

(Merzel, 2008, p. 111)

The quote above is in the context of yoga instruction, but it epitomizes the role of practitioners in literacy and numeracy programs: it explains how they are acting as facilitators and guides. The quote also acknowledges that adult learners come with knowledge and experience and that they are intelligent. It also implies that learning and understanding is a personalized process where learners can make connections to their own constructs of understanding and experiences. This is different from the traditional role of "teacher".

Being a numeracy practitioner is different from being a math teacher. The following quote clearly outlines the difference.

"In terms of classroom teaching, there appears to be a difference in what you do depending on the view you hold of what you are teaching. If as a teacher you see yourself as teaching math, this often means using a text book, getting students to sit for tests or exams, having students learn more formal math rules by rote, and so on. If your view is that you teach numeracy, you are more likely to teach math from a real life, contextual point of view where math is derived from some actual or modeled activity and where your students can learn through investigations and projects, and where you recognize, support and build upon the student's own ways of doing math.

It is for this reason that the term used to name and describe what we are teaching is important, and it is for this reason that the term "numeracy" as described above should be used to describe what it is we do when we teach math in ABE. It is a way forward."

(Tout, 2002)

As a practitioner you want to promote growth, use discernment, and learn how to read learners' needs to create a balance between supporting and allowing them to do for themselves.



Does Numeracy Make Your Knees Knock or Your Toes Tap?

"I'm not afraid of storms, for I'm learning how to sail my ship."

(Louisa May Alcott, Retrieved July 7, 2008, from <http://www.quoteworld.org>)

The prior experiences, beliefs and attitudes that a practitioner holds towards math and numeracy can have a great deal of influence on the learner's self-efficacy and success. Just as with learners, a practitioner's prior knowledge and life experiences play a role in how they instruct numeracy. Practitioners need to acknowledge and deal with any anxieties they may have. Anxiety may be sensed by learners even if it is not verbalized.

One way to energize yourself, to work through math anxiety and get your toes tapping about numeracy is to learn. How about practicing the 'Golden Rule'? do for yourself as you would do with learners:

- recognize the ways in which you are already numerate.
- find the math in your everyday tasks.
- look at how you can transfer existing skills to new contexts.
- understand and continue to develop your learning style.
- integrate numeracy into an area of strength.

Remember you do not need to know it all. It is a myth that the practitioner knows everything- that's unrealistic. As a practitioner, it is important to engage in the process of learning how to learn. The idea of facilitation is that practitioners help learners to learn, and so practitioners can learn as they work with learners too. Join an association, attend workshops, read, network with other practitioners, learn alongside learners, be open to having learners teach you and reflect on your own day-to-day activities to see all the ways you are numerate.

Creating a Learning Plan

"... teachers would do well to devise a curriculum that strives to:

- 1. begin with context and teach problem solving and procedures in service of solving real or realistic problems;*
- 2. draw upon contexts that are important to adults and that are part of their experience. [Also], provide a variety of numeracy tasks that emerge from contexts that are less familiar to the learners, but are worthwhile to know. Instructors must become familiar with the mathematics needed to manage the demands of family, workplace, community, and further education."*

(Ginsburg, Manly and Schmitt, 2006, p.35)



Practitioners, guided by adult learning principles, recognize that a learning plan needs to be relevant to adult learners' lives: it therefore needs to be learner driven and learners need to be involved in the planning and implementation.

The creation of a learning plan requires collaboration between learners and practitioners. Here are some tips to guide the process:

- Learners and practitioners need to work together to develop goals and a learning plan, and to find learning activities.
- The practitioner can help the learner achieve his/her goals by defining the numeracy skills and knowledge needed for the context of the learner.
- A practitioner may not know about certain contexts and the content involved, and so they may have to learn along with the learner.
- Expand the contexts for learners by connecting the skills to other applications that the learner may not see.
- Practitioners can help learners put tasks/goals in other contexts so that learners can confidently transfer their skills to other areas of their lives.

