

# **Working Mathematically in VELS**

## **The Maths With Attitude approach**

### **Years 5 & 6**

**– a service to MAV members –**

The curriculum that follows offers an alternative to text-based learning. It is built around *Maths With Attitude* in conjunction with other resources.

You can do without a textbook, and reap the benefits of the freedom this brings.

This guide represents one way to integrate these components to provide a curriculum consistent with the intentions of all of VELS, particularly the integration of Working Mathematically with the other dimensions, and also the integration of the Interdisciplinary Learning (Communication, Thinking, ICT, Creativity) with the discipline of Mathematics. It is not meant to be *the* course, but is offered as a detailed, well-resourced starting point which can stand on its own, or be open to local modification.

#### **What is ‘Working Mathematically’?**

The following statement comes from *Maths300*, the *Problem solving Task Centre* and *Maths With Attitude*. It describes the essential features of working mathematically as “working like a mathematician”.

#### **Working mathematically**

*First give me an interesting problem.*

#### **When mathematicians become interested in a problem they:**

- Play with the problem to collect and organise data about it.
- Discuss and record notes and diagrams.
- Seek and see patterns or connections in the organised data.
- Make and test hypotheses based on the patterns or connections.
- Look in their strategy toolbox for problem solving strategies which could help.
- Look in their skill toolbox for mathematical skills which could help.
- Check their answer and think about what else they can learn from it.
- Publish their results.

#### **Questions which help mathematicians learn more are:**

- Can I check this another way?
- What happens if ...?
- How many solutions are there?
- How will I know when I have found them all?

#### **When mathematicians have a problem they:**

- Read and understand the problem.
- Plan a strategy to start the problem.
- Carry out their plan.
- Check the result.

#### **A mathematician's strategy toolbox includes:**

- Do I know a similar problem?
- Try a simpler problem
- Make a list or table
- Act it out
- Make a model
- Try all possibilities
- Break the problem into smaller parts
- Guess, check and improve
- Write an equation
- Work backwards
- Draw a picture or graph
- Look for a pattern
- Seek an exception

*If one way doesn't work we just start again another way.*

## Shopping list

To use the suggestions below you will need the following:

### **Minimum resources**

*Maths With Attitude*, available through MAV. This also requires membership of *Maths300*, also available through MAV. For details see later.

*Teach for understanding – Teaching notes* (book, from MAV)

*RIME* (3 books &/or CD, from MAV)

*Active Learning* (3 books &/or CD, from MAV)

*Active Learning 2* (3 books, from MAV)

### **Additional books**

*people count* (book for teachers, from MAV)

### **Computer software (see note below)**

*Interactive Learning* (CD of hundreds of user-friendly Excel spreadsheets, from MAV)

‘Learning objects’: For Victorian Government schools, from [www.education.vic.gov.au/teacher/default.htm](http://www.education.vic.gov.au/teacher/default.htm) and go to DigiLearn; or approach the non-government sector office in your state.

*Tinkerplots*

## Building up your resources

As you will see from a quick scan, there is a vast quantity of good resources available at every point, without including your textbook. You will need to make a choice. Sometimes this will be an economic one – you may be able to purchase only some of the wide range of resources. Here is a suggestion to get started.

- 1 Start with *Maths300*. Go to [www.mav.vic.edu.au/shop](http://www.mav.vic.edu.au/shop) and subscribe. You can add these to your teaching while still weaning yourself off the textbook gradually. You will start to move towards a better balance of toolbox teaching (what the textbook is about) and Working Mathematically (what Maths300 is about).
- 2 If you also own a set of *Problem Solving Task Centre* tasks you can set about using these to shift the balance further. Go to [www.blackdouglas.com.au/taskcentre](http://www.blackdouglas.com.au/taskcentre) for more details.
- 3 When you are ready, move up to *Maths With Attitude (MWA)*. For this you require *Maths300* membership either in advance or at the same time. There are four kits at Years 5/6:

Number & Computation; Space & Logic; Measurement, Chance & Data; Pattern & Algebra.

