

# Gifted and talented education

Teachers' workshop 2009

## Curriculum Differentiation in the Mathematics KLA



NEW SOUTH WALES  
DEPARTMENT  
OF EDUCATION  
AND TRAINING



Curriculum K-12 Directorate

[www.curriculumsupport.education.nsw.gov.au/policies/gats/index.htm](http://www.curriculumsupport.education.nsw.gov.au/policies/gats/index.htm)

[www.curriculumsupport.education.nsw.gov.au/secondary/mathematics/index.htm](http://www.curriculumsupport.education.nsw.gov.au/secondary/mathematics/index.htm)





## Gifted and Talented Education

### New Partially Selective High Schools Workshops for teachers of Mathematics

Mercure Hotel, Sydney Airport  
18 September 2009

8:30 am	Coffee and registration
9:00 am	Welcome and introductions <b>Quality Teaching and the Nature of the Gifted Learner</b>
10:30 am	Morning tea
11:00 am	<b>Planning and Designing a Differentiated Curriculum</b>
12:00 pm	<b>Models of Curriculum Differentiation – Part A</b>
12.45 pm	Lunch
1.30 pm	<b>Models of Curriculum Differentiation – Part B</b>
2:15 pm	<b>Applying the Curriculum Differentiation Strategies in the Mathematics KLA</b>
3:15 pm	Evaluation and close




Program

## Gifted and Talented Education

### Mathematics - Teacher Workshops 2009: Flash Drive Contents

The workshop consists of four sessions. The resources that relate to each workshop session are written to the flash drive as shown in the table. Additional information including curriculum ideas, units of work, case studies and useful websites are also provided on the flash drive.

Session	Flash drive
<b>One</b>	<i>Quality Teaching and the Nature of the Gifted Learner</i>
	<ol style="list-style-type: none"> <li>1. Planning matrix (pdf)</li> <li>2. Gagné (pdf)</li> <li>3. Policy role and responsibilities (pdf)</li> <li>4. Characteristics of gifted students – GERRIC (pdf)</li> <li>5. Cognitive and Affective Characteristics of Gifted Students - Clark (pdf)</li> <li>6. Teacher nomination form: Gifted Underachiever - Whitmore (pdf)</li> <li>7. Van Tassel-Baska 'Needs' document (pdf)</li> <li>8. GAT Action Planners (doc)</li> <li>9. Options paper (pdf)</li> <li>10. Workshop activity sheets</li> </ol>
<b>Two</b>	<i>Planning and Designing a Differentiated Curriculum</i>
	<ol style="list-style-type: none"> <li>1. Curriculum Differentiation support document</li> <li>2. Scope and sequence / Mapping of Learning Outcomes templates (doc)</li> <li>3. Intellectual Standards and Focus Questions (pdf)</li> <li>4. QT &amp; Curriculum Planning (pdf)</li> <li>5. QT Key Questions (pdf)</li> <li>6. KWHL pre-test (pdf)</li> <li>7. Concept map blank (doc)</li> <li>8. Examples of concepts (pdf)</li> </ol>
<b>Three</b>	<i>Models of Curriculum Differentiation</i>
	<ol style="list-style-type: none"> <li>1. Models of Curriculum Differentiation workbook (pdf)</li> <li>2. Curriculum differentiation template (doc)</li> <li>3. Supporting underachievers (ILP) (pdf)</li> <li>4. Activities for Differentiating the Curriculum (pdf)</li> <li>5. Guidelines for reflection (pdf)</li> </ol>
<b>Four</b>	<i>Applying the Curriculum Differentiation Strategies in Mathematics</i>
	<ol style="list-style-type: none"> <li>1. Stage 4 Mathematics area unit (pdf)</li> <li>2. Area of triangle (GeoGebra – ggb)</li> <li>3. Area of parallelogram (GeoGebra – ggb)</li> <li>4. Understanding area (ActivStudio flipchart)</li> <li>5. Area of rectangles (TLF learning objects – 139, 384)</li> <li>6. Area of triangles (TLF learning objects – 145, 354, 355, 356, 357)</li> <li>7. Area of compound shapes (TLF learning objects – 150, 151, 152, 153, 383)</li> <li>8. Keeping learning on track: Formative assessment and the regulation of learning - Wiliam (pdf)</li> </ol>

	9. Formative assessment in mathematics. Part 2: feedback – Wiliam (pdf) 10. Stage 6 exponential growth and decay concept map (pdf) 11. Maker model – Stage 4 probability (pdf) 12. Maker model – mathematics (pdf) 13. Individual student-centred learning project (pdf) 14. Gifted in numeracy fact sheet (pdf) 15. Stage 4 Mathematics Data proforma (doc)
<b>Case Studies</b>	
	1. Baulkham Hills HS case study (doc) 2. Castle Hill HS case study (doc)
<b>KLA Curriculum ideas / Units of work (pdf)</b>	
	1. Stage 3 Mathematics unit – <i>Patterns and algebra</i> 2. Stage 4 Mathematics unit – <i>Polyominoes</i> 3. Stage 4 Mathematics unit – <i>Systems of communication - Data representation, analysis and evaluation</i> 4. Stage 4 <i>Interdisciplinary</i> unit 5. Stage 5 Mathematics unit – <i>Logarithms</i> 6. Stage 6 Mathematics unit – <i>Exponential growth and decay</i>
<b>Assessment and Reporting</b>	
	Assessment and Reporting (pdf)
<b>References</b>	
	References (including web links) (doc)
<b>Useful websites</b>	
	<p><b>Curriculum Support Gifted and Talented Education - Mathematics</b></p> <p>The New South Wales government aims to identify gifted and talented students and to maximise their learning outcomes in all public schools. Gifted and talented students are found in all communities regardless of their ethnic, cultural or socio-economic backgrounds. The gifted population includes students who are underachieving and who have disabilities.</p> <p><a href="http://www.curriculumsupport.education.nsw.gov.au/policies/gats/programs/curric_ideas/mth.htm">http://www.curriculumsupport.education.nsw.gov.au/policies/gats/programs/curric_ideas/mth.htm</a></p>
	<p><b>NRICH – specialists in rich mathematics</b></p> <p>NRICH is a team of qualified teachers who are also practitioners in RICH mathematical thinking. This unique blend means that NRICH is ideally placed to offer advice and support to both teachers and learners of mathematics.</p> <p><a href="http://nrich.maths.org/public/viewer.php?obj_id=5713">http://nrich.maths.org/public/viewer.php?obj_id=5713</a></p>
	<p><b>Plus magazine ... living mathematics</b></p> <p>Plus magazine opens a door to the world of maths, with all its beauty and applications, by providing articles from the top mathematicians and science writers on topics as diverse as art, medicine, cosmology and sport.</p> <p><a href="http://www.pass.maths.org/index.html">http://www.pass.maths.org/index.html</a></p>

**MARS tasks**

The products and processes, the core of Mathematics Assessment Resource Service research output, include: assessment and evaluation tasks and curriculum support materials.