There are **three basic questions** that lead the process when working with learners to create a learning plan ⁹. They are as follows:

1. What is it the learner wants to be able to do?
2. What does the learner have to know to be able to do what he or she wants to be able to do?
3. What is it the learner can already do and what else must he or she learn to achieve his/her goals?

Question #1

The answer comes in the intake process when the learner is asked what it is they want to be able to do. The response to this may be related to numeracy, reading, writing, life skills, work, community, personal, etc. The answer to this question becomes the learner's goal(s). The goal(s) can be expanded by asking about other related tasks the learner does.

Question #2

Once the learner has determined his or her goal(s), it is then the role of the practitioner to answer question #2 by finding the content that matches the learner's context. What is required to support the learning the learner needs in order to meet their goal(s)?

⁹ See Appendix F: Creating a Learning Plan



Question #3

The answer to this question is found jointly by the learner and practitioner. The use of a skills and knowledge checklist ¹⁰ like the ones below can help to identify those things that the learner can do that show he/she is already numerate. The checklist can also determine what numeracy skills are needed to move the learner from what he/she already knows to what he/she wants to be able to do.

Those needs are the foundation of the learning plan used to then determine the learning activities. The learning activities relate back to the context of the learner's goal(s), and connect what the learner wants to be able to do to what it is they already know and do (knowledge and skills).

In the example of David, (the hypothetical learner we introduced in the section above), the first conversation may have been with the supervisor of the inside sales job. He asked the supervisor, "What do I have to be able to do as the inside sales person?" David could see that he already had some of the required skills that he could transfer to the new position, but would have to add new skills. In this example the supervisor unknowingly took on the role that a practitioner would with a learner. This process is very situational. It will look different for every learner.

The next two pages contain two checklist examples.

¹⁰ See Appendix G: Skills and Knowledge Checklist



A Level 1 Example - Balancing a Cheque Book

| Context - Learner's Goal | Content - Numeracy Skills and Knowledge Required | Able to do it now | Not able to do it | Want to be able to do it |
|--------------------------|---|-------------------|-------------------|--------------------------|
| Balancing a cheque book | Writing dollar values e.g. \$5.98 | √ | | |
| | Add numbers -whole numbers -positive and negative -decimal values | √ √ | √ | √ |
| | Subtract numbers -whole numbers -positive and negative -decimal values | √ √ | √ | √ |
| | Represent deposit with addition and withdrawal with subtraction | | √ | √ |
| | Understand "service charges" | | √ | √ |
| | Understand overdraft | | √ | √ |
| | Organize and record data in a table (cheque book) | | √ | √ |
| | | | | |



A Level 2 Example - Writing a Quote for Painting a Room

| Context - Learner's Goal | Content - Numeracy Skills and Knowledge Required | Able to do it now | Not able to do it | Want to be able to do it |
|-------------------------------------|--|-------------------|-------------------|--------------------------|
| Writing a quote for painting a room | Take direct measurements of length, width and height. | √ | | |
| | Calculate derived measure of area using the direct measures. | √ | | |
| | Use ratio and proportion to estimate or calculate the amount of paint needed to cover the wall area. | | √ | √ |
| | Estimate the amount of time needed to complete the job. | | √ | √ |
| | Understand rates of pay as \$/hour. | √ | | |
| | Use algebraic formula or proportional thinking to calculate the cost of labour. | | √ | √ |
| | Add dollar amounts, time values. | √ | | |
| | Calculate taxes. | | √ | √ |
| | Total an invoice. | √ | | |
| | | | | |



Lastly, consider these things when creating a learning plan:

- A learning plan is a 'living document': goals and contexts may change as learners' lives and learning needs change.
- A five year goal can be broken into pieces or chunks that are more easily achieved and less intimidating.
- Goals can be broadened through questioning and discussion.
- As learners meet goals, they may choose to change or add new goals.
- Work with the learner to set realistic but flexible timelines to achieve goals.

