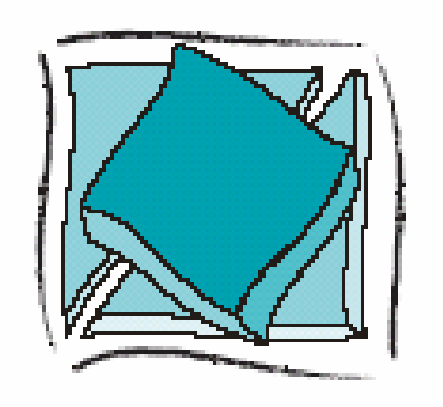

QUALITY TEACHING AND MATHEMATICS

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QUALITY TEACHING AND **MATHEMATICS**

These notes explain the use of the black line masters following this page.

The one page summary: Quality Teaching and Mathematics reflects my attempt to write a generic mathematics statement about each of the 18 elements in the three dimensions of the Quality Teaching framework. I did not set out to try to cover every aspect of each dimension, as described in the QT booklet: *A classroom practice guide*. The mathematics statements should really be taken as starting thoughts.

The one page summary is then enlarged to a one dimension per page format making it easier to read with an OHP.

I have also used these large format pages with the name of each element still visible but my mathematics statements deleted. These blank pages are useful to give teachers who may wish to write their own generic mathematics statements about each of the 18 elements. The blank pages are not included as they can be easily reproduced by deleting the appropriate text.

I then set about making up a mathematics example of each of the elements, initially within K-6. I was not even sure if it was possible to make up a reasonable mathematics example for each element. It tends to be much easier to do this for the dimension of Intellectual Quality than the other two dimensions, although some elements in Significance can be directly related to mathematics.

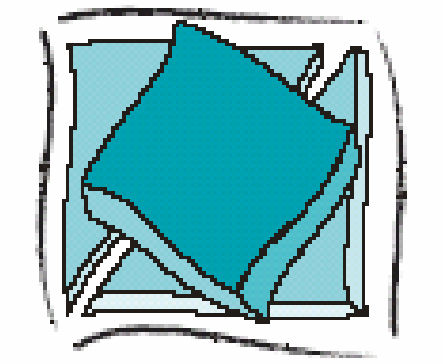
Once again, it is useful to give teachers blank versions of these pages for them to make up their own examples, perhaps just for their Stage. The task certainly forces the writer to focus on exactly what each element means.

As a beginning for 7-12 I have included mathematics examples of the Intellectual Quality dimension.

Teachers have stated they have found the following pages useful in attempting to get their head around what Quality Teaching in the mathematics classroom looks like.

I welcome feedback on the document.

Bruce Llewellyn



QUALITY TEACHING AND **MATHEMATICS** (1 page summary)

INTELLECTUAL QUALITY	
DEEP KNOWLEDGE	Mathematical concepts (building blocks). Teacher/students have sound knowledge of mathematical content.
DEEP UNDERSTANDING	Students can see relationships between mathematical concepts.
PROBLEMATIC	Knowledge is not fixed. It can be constructed from a variety of viewpoints.
HIGHER ORDER THINKING	Mental processes beyond simple recall of facts eg categorising, analysing, synthesising, evaluating.
METALANGUAGE	Focus on English language or mathematics symbolism. Descriptions of terminology rather than definitions. Derivations of terms (etymology).
SUBSTANTIVE	On going, focused, oral or written dialogue linking mathematical ideas and justifying the links.
QUALITY LEARNING ENVIRONMENT	
EXPLICIT QUALITY	Explanation given for amount of detail to be shown in solving mathematical problems.
ENGAGEMENT	Enthusiastic and sustained involvement in solving mathematical problems.
HIGH EXPECTATIONS	Rich mathematical problems chosen to involve all students of varying abilities.
SOCIAL SUPPORT	Encouragement of all attempts at solving mathematical problems.
STUDENTS' SELF	Students attention remains focused on mathematical problems.
STUDENT DIRECTION	Multiple mathematical problems available for student to choose own pathway. Student creates new problems through asking "What If?" questions.
SIGNIFICANCE	
BACKGROUND	Previous knowledge is used as building blocks to form new knowledge.
CULTURAL KNOWLEDGE	Recognition that different cultures produce mathematics different to our own.
KNOWLEDGE INTEGRATION	Involvement of content from other KLAs in mathematical problems.
INCLUSIVITY	Mathematical problems allow comment by students from differing cultural or social backgrounds.
CONNECTEDNESS	Use of real life mathematical problems.
NARRATIVE	Mathematics content is embedded in a story which may be acted out.