<http://www.nottingham.ac.uk/education/MARS/tasks/>

**Young Gifted & Talented**

The site to challenge, fascinate and inspire you. It's packed with fun activities and information – whatever your gift and talent!

**Mathematics** <http://ygt.dcsf.gov.uk/Secondary/ClassroomSubjectPage.aspx?id=20>

**All subjects** <http://ygt.dcsf.gov.uk/Secondary/Classroom.aspx>

**AIMS Puzzle Corner**

The AIMS Puzzle Corner provides over 100 interesting math puzzles that can help students learn to enjoy puzzles and the mathematics behind them. The puzzles are categorized by type, and within each category are listed in order of increasing difficulty.

<http://www.aimsedu.org/Puzzle/index.html>

**The Mathematical Association of NSW (MANSW)**

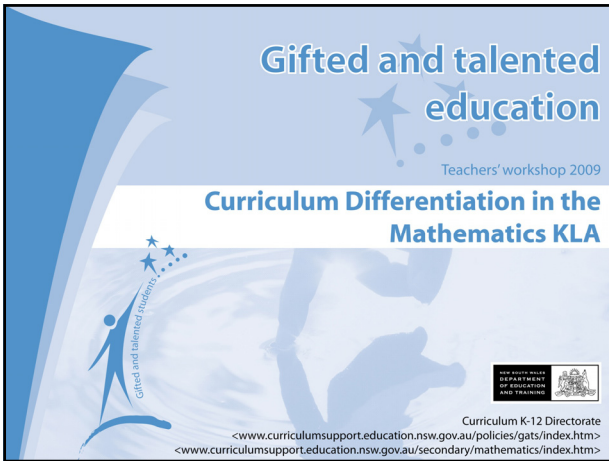
A list of websites for working mathematically.

<http://www.mansw.nsw.edu.au/cgi-bin/links/linkmat.cgi?script=links&browse=Y&category=15>

**Explorers club**

<http://www.nagcbrtain.org.uk/explorers/youth.php>






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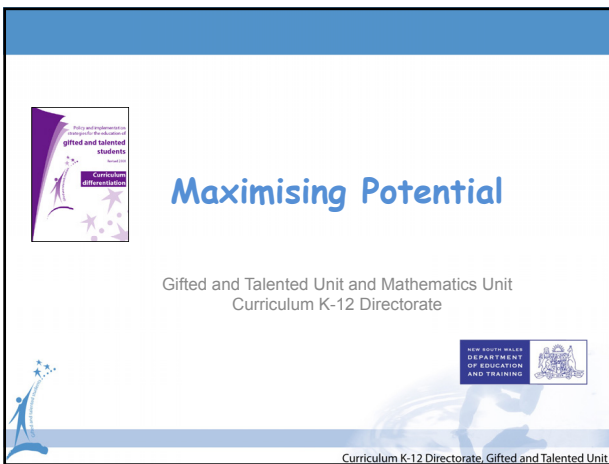
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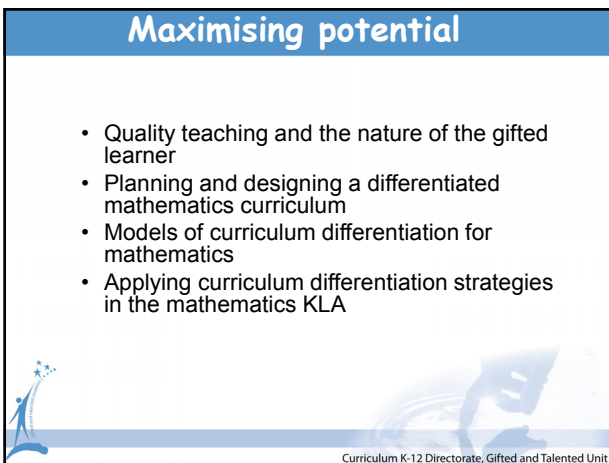
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Quality Teaching

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Key factors of student achievement

(Dinham, 2008)

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Teacher Quality

- Major influence on student achievement  
(Cuttance, 2001; Hattie, 2003; Hattie, 2009; Rowe, 2002)
- Value-added research has confirmed that teachers can produce a strong cumulative effect on student achievement  
(Wright, Horn & Sanders, 1997)

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Quality Teaching  
(visible teaching - visible learning)

Key ingredients:

- share learning goals
- provide clear, explicit success criteria
- understand student's prior knowledge and skills
- provide challenging experiences related to subject-matter

(Hattie, 2009)

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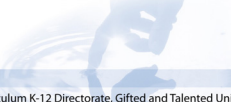
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Quality Teaching  
(visible teaching - visible learning)

- map learning progression
- provide direction and re-direction to help students achieve the outcomes
- “get out of the way when learning is progressing towards the success criteria”
- create a safe environment where errors are welcomed

(Hattie, 2009)

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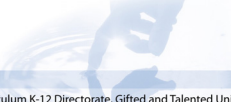
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Feedback for students and teachers

- concept of role reversal – teachers need to be vigilant on what is working or not working in the classroom
- student voice
- feedback can have a powerful impact on student learning

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## Feedback for students and teachers

- Where am I going? (learning intentions, goals, success criteria)
  - How am I going? (self-evaluation, peer evaluation, appropriate audiences)
  - Where to next? (progression, new goals)
- (Dinham, 2008; Hattie, 2009)



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## *Nature and needs of gifted and talented students*



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## Definitions

- research-based
- accessible to teachers
- direct and logical connection to identification programs and programming



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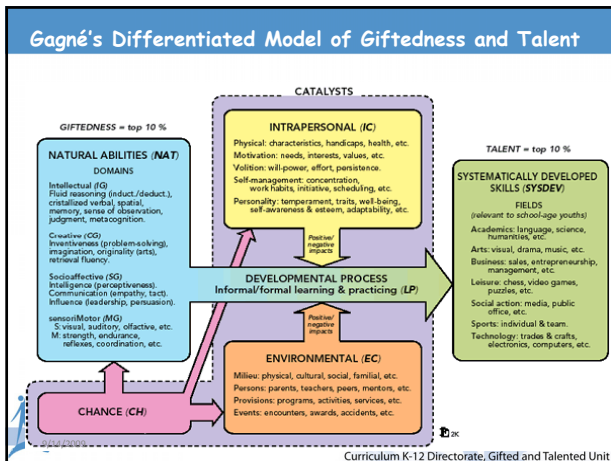
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### IQ and levels of giftedness