Marking Success

"To experience success, students must be taught to set achievable goals and assess themselves as they work toward these goals."

(Western and Northern Canadian Protocol, The Common Curriculum Framework: Grades 10-12 Mathematics, 2008, p.3)

Success for an adult learner can have many faces. Learners may experience success in the following ways:

- Beginning a program.
- Setting attainable goals for themselves.
- Progressing along the way to their goal.
- Reassessing and adjusting goals as opportunities arise.
- Recognizing successful moments/achievements as success.
- Achieving the goal(s) they have set for themselves.
- Attaining a Benchmarks Level 1 or 2.

Notice that achieving a Level 1 or 2 standing is only one example in the list of successes. This may not be the goal that every learner has set for themselves. The achievement of Levels 1 or 2 is a mark of success only when that was the learner's goal. And, even though a Level 1 or 2 may not be fully met this does not mean the learner was not successful.

There are many steps along the road that should be acknowledged as success. Success for learners is not only about meeting the long term goal, but marking the progress and achievements in the journey to the long term goal.

Practitioners and learners can use the Benchmarks as a standard to see where personalized learner goal(s) and successes fit into the Benchmarks structure. This can be kept in a portfolio for future use. Learners may use the achievement of Level 1 and 2 as a step onto further training.



Something to think/write/talk about...



- Am I a teacher of mathematics or a facilitator of numeracy? Or am I both?
- Why should learners be involved in creating their learning plan?
- How do I involve learners in the creation of their numeracy learning plan?
- How do I encourage learners to identify how they are numerate in their everyday lives?
- Why should I revisit numeracy goals with learners throughout their program?
- Why should I help learners break their long term numeracy goals into smaller, manageable chunks?
- How do I encourage learners to transfer their numeracy learning to other contexts?

Notes and Ideas...



Supports for Learner Success

Authentic Learning Materials - “Real” versus “Realistic”

[Real learning materials] implies that real adults are managing real situations in the real world, whereas [realistic learning materials] implies adults are operating within someone’s simulation or approximation of the real world.

(Ginsburg, Manly and Schmitt, 2006)

Adult learning is grounded in purpose. Instruction needs to be structured around what a learner wants to do and how to use the math to do it. That purpose is unique to the learner. The learning materials used in programs should reflect this and be contextualized or “real” to the learner whenever possible. Examples of real learning materials are employment applications, deposit slips, a menu, sale flyers, or recipes.

With ‘real learning materials’ learners are learning within the exact context of their lives, they are not using material that is a simulation of what may be part of their lives one day. This contextualized approach may also divert the questions that traditionally arise “Why do we need to learn this?” or “When or where will I ever use this?”

Scenario:

A learner is struggling with filling out her timesheet. Hours need to be written in decimal form. For example 1 hour and 15 minutes is 1.25 hours.

When a learner is asked what it is she wants to be able to do, she may reply “To fill out my timesheet with no mistakes”. The learner may not be able to express to you that she cannot convert hours to decimals because that is what she struggles with. Have her bring her timesheet to get help with filling out the fractions of the hours she works. The timesheet is an authentic learning material.

Find out what she can already do. As an instructor ask:

- Can she tell time? Have her bring in the watch she wears to work and use that as a resource. Is it digital or analog? Can she tell time on either and find the total hours and minutes?
- Can she add hours and minutes?
- Does she see that half an hour is 30 minutes out of 60 and not 50 minutes? (This is a common error in working with time because usually half is thought of as 50 out of one hundred.)
- Does she understand the format of the timesheet as a chart or spreadsheet for filling in data? Some computer software could be incorporated if the learner desired.
- Does she use a calculator?



Using the learner's real life context and purpose for learning is what contextualizing instruction is about. Later she may bring a pay stub to understand how her net pay is calculated from gross pay.

