
Building Strength with Numeracy

Developed by Beth Marr



VALBEC

Introduction

'Building Strength in Numeracy' revises and improves on the iconic numeracy resources *'Strength in Numbers'* and *'Breaking the Maths Barrier'*, and other 'tried and true' numeracy teaching resources developed by Beth Marr and other experienced numeracy teachers.

The new resource is a collection of activities that builds on and updates elements of the previous resources, as well as including many new, previously unpublished ideas, activities and student practice exercises. The resource is accessible online for teachers to use in a range of settings.

The activities and practice sheets span a range of levels and subject areas with some suggestions regarding links and sequencing. However, as with the previous resources, it is not intended to cover the whole of any particular curriculum or course. It is intended that teachers select content relevant to the needs of their learners and integrate it into their own teaching plans in conjunction with other materials. For this reason it has been presented to enable users to download separate activities, single practice sheets or whole sections, as required.

The resource is a work in progress in that not all sections of previous resources have yet been included. Hopefully these will be added in the future.

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About the resource

Background

In 2011, the VALBEC Committee recognised that it was over two decades since the publication of the iconic numeracy resources *Strength in Numbers and Breaking the Maths Barrier*, and others*. They decided it was timely to celebrate their coming of age by funding the development of new resources that would build on and update elements of these resources for teachers to use in a range of settings and made accessible online.

The original publications benefitted from the input of teachers who were at the time pioneering the new field of adult numeracy. These teachers, who had backgrounds in mathematics, language and literacy and primary education, came together through professional development events to share their growing 'wisdom of practice'. Sharing their experience and practices not only aided their own professional growth, but benefitted others through the publications that were influenced by their discussions.

The adult educational environment has changed enormously in the past two decades. The early publications are no longer easily available and need updating with regard to the prices and contexts in Practice Sheets and examples. There is a danger that the professional 'know how' and creative approaches to adult numeracy teaching contained in the publications will be lost to the new generation of practitioners entering the field. In addition to this, many of the older cohort of adult numeracy teachers are retiring, and with them goes their knowledge of working in this important field.

VALBEC acknowledged that it is important to ensure that the 'wisdom of practice' contained within the earlier publications is made available to new teachers. They received funds from the Adult Community and Further Education (ACFE) in 2012 to create a new resource collection that could be updated and available online to current numeracy teachers across Victoria, and more widely in other parts of Australia. The development of this resource is the beginning of that process.

The major task was to select the best and most needed activities from these and other numeracy resources of the eighties and nineties and include new content that reflects growth and new ideas developed from years of ongoing practice with diverse groups of adult learners. A survey of practising numeracy teachers was conducted to canvas their opinions about which publications were most useful and why, and also to ascertain the levels and skill areas that teachers wanted to prioritise. The number of enthusiastic responses by teachers overwhelmingly endorsed the project. We trust that the resources will be of lasting value and contribute to learning and the professional development and knowledge base of a new generation of adult numeracy teachers.

*Fuller details of resources are included in 'References' at the end of this section.



Principles for development

The principles on which the methods and materials of the original resources were developed are still relevant and appropriate today and have been applied to the new resources. We believe that they remain worthwhile guidelines for all adult numeracy teaching:

- Ensure that all students in the group perform tasks at which they can experience **success** to build confidence as they progress.
- Use **language** as part of mathematics teaching to explain ideas, concepts and terminology that can be understood by students and applied through talking and listening to each other. Mathematical language should be kept relevant to the students and put into meaningful contexts. We have attempted to use everyday and common language, especially in the student Practice Sheets, so that the content is accessible to, and understood by, a large range of adult literacy and numeracy students.
- Encourage students to learn through **interaction**, with activities that involve **discussion**, asking questions, explaining their reasoning to others, and working co-operatively in pairs or small groups. Structured interaction early in any numeracy course also encourages greater communication between students at other times in their classes.
- Use **practical activities** and hands-on materials. Assist students to distance themselves from the realms of the 'mystifying magic tricks' that maths teachers displayed to them when they were at school. Using a hands-on approach with adults, along with the other strategies, has consistently been rewarded with cries of 'I see', 'Now it makes sense' or 'Why didn't they do it this way in school?' The extra effort involved in cutting out fraction circles, cutting up straws or using counters is worthwhile and important. Another advantage of hands-on materials is that students can return to them confidently if they forget the process or the rule, or if they wish to check their reasoning.
- Teach concepts in a **context** relevant to adult students, drawing from their backgrounds, interests and experiences. This includes placing mathematical ideas into an historical and social context, in particular using the student's personal and work situation. Using real products and materials such as local sales brochures, menus, catalogues and advertising materials, in the class, also enhance relevance and understanding.
- Enable students to learn about other content or topics while doing mathematics. This involves learning about other areas of knowledge whilst studying the mathematical concepts and skills embedded in them. The advantages of expanding the topics and content areas are not only to give students a **wider general education**, but also supports the **integration** of different areas of knowledge across the curriculum.
- Raise **awareness** about social and economic structures influencing their lives. This can be done by developing or analysing examples in the press or the internet and other media sources, as well as from government reports and information brochures.
- Include activities that are **fun and engaging** to help dispel some of the myths and fears around maths and adult learning.



In addition to the original principles others have become even more essential today:

- Acknowledge students' 'survival' strategies, (alternate calculation techniques) and build their confidence with numbers by assisting them to develop other '**in the head**' techniques. Rather than repeating the rote calculation techniques from past schooling, time spent exploring numbers and how they are put together (place value) will enable students to develop a range of quick and sensible calculation methods.
- Encourage students to check calculations by **estimation**. This is extremely important in an era when students are tempted to trust any result displayed on a calculator or spread sheet. It means emphasising the use of sensible or friendly numbers to approximate calculations, developing the skills of multiplying and dividing by tens, hundreds, etc and a range of other 'in the head' or shortcut techniques.

References

Mathematics: A New Beginning: A Resource Book for Teachers of Adults Returning to Study. Melbourne State Training Board of Victoria (1987). Beth Marr and Sue Helme with the Teaching Mathematics to Women Project Team.

Strength in Numbers: A Resource Book for Teaching Adult Numeracy, Eastern Metropolitan College of Further Education. (1991). Ruth Goddard , Beth Marr, and Judith Martin.

Breaking the Maths Barrier: A Kit for Building Staff Development Skills in Adult Numeracy. Department of Education and Training, Canberra. (1991). Beth Marr and Sue Helme.

Numeracy on the Line: Language Based Numeracy Activities for Adults. National Automotive Language & Literacy Coordination Unit. (1994). Beth Marr, Dave Tout and Chris Anderson.

Some Beginnings in Algebra: A Resource Book for Teachers of Adults Returning to Study. Melbourne. Northern Metropolitan College of TAFE. (1995). Beth Marr and Sue Helme.

Adult Numeracy Teaching: Making Meaning in Mathematics. National Staff Development Committee for VET (1995). Betty Johnston and Dave Tout with writing and input from many adult numeracy teachers.

Measuring Up: An Interactive Multimedia computer resource for adult learners. Protea Textware and Department of Education, Employment, Training and Youth Affairs, Canberra (1996). Beth Marr and Dave Tout.

Rethinking Assessment: Holistic adult numeracy assessment. – A resource book for practitioners, policy makers, researchers and assessors. Melbourne: Language Australia & Commonwealth Department of Education, Science and Training. (2003). Beth Marr, B., Sue Helme and Dave Tout, with a team of experienced adult numeracy practitioners.



Contents and Structure

The resource is presented as a series of **Activities**, including: games, small group and pair activities, problem solving and discussions; explorations with 'hands on' materials and teacher led presentation of essential skills and new approaches to calculations. Included are reworked and updated versions of favourite activities from the original resources, as well as new activities that have been developed in the years since their publication.

The activities include **Activity Sheets** with all the essentials for conducting the activity with the group of students.

They are supplemented with student **Practice Sheets** which provide individual exercises for students to reinforce the skills and knowledge of the activities.