Level	IQ range	Frequency
Mildly	115 - 129	> 1:40
Moderately	130 - 144	1:40 – 1:1000
Highly	145 - 159	1:1000 – 1:10000
Exceptionally	160 - 179	1:10000 – 1:1 million
Profoundly	180 +	< 1:1 million

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### Cognitive characteristics

- Advanced comprehension
- High level of language development
- Unusual capacity to process information
- Rapid pace of learning
- Divergent thinking/creativity

(Clark, 1992)

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## Cognitive characteristics

- Reflective thinking
- Capacity to see unusual and diverse relationships among ideas/disciplines
- Advanced thought processes
- Judgemental approach to self and others

(Clark, 1992)



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## Affective characteristics

- Concern with justice
- Mature moral reasoning
- Keen sense of humour
- High levels of energy
- Emotional intensity

(Clark, 1992)



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## Social and emotional development

The more highly gifted the person,  
the more problematic the emotional  
and behavioural issues may become.



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## Specific areas of vulnerability

- Heightened sensitivity
- Emotional intensity
- Perfectionism
- Feeling different
- Asynchronous development of intellectual, social and emotional skills



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## What do gifted learners need?

### Activity

You will be divided into 5 groups for this activity.

1. Read the introduction to the paper 'Lessons learned about educating the gifted and talented: A synthesis of the research on educational practice' by Karen Rogers
2. Now read the assigned lesson (Group 1 – Lesson 1 etc.) and answer the following questions:
  - What is/are the recommended practice(s) for gifted learners?
  - What issues do you envisage for teachers and partially selective high schools in implementing the recommended practice(s)?



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## What do gifted learners need?

### Instructional strategies

- General teaching behaviours – curriculum planning and instructional practice
- Differentiated teaching behaviour
  - Accommodations for individual differences
  - Problem solving
  - Critical thinking strategies
  - Creative thinking strategies
  - Research strategies

(Van Tassel-Baska, 2005)

- Independent study



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## Planning and designing a differentiated curriculum



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## What is curriculum differentiation?

Curriculum differentiation:

- ranges from slight to major modifications of the curriculum through adjustments to content, processes, products and the learning environment
- provides meaningful and appropriate assessment opportunities

(Tomlinson & Allan, 2000)

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## Curriculum Differentiation - An Overview

Outcomes	Content	Process	Product
Why do you want students to learn?	What do you want students to learn?	How do you want students to learn?	How do <b>students demonstrate</b> what they have learnt?

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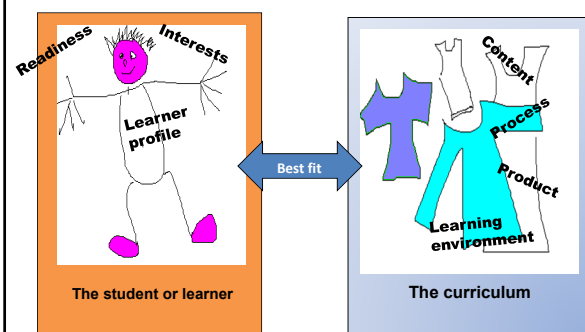
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Differentiation is a response to the diverse learning needs of students/learners

Qualitatively different from the basic or regular curriculum (Maker, 1982)



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## Why differentiate?

- Precocity
- Intensity
- Complexity



(Van Tassel-Baska, 2003)



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## What do gifted students need?

- challenge
- pace
- complexity
- explicit instruction and scaffolding but not the degree of support and repetition required by less able students



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## Focus Questions - Reflective Thinking

Intellectual Standards	Focus Questions
Clarity	<ul style="list-style-type: none"> <li>• Could you elaborate further?</li> <li>• Could you give an example</li> <li>• Could you illustrate what you mean?</li> </ul>
Accuracy	<ul style="list-style-type: none"> <li>• How would you check on that?</li> <li>• How could you find out that is true?</li> <li>• How could we verify or test that?</li> </ul>
Precision	<ul style="list-style-type: none"> <li>• Could you be more specific?</li> <li>• Could you give me more details?</li> <li>• Could you be more exact?</li> </ul>
Relevance	<ul style="list-style-type: none"> <li>• How does that relate to the problem?</li> <li>• How does that bear on the question?</li> <li>• How does that help us with the issue?</li> </ul>

Source: Paul, R. W. & Elder, Linda (2004). *The Thinker's Guide to the Nature and Functions of Critical and Creative Thinking*.

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## Focus Questions (contd.)

Intellectual Standards	Focus Questions
Depth	<ul style="list-style-type: none"> <li>• What factors make this a difficult problem?</li> <li>• What are some of the complexities of this question?</li> <li>• What are some of the difficulties we need to deal with?</li> </ul>
Breadth	<ul style="list-style-type: none"> <li>• Do we need to look at this from another perspective?</li> <li>• Do we need to consider another point of view?</li> <li>• Do we need to look at this in other ways?</li> </ul>
Logic	<ul style="list-style-type: none"> <li>• Does all this make sense together?</li> <li>• Does your first paragraph fit in with your last?</li> <li>• Does what you say follow from the evidence?</li> </ul>
Significance	<ul style="list-style-type: none"> <li>• Is this the most important thing to consider?</li> <li>• Is this the central idea to focus on?</li> <li>• Which of these facts are most important?</li> </ul>
Fairness	<ul style="list-style-type: none"> <li>• Do I have any vested interest in this issue?</li> <li>• Am I sympathetically representing the viewpoints of others?</li> </ul>

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## Key question

'How can the NSW Board of Studies mathematics syllabuses, the *Quality Teaching* (QT) model of pedagogy and the gifted education research be used to devise developmentally appropriate curriculum for gifted and talented students'?