Each kit combines the 20 best *Problem Solving Task Centre* tasks for that level and dimension and the most suitable *Maths300* lessons on CD. (If you already own the tasks, you needn't buy them again.) Each kit comes with an impressive book outlining how to make the best use of this combination. These books are referred to in the course details that follow, for example ‘*MWA* Number & Computation Years 5 & 6’. Go to [www.mav.vic.edu.au/shop](http://www.mav.vic.edu.au/shop) and purchase.

- 4 Most other resources are available from MAV. There are two series of three books called *Active Learning*. There is a CD of spreadsheets designed for students with no computer skills – called *Interactive Learning CD*. Once purchased, this may be copied for teacher or student use.
- 5 ‘Learning objects’ are available *free* from the sector office in your state. For Victorian government schools, go to [www.education.vic.gov.au/teacher/default.htm](http://www.education.vic.gov.au/teacher/default.htm), and choose ‘DigiLearn’. For Catholic school teachers, contact your local CEO. Independent schools contact AISV.

## Scope and sequence – Summary

### Year 5

Week	Semester 1	Semester 2
1	<i>Working Mathematically with MWA</i> <b>Data:</b> Measurement and data	<i>Working Mathematically with MWA</i> <b>Measurement:</b> Problems
2	<i>Working Mathematically with MWA</i> <b>Data:</b> Measurement and data	<i>Working Mathematically with MWA</i> <b>Measurement:</b> Problems
3	<i>Working Mathematically with MWA</i> <b>Data:</b> Measurement and data	<i>Working Mathematically with MWA</i> <b>Chance:</b> Problems
4	<i>Working Mathematically with MWA</i> <b>Whole numbers:</b> Add and multiply	<i>Toolbox</i> <b>Whole numbers:</b> Factors, composite and prime numbers
5	<i>Toolbox</i> <b>Whole numbers:</b> Subtract, Multiply by 2 digits, Divide by one digit.	<i>Working Mathematically with MWA</i> <b>Whole numbers:</b> Problems
6	<i>Toolbox</i> <b>Whole numbers:</b> Multiples and table facts	<i>Working Mathematically with MWA</i> <b>Whole numbers:</b> Problems
7	<i>Working Mathematically with MWA</i> <b>Whole numbers:</b> Whole number problems	<i>Toolbox</i> <b>Space:</b> Transformations and symmetry
8	<i>Working Mathematically with MWA</i> <b>Whole numbers:</b> Whole number problems	<i>Working Mathematically with MWA</i> <b>3D space:</b> Nets and solids
9	<i>Toolbox</i> <b>Space (2D):</b> Angles, triangles, quadrilaterals	<i>Working Mathematically with MWA</i> <b>Structure:</b> Functions
10	<i>Working Mathematically with MWA</i> <b>Space (2D):</b> Spatial problems	<i>Working Mathematically with MWA</i> <b>Structure:</b> Functions
11	<i>Working Mathematically with MWA</i> <b>Structure:</b> Functions	<i>Working Mathematically with MWA</i> <b>Structure:</b> Functions
12	<i>Working Mathematically with MWA</i> <b>Structure:</b> Functions	<i>Working Mathematically with MWA</i> <b>Structure:</b> Functions
13	<i>Working Mathematically with MWA</i> <b>Structure:</b> Functions	<i>Toolbox</i> <b>Structure:</b>
14	<i>Working Mathematically with MWA</i> <b>Number (Fractions):</b> Simple problems	<i>Working Mathematically with MWA</i> <b>Number (Fractions &amp; decimals):</b> Converting between types
15	<i>Working Mathematically with MWA</i> <b>Number (Fractions):</b> Simple problems	<i>Toolbox</i> <b>Number:</b> Introduction to percentages
16	<i>Toolbox</i> <b>Number (Fractions &amp; decimals):</b> Equivalent fractions and decimals	<i>Toolbox</i> <b>Number:</b> Converting between fractions, decimals and percentages
17	<i>Toolbox</i> <b>Number (decimals):</b> Multiply and divide by powers of 10	<i>Working Mathematically with MWA</i> <b>Number:</b> Percentages of quantities