The activity descriptions also contain a brief **Overview** of the reasons for teaching the skills and knowledge and the rationale for the methods used.

The activities are sorted into five **Sections**:

- Getting Started – *activities recommended for starting a course or session*
- Exploring Numbers – *activities for enhancing understanding of numbers, their properties, operations on them (+ - x ÷) and essential facts important for using numbers*
- 'In the head' calculations – *activities to develop and strengthen students' 'in the head' and quick methods for working with numbers*
- Fractions – *activities to develop fraction concepts, introduce simple fraction calculations and lay foundations for understanding percentages and decimals*
- Percentages – *activities to enhance understanding of percentages and their links to fractions and using these fundamentals for percentage calculations*

Each section contains an **Introduction** that explains its purpose and the reasons behind grouping the activities together.

It is anticipated that more activities will be added to the existing sections on an ongoing basis and further sections will be created in the future.

Who is it for?

This resource, like those it is based on, has been written with the needs of inexperienced adult numeracy teachers in mind. It consciously tries to cater for the wide range of practitioners who teach adult numeracy. These can include adult language and literacy teachers with little prior experience of teaching numeracy, as well as mathematics teachers with secondary school backgrounds who have not previously taught adult students.



The style and format chosen is quite specific in several aspects. For those with less experience in teaching mathematics and numeracy, it spells out the mathematics of the activities in detail, attempting to supply the graduated steps which may not be necessary for more experienced maths teachers. For those who are not as familiar with adult learners, it supplies tips about non-traditional approaches in the classroom, use of small groups and pairs and other means of encouraging student interaction in an adult classrooms.

Most of this information is contained in the **Suggested Procedure** for the activities.

Suggested Procedures

The 'suggested procedures' are there as a guide for teachers to use the activities with a group of students.

The procedures are a combination of:

- description of how to use the materials
- suggestions for teachers to create local materials of relevance to their learners
- prompt questions and explanations that can be used directly with the students
- suggested examples of gradually increasing complexity to introduce skills.

The prompt questions and suggested examples are italicised so they will stand out for teachers using the guide within a teaching session.

It is not expected that teachers will follow the 'script' of these questions and explanations verbatim; such discussions with a class are always unique to the situation. They are there as a support, or safety net, for busy teachers, not yet familiar enough with the material to individualise it.

A note about selection of content

Selecting material to be part of the resource focused on what we regard as particularly important in numeracy and may not necessarily be available elsewhere for adult learners. This focus could be described loosely by four themes '**Exploration**', '**Estimation**', '**Essential skills**' and '**Engagement**' of skills in a variety of adult teaching and learning situations.

The **exploration** theme flows through all sections of the publication. It guides the choice of many games, 'hands on' and discussion activities, to explore:

- the students as learners (their feelings and aspirations regarding learning maths)
- the language and basic properties of numbers, common fractions and percentages
- the operations (+ - x ÷) (when to use them and relationships between them)
- calculators (why, when and how to use them).



Rather than focusing on teaching rote calculation techniques, as commonly practised in schools, the resource encourages teachers to acknowledge students' 'survival' strategies, (alternate calculation techniques) and assist them to develop others that will further build their confidence with numbers. This creative use of alternative methods is aided by exploring the ideas underpinning the number system.

Estimation is extremely important when students are tempted to trust any result displayed on a calculator or spread sheet. The skills necessary to check calculations by estimation are developed in the 'In the Head' Section, and the habit of estimating is encouraged throughout the resource.

Essential skills are arithmetical skills necessary for a numerate person that are developed extensively in the resource through the Activities and the Practice Sheets.

Note: essential skills are focused around level 2 of the ACSF and Certificate I (Introduction) of the CGEA with some variation (for example the percentage section extends into ACSF level 3 and some of the early essential number skills may also fit well into ACSF level 1).

Engagement of skills in a variety of adult appropriate situations is also encouraged through the variety of Practice Sheets, which encourage transference of ideas and application of the skills in diverse contexts.



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