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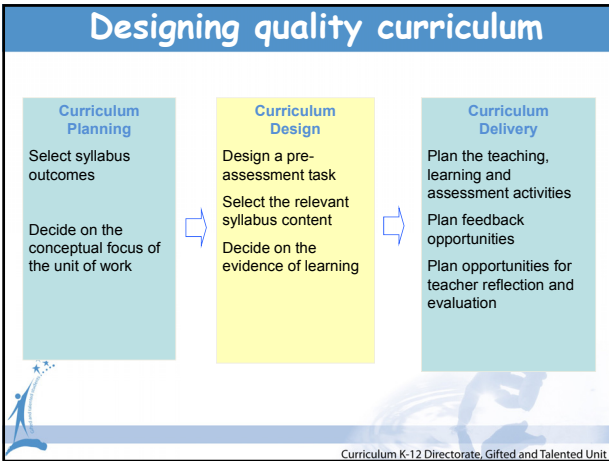
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### Curriculum Planning

#### Planning Quality Curriculum for Gifted Learners:

- Developing **scope and sequence**
- Mapping syllabus **outcomes** for different units throughout the stage and differentiating them
- Deciding on the **conceptual focus** of a unit of work
- Selecting **Quality Teaching elements** for different units of work

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### Scope and sequence

Year	Concept Focus	Content Focus	Resources	Skills Focus	Assessment Focus
7					
8					
9					
10					

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### Mapping of learning outcomes

Term	Learning Outcomes	Units of Work Focus	Content Focus	Skills Focus	Assessment Focus
1					
2					
3					
4					



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### Teaching conceptual understanding

Essential Understandings

↑

Concepts


↑

Topic

↑

Critical Content / Facts

*"Enduring understandings" / "Essential understandings" /  
 "Generalisations" / "Big ideas"*



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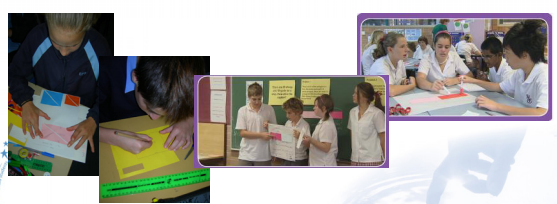
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
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### Curriculum design

#### Designing *differentiated* curriculum for gifted learners:

- Choosing key **learning outcomes** (core and extended)
- Selecting relevant syllabus **content** (core and extended)
- Deciding on the **evidence of learning** (core and extended)
- Integrating **Quality Teaching** elements into differentiated units of work





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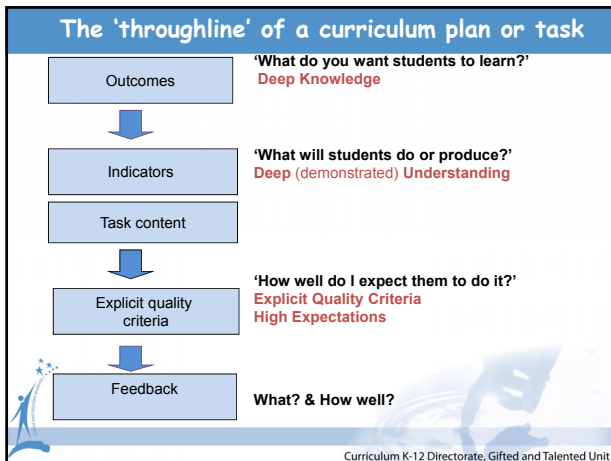
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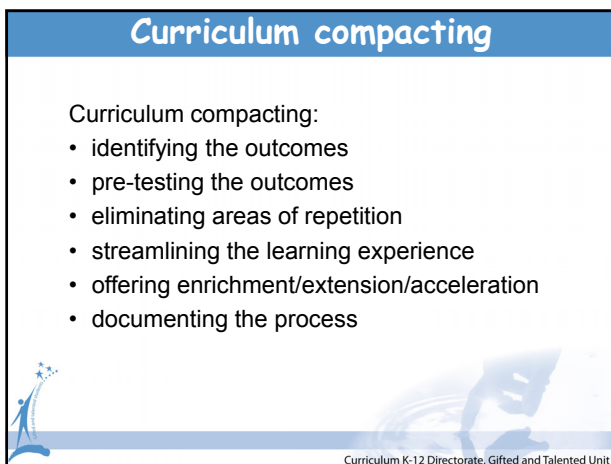
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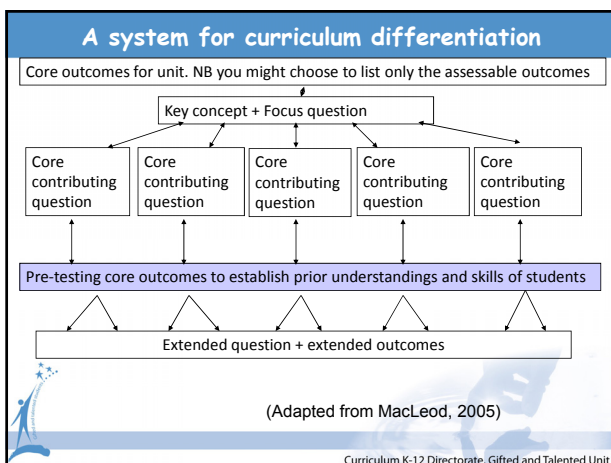
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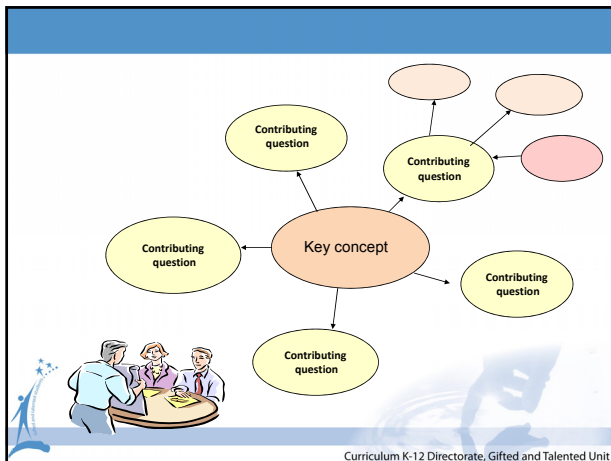
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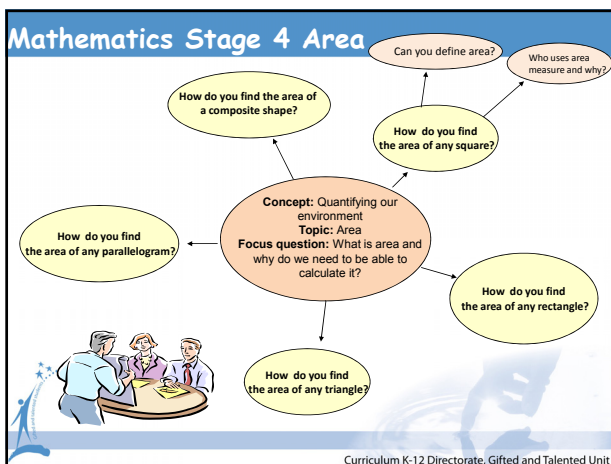
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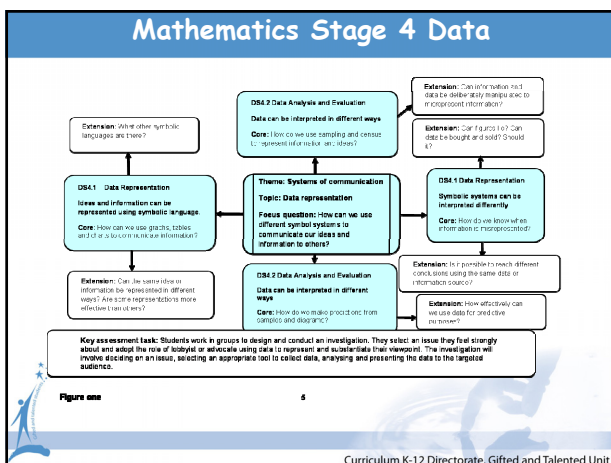
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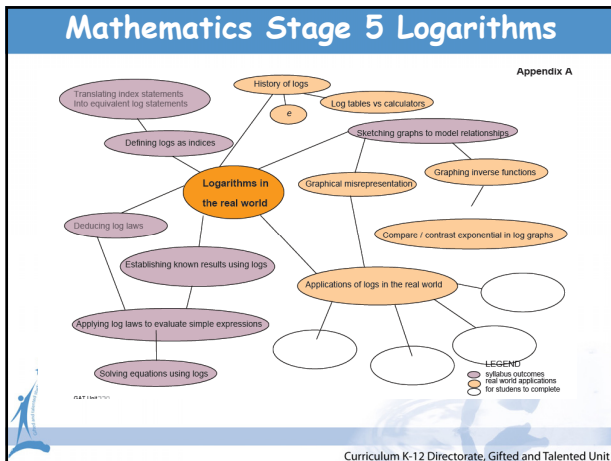
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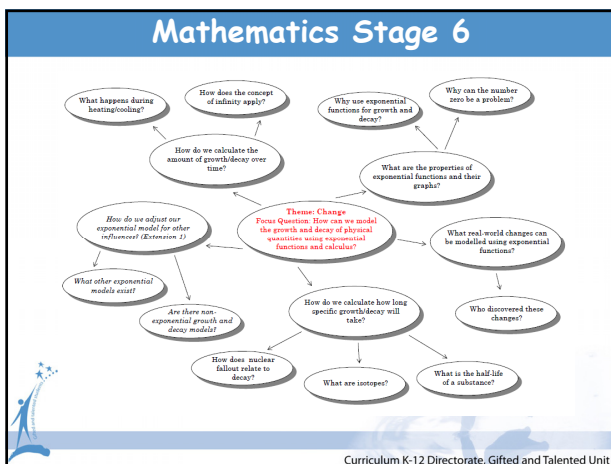
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## Concept mapping