## Scope and sequence – Summary

### Year 6

Week	Semester 1	Semester 2
1	<i>Toolbox</i> <b>Measurement:</b> Length, perimeter, area	<i>Toolbox</i> <b>Measurement:</b> Volume, capacity, mass
2	<i>Working Mathematically with MWA</i> <b>Measurement:</b> Length and scale	<i>Toolbox</i> <b>Measurement:</b> Time (short and long), calendars
3	<i>Working Mathematically with MWA</i> <b>Whole numbers:</b> Add, multiply	<i>Toolbox</i> <b>Chance:</b> Probability, related to fractions, decimals and percentages
4	<i>Toolbox</i> <b>Whole numbers:</b> Subtract, divide, deal with remainders	<i>Working Mathematically with MWA</i> <b>Number:</b> Ratio and scale
5	<i>Working Mathematically with MWA</i> <b>Number:</b> Problem tasks	<i>Toolbox</i> <b>Number:</b> Ratio and scale
6	<i>Working Mathematically with MWA</i> <b>Number:</b> Problem tasks	<i>Toolbox</i> <b>Number:</b> Ratio and scale
7	<i>Toolbox</i> <b>Number:</b> Estimation, use of calculators	<i>Working Mathematically with MWA</i> <b>Space (3D):</b> Problem tasks
8	<i>Working Mathematically with MWA</i> <b>Chance:</b> Problems in chance	<i>Working Mathematically with MWA</i> <b>Space (3D):</b> Problem tasks
9	<i>Toolbox</i> <b>Space (2D):</b> Scale	<i>Working Mathematically with MWA</i> <b>Structure:</b> Functions
10	<i>Working Mathematically with MWA</i> <b>Space (2D):</b> Problems, and position	<i>Working Mathematically with MWA</i> <b>Structure:</b> Functions
11	<i>Working Mathematically with MWA</i> <b>Structure:</b> Equations	<i>Working Mathematically with MWA</i> <b>Structure:</b> Functions
12	<i>Working Mathematically with MWA</i> <b>Structure:</b> Equations	<i>Working Mathematically with MWA</i> <b>Structure:</b> Non-linear situations & patterns
13	<i>Toolbox</i> <b>Structure:</b> Equations and word problems	<i>Toolbox</i> <b>Structure:</b> Sets and language
14	<i>Working Mathematically with MWA</i> <b>Number:</b> Fractions decimals, percentages	<i>Working Mathematically with RIME</i> <b>Number:</b> Fractions decimals, percentages
15	<i>Working Mathematically with MWA</i> <b>Number:</b> Fractions decimals, percentages	<i>Working Mathematically with RIME</i> <b>Number:</b> Fractions decimals, percentages
16	<i>Working Mathematically with MWA</i> <b>Number:</b> Data, Fractions, percentages	<i>Toolbox</i> <b>Number:</b> Integers
17	<i>Toolbox</i> <b>Number:</b> Multiplying two decimals	<i>Working Mathematically with MWA</i> <b>Number:</b> Integers

## Teaching

In the four sessions of each ‘toolbox’ week it is suggested that the class be split into two groups by level: VELS 2 & 3 and VELS 4 & 5. These alternate between your instruction and use of worksheets or computer use.

‘Half’ class	Session 1	Session 2	Session 3	Session 4
VELS 2 or 3	Teach (ICT) & worksheet	Worksheet or ICT	Teach (ICT) & worksheet	Worksheet or ICT
VELS 4 or 5	Worksheet or ICT	Teach (ICT) & worksheet	Worksheet or ICT	Teach (ICT) & worksheet

Suggestions for teaching are to be found in *Teach for understanding*, available from MAV.

## Assessment

Class tests are suitable only for checking skills. These should form only a small part of your data gathering. Formative assessment is best managed by observation of students at work in the classroom, and records of this are best managed through checklists. The strength of ‘continuous’ formative assessment is that you become aware of what each student knows and can do at all times, and this will affect how you teach, who you help and what support you give. Evidence to support this system can be kept through copies of some parts of your students’ work. Specific suggestions for assessing the mathematics dimensions (including Working Mathematically) are made in relation to each unit of a few weeks.