BRUCE LLEWELLYN North Coast Region K-12 Numeracy Consultant Murwillumbah

QUALITY TEACHING AND **MATHEMATICS**	
INTELLECTUAL QUALITY	
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QUALITY TEACHING AND **MATHEMATICS**	
QUALITY LEARNING ENVIRONMENT	
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HIGH EXPECTATIONS	Rich mathematical problems chosen to involve all students of varying abilities.
SOCIAL SUPPORT	Encouragement of all attempts at solving mathematical problems.
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QUALITY TEACHING AND **MATHEMATICS**	
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QUALITY TEACHING: **K-6** MATHEMATICS

INTELLECTUAL QUALITY

DEEP KNOWLEDGE	A diagonal is a straight line passing from one vertex of a polygon to any other vertex except the two neighbouring vertices. It cannot exist without the polygon and is not related to non-vertical, non-horizontal (ie sloping) lines or axes of symmetry.
DEEP UNDERSTANDING	All quadrilaterals have two diagonals. A square is a quadrilateral. A square has two diagonals.
PROBLEMATIC KNOWLEDGE	When multiplying a number by 10 just add a zero. Does not apply to decimal numbers. When multiplying a decimal number by 10 move the decimal point one place to the right. Decimal points are fixed in place between the units column and the tenths column.
HIGHER ORDER THINKING	Explain why the chance of throwing a head with a fair coin is equal to one half. Justify why doubling the perimeter of a shape does not double its area. Working Mathematically: Reasoning (explore relationships, support conclusions)
METALANGUAGE	A prism is a 3D object with both ends the same size and shape. Informally, a cylinder is a circular prism. Etymology. Perimeter: peri; around, meter; to measure. Perimeter literally is to 'measure around'. Working Mathematically: Communicating http://www.etymonline.com/
SUBSTANTIVE COMMUNICATION	Discussion of various mental computation strategies eg jump, split, compensation giving strengths and weaknesses of each strategy.

QUALITY TEACHING: **K-6** MATHEMATICS

QUALITY LEARNING ENVIRONMENT

EXPLICIT QUALITY CRITERIA	Draw a column graph of the information presented in the table. Make your graph about a third of a page in size, labeling both axes and clearly show a title to your graph. Enhance the presentation of your graph by the use of colour.
ENGAGEMENT	Students remain involved in solving set mathematical tasks as the tasks are just beyond their comfort level but not too difficult to cause frustration.
HIGH EXPECTATIONS	1. Predict the next term in this pattern. 2. Give a reason for your choice. 3. State the rule in your own words. 4. Make up your own pattern and state its rule in words. 5. Make up a rule in words and write down the first four terms in the pattern. All students can access at least part of the above tasks.
SOCIAL SUPPORT	If having difficulty with finding a solution to this mathematical problem team up with a partner and combine your thoughts. Decide on a plan, make a start, record your thoughts, even if you are not confident you have the correct method.
STUDENTS' SELF REGULATION	Students continue to apply themselves to the solution of mathematical tasks due to the intrinsic interest generated by the rich tasks.
STUDENT DIRECTION	Now that I have found all the solutions to the cracked tile problem based on a square I will investigate solutions based on a rectangle ie what if the square was a rectangle? Working Mathematically: Questioning (ask questions in relation to mathematical situations).

QUALITY TEACHING: **K-6** MATHEMATICS

SIGNIFICANCE

BACKGROUND KNOWLEDGE	Knowledge of the combinations of ten (friends of 10) is needed for the Bridging to Ten Strategy which is then combined with the knowledge of off decade counting to produce the Jump Strategy. Working Mathematically: Reflecting (make connections with, and generalisations about, existing knowledge and understandings).
CULTURAL KNOWLEDGE	Is the Metric system the only measurement system in existence?
KNOWLEDGE INTEGRATION	Make a freehand sketch of a hex bolt.
INCLUSIVITY	Investigate how teen numbers are spoken in other languages and compare their merits to the way our own teen numbers are spoken.
CONNECTEDNESS	Is it better to buy a dozen eggs for $3.20 or two lots of half a dozen eggs for $1.70 per half dozen? Discuss whether four dozen eggs for $10 would be a good purchase.
NARRATIVE	Kindergarten is going on a bus trip today to Sea World. Our bus has ten seats made up of two sections of five seats each just like the seats at the front of the room. The driver's name is Eddie. To go on the excursion you need a ticket which shows you which seat to sit in. Where will the student with ticket number six sit?

QUALITY TEACHING: **7-12** MATHEMATICS

INTELLECTUAL QUALITY

DEEP KNOWLEDGE	1. The differential of $y = x^2$ is related to the rate of change of the variables x and y and gradient of the tangent at a particular point and is not just equal to 2x. 2. State the difference between a rectangle and an oblong.
DEEP UNDERSTANDING	As well as the numerical value of π (approx 3.14) being known the concept of the ratio, C:d, is understood. Eg π is the number of times the diameter of a circle fits around the circle's circumference, which is a little over three times. This property applies to all circles, regardless of size.
PROBLEMATIC KNOWLEDGE	Jessica pays $100 per week in rent. How much does she pay per month? 100 X 4 = $400 100 X 52/12 = $433.33 100 / 7 X 365.25 / 12 = $434.82
HIGHER ORDER THINKING	Explain why it is more dangerous for an infant to be locked in a car parked in the sun than an adult.
METALANGUAGE	1. Compare (2 + 3) x 5 and 2 + 3 x 5 2. Explain why a quadrilateral found on a deserted island might be a rectangle. 3. The geometric word *subtend* literally means 'stretched under' (Latin: sub, under; tendere to stretch). Interestingly, so does the word *hypotenuse* (Greek: hypo, under; teinein, to stretch).
SUBSTANTIVE COMMUNICATION	Interlock four cubes to form an L shape ie three in a row with the forth on top of an end cube. You have constructed a baby worm. Your task is to build an adult worm which is always twice as big as a baby worm. You are required to justify why you think your adult worm has been correctly constructed.