- Identify the focus outcomes
- Identify the key concepts
- Identify the key conceptual understandings or generalisations
- Design 4-5 core contributing questions

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## Concept mapping

- Design pre-test or pre-assessment
- Construct extension questions and modified outcomes
- Construct teaching and learning sequence
- Develop key assessment task and differentiated assessment task



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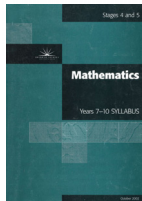
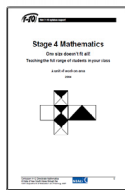
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## Identifying concepts activity



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## Why differentiate the curriculum in mathematics?

- Maths classes are often already in ability groups – don't we already differentiate the curriculum?



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## Why differentiate the curriculum in mathematics?

Even within an ability grouped class there is a distinct range of mathematical ability and prior knowledge that students bring to learning mathematics concepts, particularly across the syllabus strands



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## What does curriculum differentiation look like in mathematics?

It is a program of activities that offers a variety of entry points for students who differ in abilities, knowledge and skills



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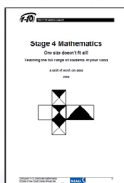
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Stage 4 Mathematics  
One size doesn't fit all!  
Teaching the full range of students in your class  
*A unit of work on area*



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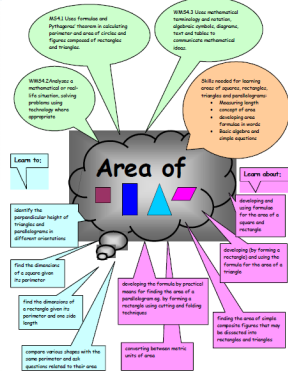
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## Differentiated programming is:

- Open Session 4 area.pdf
- having high expectations for each student
- *Area topic overview (page 4)*



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## Differentiated programming is:

- Permitting students to demonstrate mastery of material they already know and to progress at their own pace through new material
- *Area assessment for learning tasks (page 5-8)*
- **Discussion**
  - Read pages 5-8
  - Have you used a similar AFL in your class? What happened?

What do I already know about area of squares, rectangles, triangles and parallelograms and what do I need to learn?

Place a tick (✓) in the box against the statement that describes what you CAN do.

Knowledge	I can always do this	I can do this sometimes	I don't know how to do this
1. I know what squares and rectangles look like.			
2. I can draw squares and rectangles.			
3. I can draw a triangle.			
4. I can label the perpendicular height on a triangle.			
5. I know what a parallelogram looks like.			
6. I can label the perpendicular height on a parallelogram.			
7. I can explain what the area of a shape is.			
8. I can find the length and breadth of a rectangle.			
9. I can find the area of squares and rectangles by counting square units.			
10. I can calculate the area of squares and rectangles by using the area formula.			
11. I can find the area of triangles by counting square units.			
12. I can calculate the area of any triangle by using the area formula.			
13. I can calculate the area of any parallelogram by using the formula.			
14. I can find the area of shapes that can be cut into rectangles and triangles.			
15. I can convert square millimetres to square centimetres.			

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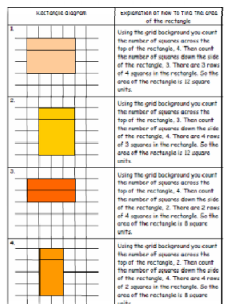
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## Differentiated programming is:

- Providing different avenues to acquiring content, to processing or making sense of ideas, and to developing products
- *Area of a rectangle: Task 1, 2 and 3 (pages 10-13)*
- **Computer task – learning object**
  - 384 Find area of rectangle
  - 383 Find the area of compound shapes



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## Differentiated programming is:

- Providing multiple assignments within each unit, tailored for students with differing levels of achievement.