Math Manipulatives

"Mathematics is not... a spectator sport. Too much of current instruction fails to actively involve students. One way to address the problem is through the use of manipulatives. [These are] physical objects that help students visualize relationships and applications."

(Retrieved July 10, 2008 from: The National Library of Virtual Manipulatives, <http://www.nlvm.usu.edu/en/nav/siteinfo.html>)

Math manipulatives refer to concrete items that can be used and physically touched by learners to help to see and do math. Manipulatives make the abstract concrete. There are commercial math manipulatives that can be purchased. However, everyday items can also be considered manipulatives: a clock, money, a cake mix, a chocolate bar, a ruler or tape measure, measuring cups and/or a calculator. Games like cribbage, rummy, or solitaire use counting and they can be effective in mental math strategies.

Scenario:

When working with fractions, learners can use a set of measuring cups to discover the relationships that exist between fractions. For example: Two half cups will fill one cup. Three third cups will fill one cup. Four quarter cups will fill one cup.

The same idea could be used with purchasing foods. For example, is it cheaper to buy milk in one litre, two litre, or four litre containers? Using the actual packaging as manipulatives can help determine what the most affordable deal is really. With the learner you can see how many of the small packages it takes to fill up the larger. Does the money paid for each have the same relationship?





Technology

"I use [calculators] as instructional tools to assist in the development of concepts, to help reinforce skills, to promote higher level thinking, and to enhance problem-solving instruction. By freeing [learners] from the routine, long, or complex calculations, more time can be spent on conjecturing and reasoning."

(Esther D. Leonelli, Retrieved July 23, 2008 from <http://www.ncsall.net/?id=348>)

The use of calculators has long been debated. Here are some of the questions the debate sparks:

- When should they be permitted for use?
- Should everyone have the multiplication tables memorized?
- What about learners with disabilities?
- Will using a calculator prevent people from developing thinking skills?

Calculators are used in the workplace so using a calculator is a valuable, transferable skill for learners. Calculators should save time, not thinking. They can also alleviate the anxiety that comes with not having "basic facts" memorized and allow learners to use time for higher level thinking and processes like reasoning and problem solving. If a learner has an intellectual disability and can't remember basic numerical facts, a calculator can allow them to progress. The calculator can also be used to teach concepts of number theory and number sense, and promote reasoning skills.

Calculators come in a variety of models and with a range of functions. Some calculators display 8 digits, others 10, increasing the accuracy of calculations.

Calculators may be used to teach the need for the Order of Operations. The Order of Operations is applied when there is more than one mathematical operation to be carried out. The Order of Operations follows these rules:

1. Division and multiplication must be completed before addition and subtraction.
2. Addition and subtraction must be completed in the order in which they occur.
3. Division and multiplication must be completed in the order in which they occur.

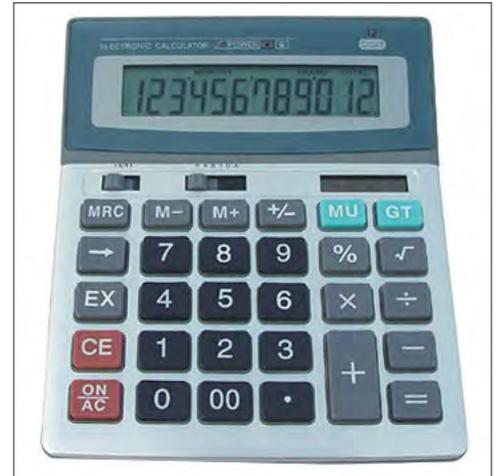
**A Scenario that demonstrates the need for following the Order of Operations:**

If one ticket was purchased at \$3.00 and 4 other tickets each at \$7.00, then what is the total spent?

The total would be calculated as \$3.00 added to the answer of $4 \times \$7.00$. However, if the question is taken out of context and given as $3 + 4 \times 7$ the answer would be 49, which is not correct.