## Computer access

The toolbox sessions could include some demonstrations using software, e.g. *Interactive Learning CD* or *Learning Objects*. These are excellent on an interactive whiteboard, or with a data projector.

## How it is organised

The structure suggested below runs to 17 weeks in each semester. For both educational and reporting purposes, each dimension is experienced in each semester.

Semester	5a	5b	6a	6b
<b>Whole number and Integers</b>	5	3	4	4
<b>Fractions, decimals, percent, ratio</b>	4	4	4	4
<b>Measurement/Chance&amp;Data</b>	3	3	3	3
<b>Space</b>	2	2	2	2
<b>Structure</b>	3	5	4	4

Within a VELS-friendly curriculum there should be a balance of learning concepts and skills (‘learning to use the toolbox’) and Working Mathematically. A careful selection has been made from *Maths With Attitude* and a select suite of other resources to provide a balance of both types of teaching in a VELS-friendly curriculum.

A ‘Working Mathematically’ curriculum will also be VELS-friendly. Not only will it relate specifically to the content dimension and to ‘Working Mathematically’ in VELS, but it will also related to the VELS Inter-disciplinary strand and its four dimensions. Some of these relationships are listed in the boxes at the start of each learning unit. In general, it is the ‘working like a mathematician’ components of this curriculum that carry the non-content VELS components and that makes this curriculum so rich. It is rich in content, but rich in pedagogy as well.

## Year 5 Semester 1

### Data (3 weeks)

**VELS:** see page 24

**Assessment for learning:**

- For *Working Mathematically*, refer to the Assessment pages in the *Maths With Attitude* booklets. These give ideas on questions, journals, record keeping and self-reflection.
- Get to know your students as individuals through this activity. But keep an open mind about their potential. Build their self-confidence. Do not test any skills at this stage.

5-1Wk 1,2,3 **Working Mathematically with MWA**

*Content (Reference: people count Ch 71 –74)*

Second-hand data: interpret the results using graphs, averages, comparisons.

*Teaching resources:*

*MWA Chance & Measurement Years 5 & 6: Year 5 weeks 1, 3 and 4*

**Maths300 lessons:** Feet-uring mathematics

**Problem solving tasks:** 64=65, Angle estimation, Brick walls, Kids on grids, Photo angles, Planets, Scale drawing, Surface area with tricube, Time swing, Triangle area, Volume line up, Where is the rectangle?

*Interactive Learning CD:*

Median, Lineplot, Estimating means, Mean vs median

## Yr5 sem 1: Whole numbers (5 weeks)

**VELS:** see page 24

**Assessment for learning:**

- For *Working Mathematically*, refer to the Assessment pages in the *Maths With Attitude* booklets. These give ideas on questions, journals, record keeping and self-reflection.
- This is familiar content, so be on the look out for difficulties to be overcome later in the year. Use this as a diagnostic unit – determine who seems to need specific assistance on place value ideas and their applications to operations.
- Plan long term remedial activities for those weak in table facts, and involve parents.

5-1Wk 4 **Working Mathematically with MWA**

*Content (Reference: people count Ch 4, 6, 8)*

Addition, multiplication, Number laws (distributive, commutative)

*Teaching resource:*

*MWA Number & Computation Years 5 & 6: Year 5 week 1*

**Maths300 lessons:** Gauss beats the teacher, Steps, Number charts

**Problem solving tasks:** 4&20 blackbirds, Add the pack, Bob's buttons, Change, Doctor Dart, Number game, Pick a box, Steps

**Software**

MWA includes software with the Maths300 lessons *Steps, Number Charts*

5-1Wk 5 **Toolbox**

*Content (Reference: people count Ch 5, 7, 11, 12)*

Subtracting, multiplying by 2 digit numbers, dividing by 1 digit numbers, order of operations