- Range of tasks across unit – writing, computer, textbook, ...

Extension	Learning objectives and learning outcomes
1. Researching the area of a rectangle	<ul style="list-style-type: none"> <li>Use a ruler to measure the length and width of a rectangle.</li> <li>Calculate the area of a rectangle using the formula: <math>\text{Area} = \text{length} \times \text{width}</math>.</li> <li>Assessment for learning (AFL) activity: Choose one of the tasks below and explain to your partner why you chose this task.</li> </ul>
2. Researching the area of a rectangle	<ul style="list-style-type: none"> <li>Use a ruler to measure the length and width of a rectangle.</li> <li>Calculate the area of a rectangle using the formula: <math>\text{Area} = \text{length} \times \text{width}</math>.</li> <li>Assessment for learning (AFL) activity: Choose one of the tasks below and explain to your partner why you chose this task.</li> </ul>
3. Researching the area of a rectangle	<ul style="list-style-type: none"> <li>Use a ruler to measure the length and width of a rectangle.</li> <li>Calculate the area of a rectangle using the formula: <math>\text{Area} = \text{length} \times \text{width}</math>.</li> <li>Assessment for learning (AFL) activity: Choose one of the tasks below and explain to your partner why you chose this task.</li> </ul>

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## Differentiated programming is:

- Providing multiple assignments within each unit, tailored for students with differing levels of achievement.

- Rectangle mania (page 15)

**Rectangle Mania**  
Draw all the rectangles you can that have an area of 24 cm<sup>2</sup>.

You will need:

- to work together in groups of 2-3 students
- some coloured paper, one A4 sheet of grid paper (cm<sup>2</sup>), ruler and a pencil
- to construct the rectangles, using a pencil and a ruler, on the coloured paper. Cut them out and paste them onto the A4 grid paper.
- to label the dimensions of your rectangles
- to complete this task in 20 minutes



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## Differentiated programming is:

- Allowing students to choose, with the teacher's guidance, ways to learn and how to demonstrate what they have learned (page 22)

**What's your angle on area of triangles?**

Investigate and research some methods used to find the area of a triangle other than  $\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$ .

Below are some possibilities worth investigating:

- Pick's formula
- Heron's formula
- Area of circumscribed rectangle

You may:

- work individually or in pairs
- present your work as
  - a powerpoint presentation
  - a poster
  - a model with a written explanation
  - a video

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## Differentiated programming is:

- Flexible: teachers move students in and out of groups, based on students' instructional needs (page 2)

3. Developing area formula for right-angled triangles	<ul style="list-style-type: none"> <li>• Unit overview – review of previous learning (whole class)</li> <li>• Teacher guided practical measuring activity on developing area of a triangle as half the area of the bounding rectangle, page 17 (whole class)</li> <li>• Task 4: Triangles 1 writing task, right-angled triangles, page 19 (pairs)</li> <li>• Optional: Area of triangle level 1 Learning Federation object (on CD)</li> </ul>
1 lesson	<ul style="list-style-type: none"> <li>• Return to unit overview (whole class)</li> </ul>
4. Developing area formula for any triangle	<ul style="list-style-type: none"> <li>• Unit overview – review of previous learning (whole class)</li> <li>• Teacher guided practical – area of any triangle – developed as half the area of the bounding rectangle, page 18 (whole class)</li> <li>• Task 5: Triangles 2 writing task moving from the explanation to developing the formula, page 20 (pairs)</li> <li>• Optional: Area of triangle level 2 Learning Federation object (on CD)</li> <li>• Optional Task 5: What's your angle on area of triangles? see page 22 (individual, pairs or assignment)</li> </ul>
1 lesson	<ul style="list-style-type: none"> <li>• Return to unit overview</li> <li>• Homework – write a paragraph on how the area of a triangle and a rectangle relate</li> </ul>



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## Learning goals are clear and connections are made to students' experiences

Strategies include:

- Developing a unit of work
  - For example the [Stage 4 Area](#) unit on the [Curriculum Support](#) website
- Overview of the learning (goals are clear)
- Assessment for learning (finding out what the students already know - AFL)



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## Learning is student-centred and the teacher facilitates

Read page 2 Lesson 2 of area unit

Strategies include:

- Card match (pairs) – area of rectangle 1, 2 or 3, match picture to written description
- Writing task (pairs) – students write the description to match the picture
- Rectangle mania – open-ended task (page 17)



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## Learning is student-centred and the teacher is the facilitator

Strategies include:

- Block out – area puzzle (page 16)
- Learning object (technology) – area of a rectangle and area of a triangle from the Learning Federation, available through TaLe
- [ActivStudio flipchart](#) available through TaLe for this area unit
- Practical measurement activity – area of a right- angled triangle (page 19)



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## Learning is student-centred and the teacher is the facilitator

Strategies include:

- GeoGebra applet (technology) on:
  - area of a triangle
  - area of a parallelogram



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## Teaching is responsive to students' differences - prior knowledge and learning styles

- AFL – Learning profile questionnaire (page 9)
- Activities offered over the unit cover a range of student learning styles



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**Teaching is responsive to students' differences - prior knowledge and learning styles**

- Assessment of learning (AOL)
  - Doesn't always have to be a pen and paper test
  - Consider offering a choice of assessment tasks e.g. page 26 and 27 may be used
  - Give the tasks at the beginning of the unit to give students the opportunity to ask relevant questions throughout the unit
  - Have a marking criteria (rubric) with the task so students know what a good product looks like



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***Models of curriculum differentiation***



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**Curriculum Delivery**

**Delivering Quality Curriculum for Gifted Learners:**

- Integrating aspects of **gifted curriculum models** such as Williams and Maker
- Integrating elements of the **Quality Teaching** model
- Implementing **instructional** and **management** activities
- Providing **feedback** opportunities
- Providing opportunities for teacher **reflection** and **evaluation**



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## Models of curriculum differentiation

- Bloom's (1956) Taxonomy of educational objectives
- Anderson/Krathwohl (2001) Taxonomy for learning, teaching and assessing
- Maker (1982) model
- Williams (1993) model
- Kaplan's (1993) Content-process-product model



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## Anderson-Krathwohl (2001)

- Revised taxonomy is divided into two dimensions: the knowledge dimension and the cognitive process dimension
- Useful tool to align outcomes, learning activities and assessments



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## The Maker Model

To provide qualitatively different learning experiences for gifted students, teachers need to focus upon:

- Content
- Process of learning
- Products
- Structure of the learning environment