One way to see if a calculator automatically follows the Order of Operations is to input this computation:
 $3 + 4 \times 7$

If a calculator does not follow the Order of Operations, and the question is input exactly as written, it would compute $3 + 4$ to get 7 and then multiply by 7 to get 49. (Again, this is the incorrect answer.)



Following the Order of Operations would give an answer of $3 + 28 = 31$.

If learners know that a calculator does not follow the Order of Operations, then they can adjust how the question is input. The key strokes would be $4 \times 7 + 3$.

This also reinforces that the order of addition does not change the value of the answer, i.e. $28 + 3 = 3 + 28$.

Literacy in Numeracy

"Things should be made as simple as possible, but not any simpler."

Albert Einstein

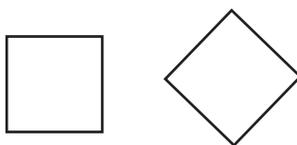
Numeracy requires reading, writing, speaking, listening, observing, representing and viewing strategies. For example, numbers and words need to be read when interpreting an address, determining the price on products or when using a calendar. Numbers are written in words and with symbols, i.e., one hundred seventy five for 175. In the workplace, a waitress setting a table for the first time may have directions that say a table setting requires three mugs, 4 placemats and 3 full cutlery settings. Mathematical operations require interpretation of symbols such as: $\times, \div, +, -, <, \leq, \neq, >, =$



Both numeracy and literacy skills are required with graphs and tables that represent relationships between things like age and weight. If literacy is an area of strength for a learner, then use literacy strategies to create success in numeracy.

When you are working with a learner on numeracy, there are many complex mathematical terms that need to be introduced and understood. Practitioners may want to use plain language when introducing these new terms. Plain language is a way of writing and communicating that is clear, free of jargon and is carefully focused to increase a reader's/learner's understanding. Plain language can communicate complex ideas in clear ways.

For example, to introduce the term 'quadrilateral' a practitioner may want to take a 'plain language approach.' Look at the two figures below along with a learner. Ask them how they would describe the figures - what would they call them? Chances are the learner may say squares, or for the one turned on its side - a diamond.



At this point the less familiar term quadrilateral could be introduced and begin a discussion about how four sided shapes are classified.

Portfolios

"Reflection is a lifelong process. It helps you look at what you've done, analyze your results, measure your successes and adjust your conduct in the future."

(Manitoba Education, Education, Citizenship and Youth, Retrieved February 14, 2008, from http://www.edu.gov.mb.ca/k12/docs/support/c_portfolio/index.html)

The portfolio process encourages reflection: it requires thinking about where you've been, what you have done and what you have learned along the way. It encourages thinking about how you can apply what you've learned. It can track success by measuring progress towards and achievement of the goals learners have set for themselves.

A portfolio is a living document that develops and grows with the learner. The design of a portfolio should allow learners to customize it for a variety of purposes by adding and removing items from it.



Items that could be included in a portfolio to showcase numeracy skills are:

- Copies of a cheque book and bank statement that balanced for a month.
- The offer of employment David got for the inside sales position.
- Copies of recipes doubled or tripled with pictures of what was made.
- A trip itinerary.
- A new bus route plan that is 20 minutes shorter.
- Knowledge and skills checklists signed by a practitioner.
- Formal assessment and evaluations.



Something to think/write/talk about...



- How do I distinguish between 'real' and 'realistic' learning materials?
- What are some 'real' or authentic materials I have used?
- Why encourage learners to bring 'real' materials into their numeracy programs?
- How do I use manipulatives in a numeracy program? Can I think of more types of and uses for manipulatives?
- How do I use portfolios to assess numeracy progress with learners?
- How do I use literacy strategies to teach numeracy skills?

Notes and Ideas...