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## Content

- Abstractness – content shifting from facts, descriptions to concepts, relationships among concepts and generalisations
- Complexity – study of inter-relationships
- Variety – content beyond that provided in the regular program
- Study of people – individuals or peoples experiences and reactions
- Study of methods of inquiry – used by experts in their fields



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## Process

This refers to the way educators teach and the way students use information

- Includes :
  - higher-level thinking – critical thinking and problem solving
  - creative thinking – involving imagination, brainstorming techniques
  - open-endedness
  - real-world skills
  - variable pacing
  - debriefing
  - freedom of choice



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## Product

- real-world problems – relevant to the student
- real audiences
- real deadlines – encouraging time management skills and realistic planning
- transformations – involving original manipulation of information rather than regurgitation
- appropriate evaluation – self evaluation, peer evaluation, teacher, expert



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## Learning environment

The learning environment should:

- be student-centred
- encourage independence
- be open and accepting
- complex and abstract
- allow mobility



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## The Maker model Stage 4 data

Content modifications – what students will learn	
<b>Abstraction</b> Dealing with abstract concepts and generalisations	<b>Ethics</b> What are the implications of misrepresenting data? What are the ethical considerations in buying and selling data?
<b>Complexity</b> Introducing greater breadth and depth	<b>Other symbol systems</b> How are symbolic languages used to communicate ideas? What is the role of culture?
<b>Variety</b> Exposure to new concepts or content beyond the curriculum	<b>Extension topic – the normal distribution</b> What is meant by the 'normal' distribution?
<b>Organisation</b> Rearrangement of content. New synthesis of key concepts or abstract ideas	<b>Data Visualisation</b> How has data visualisation been used throughout time?
<b>Study of people</b> Relating content to humans. Study creative and productive individuals and how they operate	<b>Who uses data and why?</b> How is data used by people to communicate ideas and inform?
<b>Methods of inquiry</b> Relating content to the methods	<b>Synthesis</b> Can the same information and data be represented



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## The Maker model Stage 4 data

Process modifications – how students will learn the content	
<b>Higher-order thinking skills</b> Questions focussing on analysis, synthesis and evaluation	<b>Evaluating reliability and validity</b> Evaluate the validity and reliability of different sources of information and data.
<b>Open-ended processing</b> Encouraging divergent thinking	<b>Cognitive and affective interaction</b> Should data and information be bought and sold? (See questions derived using the Williams model.)
<b>Discovery</b> Inquiry approach to determine own conclusions	<b>Multiple perspectives and different viewpoints</b> Use the Internet to investigate two different viewpoints about the same issue and compare the supporting data and information.
<b>Proof and reasoning</b> Required to give reasons, substantiate conclusions	<b>Substantiating conclusions</b> Is it possible to reach different conclusions using the same data or information source?
<b>Freedom of choice</b> Opportunities for self-directed learning	<b>Learning from the past</b> Investigate an aspect of the history of thematic cartography, statistical graphics and data visualisation.
<b>Group interactions</b> Group problem solving	<b>Collaboration and synergy</b> (Based on Maker, 1982) Work in a group to design and conduct an investigation related to an area of interest.



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## The Maker model Stage 4 data

Product modifications			
<b>Real-world problems</b> Investigating real life problems/ask provocative questions	<b>Real audiences</b> Students develop products for evaluation by various people or groups, e.g. peers, teacher, parents, Shire Council, magazine, scientific journal, etc.	<b>Transformations</b> Students are encouraged to suggest practical uses for what is learned	<b>Evaluations</b> Teacher assessment and student evaluation using pre-established criteria



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## The Maker model Stage 4 probability

CONTENT	STUDY OF PEOPLE	VARIETY	ABSTRACTION
<b>PROCESS</b>			
<b>ANALYSIS</b>	When trials of events involve "spinning" the wheel is often to be successful. Can you predict the results of a series of spins? How many spins will it take to get a certain result? (The wheel has numbers 1-10 and a "0" for a prize.)	When are the chances that a series of events will be successful? Can you predict the results of a series of spins? How many spins will it take to get a certain result? (The wheel has numbers 1-10 and a "0" for a prize.)	When are the chances that a series of events will be successful? Can you predict the results of a series of spins? How many spins will it take to get a certain result? (The wheel has numbers 1-10 and a "0" for a prize.)
<b>PARADOX</b>	Can you predict the results of a series of spins? How many spins will it take to get a certain result? (The wheel has numbers 1-10 and a "0" for a prize.)	When are the chances that a series of events will be successful? Can you predict the results of a series of spins? How many spins will it take to get a certain result? (The wheel has numbers 1-10 and a "0" for a prize.)	When are the chances that a series of events will be successful? Can you predict the results of a series of spins? How many spins will it take to get a certain result? (The wheel has numbers 1-10 and a "0" for a prize.)
<b>DISCOVERY</b>	Can you predict the results of a series of spins? How many spins will it take to get a certain result? (The wheel has numbers 1-10 and a "0" for a prize.)	When are the chances that a series of events will be successful? Can you predict the results of a series of spins? How many spins will it take to get a certain result? (The wheel has numbers 1-10 and a "0" for a prize.)	When are the chances that a series of events will be successful? Can you predict the results of a series of spins? How many spins will it take to get a certain result? (The wheel has numbers 1-10 and a "0" for a prize.)

(Source: 1996-97)

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## Maker model activity



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## The Williams Model

- Three dimensional theory
- Based upon studies of the creative process and creative person



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## The Williams Model

- Comprises the subjects that comprise the K–12 curriculum
- This is the vehicle for students to think and feel about



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## The Williams Model

- Eighteen strategies
- Used by the teacher to develop critical thinking and creativity



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## Williams Model - Teaching Strategies

1. Paradox	7. Examples of habit	13. Study creative people
2. Attributes	8. Organised random search	14. Evaluate situations
3. Analogy	9. Skills of search	15. Creative reading
4. Discrepancy	10. Tolerance of ambiguity	16. Creative listening
5. Provocative question	11. Intuitive expression	17. Creative writing
6. Examples of change	12. Adjustment to development	18. Visualisation

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## The Williams Model

Gifted and Talented Education



Page 11

Stage 4 Mathematics  
Systems of communication  
Data representation, analysis and evaluation

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## Williams model activity

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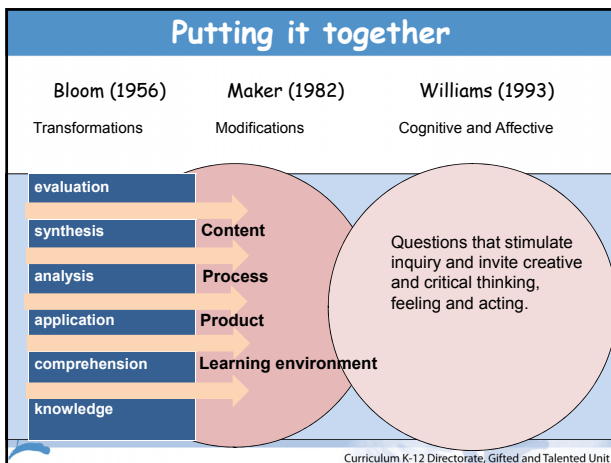
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### Kaplan - Content - Process -Product model

Content should:

- be related to a theme
- be multi-disciplinary
- have integrated topics
- include a time perspective

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### Process

Basic skills:

- observing
- recording
- describing
- recognising relationships
- predicting

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## Process

Research skills:

- using a classification key
- outlining
- using the information skills process
- reporting research



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## Process

Productive skills:

- Critical thinking skills
  - Analysis/Evaluation
  - Problem solving
- Creative thinking skills



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## Product

- Oral presentation
- Sculpture
- Map
- Letter
- Filmstrip
- Journal



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## Putting it all together

- planners – concept map
- curriculum models
- unit example
- action learning and reflection



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## Strategies

- practise pre-assessment
- allow for negotiation of planned activities
- use graphic organisers to develop lesson plans and communicate the learning intentions to students
- provide choice in class activities



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## Strategies

- record a class conversation – analyse questioning
- introduce flexible grouping to enable gifted students to work together
- collaborate with a colleague to develop a lesson sequence and reflect on its impact on student learning



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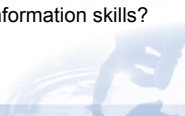

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# Evaluation and reflection



Does the unit of work:

- deal with major issues, ideas, problems, concepts?
- provide for knowledge or information base
- enable interdisciplinary study?
- provide research project, independent study opportunities?
- expect an appropriate product or presentation?
- include teaching of thinking and information skills?




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# Evaluation and reflection



Does the unit of work:

- provide accelerated level, complex, in depth faster-paced activities?
- offer flexible grouping opportunities?
- allow for self direction and self evaluation?
- state outcomes clearly and at higher levels (refer to Bloom's taxonomy)?
- provide opportunities for exploration of individual interests?



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The screenshot shows the homepage of the NSW Department of Education and Training's Curriculum Support website. The header includes the department name and a search bar. Below the header is a large banner with the title "Curriculum Support" and navigation tabs for Home, Mathematics, English, Science, History, Geography, Languages, and Arts. A left sidebar contains links such as "Curriculum-related projects", "Gifted and Talented", "Special Needs", "Policy", "Using eLearning Resources", "Useful Tools", "Programs and Initiatives", "Program Implementation", "Case Studies", "Contact Us", "Curriculum views", "Feedback", and "Professional Learning". The main content area features a "Mathematics" section with a colorful graphic of three figures running. Below this is a table titled "Sample units of work" which lists various curriculum resources categorized by level and subject.

	Level	Subject	Title	Description
	Stage 6 Year 7	Mathematics	Pythagoras (y9f 3080)	An extension activity that focuses on the manipulation of two-dimensional figures.
	Stage 6 Year 8	Mathematics	Screens of Communication (y8c 2685)	The purpose of this material is to increase the process of curriculum differentiation. It is not a complete unit of work but it is based on the <b>Bate Enrichment Unit</b> , developed by Northern Beaches Secondary College Mary Carrigan.
	Stage 5 Year 10	Mathematics	Logarithm in the real world?	This unit is intended for those of mathematics who already have some understanding of mathematical proof.

<http://www.curriculumsupport.education.nsw.gov.au/policies/gats/programs/units/mth.htm>

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<https://mth.htm>

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## Selected references

- Anderson, L. W., Krathwohl, D. R., Airasian, P. W., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., Raths, J. & Wittrock, M. C. (Eds). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. New York: Longman.
- Bloom, B. S. (Ed.). (1956). *Taxonomy of educational objectives: The classification of educational goals*. New York: Longmans, Green & Co.
- Dinham, S. (2008). *How to get your school moving and improving: An evidence-based approach*. Vic.: ACER Press.
- Gagné, F. (2003). Transforming gifts into talents: The DMGT as a developmental theory. In N. Colangelo & G. A. Davis (Eds), *Handbook of gifted education* (3rd ed., pp. 60-74). Boston: Allyn & Bacon.
- Hattie, J. A. C. (2009). *Visible learning: A synthesis of meta-analyses relating to achievement*. New York: Routledge.



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## Selected references

- Gross, M. U. M., MacLeod, B., Bailey, S., Chaffey, G., Merrick, C. & Targett, R. (2005). *Gifted and talented education professional learning package for teachers*, viewed 24 January 2006, from Australian Government Department Education Science and Training web site, [http://www.dest.gov.au/sectors/school\\_education/publications\\_resources/profiles/gifted\\_education\\_professional\\_development\\_package.htm#publication](http://www.dest.gov.au/sectors/school_education/publications_resources/profiles/gifted_education_professional_development_package.htm#publication)



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## Selected references

- Kaplan, S. N. (1993). The grid: a model to construct differentiated curriculum for the gifted. In J. S. Renzulli (Ed.) *Systems and models for developing programs for the gifted and talented* (pp. 180-193). Highett, Vic.: Hawker Brownlow Education.
- MacLeod, B. (2005). Module 5 – Curriculum differentiation for gifted students. In S. Bailey (Ed.), *Gifted and talented education professional learning package for teachers*. Sydney: Australian Government Department of Education, Science and Training and University of New South Wales, GERRIC (Gifted Education Research, Resource and Information Centre).
- Maker, C. J. (1982). *Curriculum development for the gifted*. Austin, Texas: Pro-Ed.



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## Selected references

- NSW Department of Education and Training. (2006). *Quality teaching in NSW public schools: An assessment practice guide*. Sydney.
- Tomlinson, C. A. & Allan, S. D. (2000). *Leadership for differentiating schools and classrooms*. Alexandria, VA.: ASCD.
- Williams, F. E. (1993). The cognitive-affective interaction model for enriching gifted programs. In J. S. Renzulli (Ed.), *Systems and models for developing programs for the gifted and talented*. Highett, Vic.: Hawker Brownlow Education.
- Van Tassel-Baska, J. (2003). What matters in curriculum for gifted learners: Reflections on theory, research and practice. In N. Colangelo & G. A. Davis (Eds), *Handbook of gifted education* (3rd ed., pp. 174-183). Boston: Allyn & Bacon.



Curriculum K-12 Directorate, Gifted and Talented Unit

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