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Appendices



Appendix A: Components and Subcomponents of Numeracy

Definitions and Terms Used in Numeracy

CONTEXT – the use and purpose for which an adult takes on a task with mathematical demands

Family or Personal—as a parent, household manager, consumer, financial and health-care decision maker, and hobbyist

Workplace—as a worker able to perform tasks on the job and to be prepared to adapt to new employment demands

Further Learning—as one interested in the more formal aspects of mathematics necessary for further education or training

Community—as a citizen making interpretations of social situations with mathematical aspects such as the environment, crime and politics

CONTENT – the mathematical knowledge that is necessary to complete the tasks confronted

Number and Operation Sense—a sense of how numbers and operations work and how they relate to the world situations that they represent

Patterns, Functions and Algebra—an ability to analyze relationships and change among quantities, generalize and represent them in different ways, and develop solution methods based on the properties of numbers, operations and equations

Measurement and Shape—knowledge of the attributes of shapes, how to estimate and/or determine the measure of these attributes directly or indirectly, and how to reason spatially

Data, Statistics and Probability—the ability to describe populations, deal with uncertainty, assess claims, and make decisions thoughtfully



COGNITIVE AND AFFECTIVE—the processes that enable an individual to solve problems and, thereby, link the content and the context

Conceptual Understanding—an integrated and functional grasp of mathematical ideas

Adaptive Reasoning—the capacity to think logically about the relationships among concepts and situations

Strategic Competence—the ability to formulate mathematical problems, represent them, and solve them

Procedural Fluency—the ability to perform calculations efficiently and accurately by using paper and pencil procedures, mental mathematics, estimation techniques, and technological aids

Productive Disposition—the beliefs, attitudes, and emotions that contribute to a person’s ability and willingness to engage, use, and persevere in mathematical thinking and learning or in activities with numeracy aspects

From Ginsburg, L., Manly, M., and Schmitt, M. J. (2006). The components of numeracy [NCSALL Occasional Paper]. Cambridge, MA: National Center for Study of Adult Literacy and Learning. Available: http://www.ncsall.net/fileadmin/resources/research/op_numeracy.pdf



Appendix B: Levels 1 and 2 Numeracy Benchmarks

| Numeracy Level 1 | Numeracy Level 2 |
|---|--|
| <p>Benchmark Demonstrate basic numeracy skills.</p> <p>Learning Outcomes Learners will demonstrate:</p> <ol style="list-style-type: none"> 1. knowledge of numbers and number sense. 2. knowledge of basic numerical operations. 3. basic knowledge of space, shape, and measurement. | <p>Benchmark Demonstrate complex numeracy skills.</p> <p>Learning Outcomes Learners will demonstrate:</p> <ol style="list-style-type: none"> 1. knowledge of complex numerical operations. 2. complex knowledge of space, shape, and measurement. 3. knowledge of data interpretation. |
| <p>Benchmark Solve simple numeracy problems in daily life.</p> <p>Learning Outcomes Learners will:</p> <ol style="list-style-type: none"> 1. demonstrate critical and creative thinking to solve simple mathematical problems. 2. understand and use numeracy for practical daily living tasks. | <p>Benchmark Solve complex numeracy problems in daily life.</p> <p>Learning Outcomes Learners will:</p> <ol style="list-style-type: none"> 1. demonstrate critical and creative thinking strategies to solve complex mathematical problems. 2. understand and use numeracy for complex daily living tasks. |

From Saskatchewan Literacy Network and Advanced Education and Employment. (2006). The Circle of Learning: Saskatchewan adult literacy benchmarks levels 1 and 2. Saskatoon, SK: Author. Available: http://www.aeel.gov.sk.ca/evergreen/circle_of_learning/cover.htm



Appendix C: Aligning with the Benchmarks

| Numeracy | Mathematics | Benchmarks |
|----------------------------------|--|------------------------------|
| Context: purpose/task/situation | Content | Aligning with the Benchmarks |
| What do I want to be able to do? | What math do I need to know to be able to do it? | Am I at Level 1 or 2? |
| | | |
| | | |
| | | |
| | | |
| | | |



Appendix D: Checklist - What are your math and numeracy skills?

Check off the tasks on the list that you already do and consider your math and numeracy skills.

Family or Personal

- Recognize and read numbers
- Make long distance calls on your phone
- Read money amounts in flyers
- Calculate the time it takes for a trip
- Set the timer on your stove
- Follow the directions for dosage on a prescription
- Follow a recipe
- Balance a cheque book
- Read a thermometer
- Read a map
- Read and pay bills
- Budget time or money
- Measure the height of your child
- Calculate a sale price
- Play a board game
- Follow a knitting pattern
- Fill out a tax form
- Plan for retirement
- Read a clock
- Read your child's report card
- Read gauges of a car
- other

Workplace

- Operate a cash register
- Cash out the till at the end of a shift
- Prepare goods for shipping
- Follow product assembly directions
- Get information from the internet
- Use a calculator
- Use a computer
- Follow directions on a flow chart
- Take inventory
- Fill out a time sheet
- Use a calculator
- Read and understand your pay stub
- Order out for lunch
- Track mileage for expense claim
- Make change, count money
- Use a weigh scale
- other

Community

- Take a bus, calculate fares
- Create a tournament schedule
- Rent a community hall
- Work at a concession
- Keep score for a team
- Act as a treasurer for your child's hockey team
- Give someone directions to a specific location
- Calculate a tip for a server
- Make photocopies of a community newsletter
- Fill your car with gas at a self-serve
- Make tea or coffee at a community event
- Locate a post office box
- Record team statistics
- Set up bases on a ball diamond
- other



Appendix E: Multiple Intelligence and Learning Style Inventories

Howard Gardner developed the theory of multiple intelligence twenty five years ago. The theory states that there are several ways that people exhibit intelligence.

The intelligences that Gardner identified include:

- Bodily/Kinesthetic
- Interpersonal
- Intrapersonal
- Logical/Mathematical
- Musical
- Verbal/Linguistic
- Visual/Spatial
- Naturalist

When working with learners and multiple intelligence the question to ask is, "How are you smart?" as opposed to, "How smart are you?" People have strength in certain areas. Identifying the preferred intelligences can help practitioners adjust their teaching methods to suit the learner's and their own preferences.

There are some inventories available online. Keep in mind that an inventory is like a photograph, a picture of someone in time. With time, people do change. Just like someone looks different because they have a new hairstyle or grew taller, over time preferred intelligences may change too. These inventories are designed to be snapshots of learners that can change - not permanent labels. Inventories are used to enable learners not disable them.

- Multiple Intelligences for Adult Literacy and Education
<http://www.literacyworks.org/mi/assessment/findyourstrengths.html>
- Multiple Intelligence Survey
<http://www.surfaquarium.com/MI/inventory.htm>

Learning Styles

The way that people learn is unique. There are inventories to learn more about learning style preferences.

- Learning Styles Survey
<http://www.engr.ncsu.edu/learningstyles/ilsweb.html>



Appendix F: Creating a Learning Plan

When creating a learning plan, there are three basic questions that lead the process.

What is it the learner wants to be able to do?

What does the learner have to know, to be able to do what he/she wants to be able to do?

What is it the learner can already do and what else must he or she learn to achieve his/her goals?



Appendix G: Skills and Knowledge Checklist

Working with the learner, write the learner’s goal in the left hand column. Identify the content that is required to meet the goal. Identify with checkmarks if the learner is able to do it, not yet able, wants to be able to do it. Once the content is outlined, learning activities can be developed with the learner. These activities will address what the learner is not yet able to do, but would like to.

| Context - Learner’s Goal | Content - Numeracy Skills and Knowledge Required | Able to do it now | Not able to do it | Want to be able to do it |
|--------------------------|--|-------------------|-------------------|--------------------------|
| | | | | |
| | | | | |
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| | | | | |
| Activity Ideas | | | | |