



CANBERRA GIRLS  
GRAMMAR SCHOOL

# CANBERRA GIRLS GRAMMAR SCHOOL

AIS ACT CELEBRATING TEACHING AND LEARNING

Thursday, 10 November 2016

Canberra Girls Grammar School

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## COACHING: THE JOURNEY CONTINUES



Coach: Yvonne McGarry  
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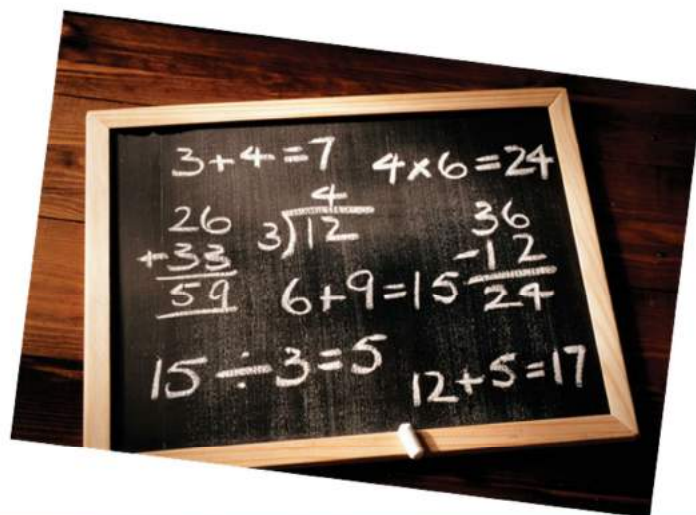
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Numeracy coaching is a journey...a journey that most of us have been on for the past two years.

LONG TERM GOAL: STUDENT COHORT SHOWS IMPROVED RESULTS IN THE QUANTITATIVE QUESTIONS OF THE YEAR 12 AST EXAMINATIONS



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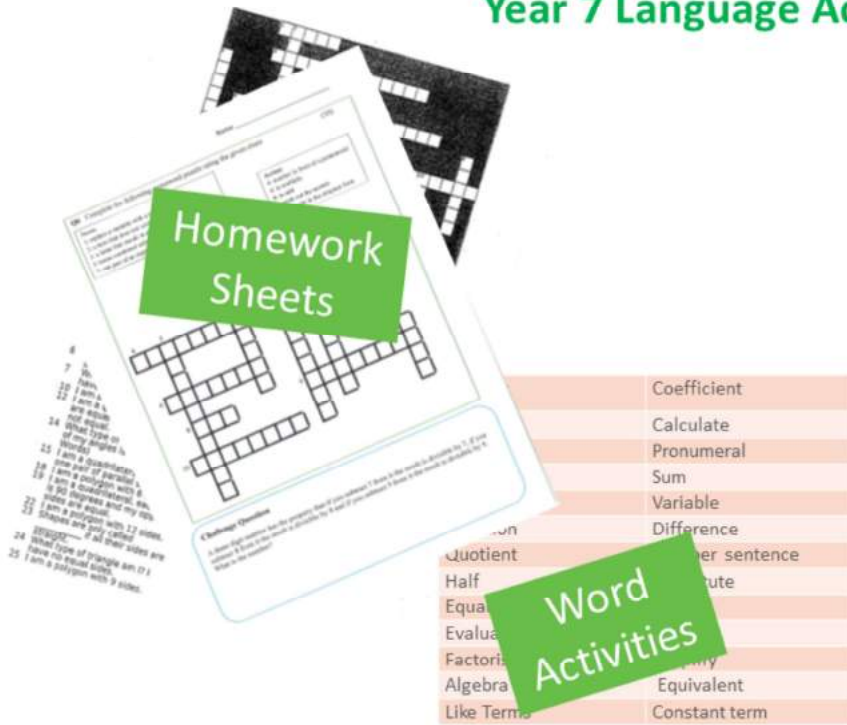
To quickly recap... Last year I spent the beginning of the year completely lost and chasing my tail. I didn't really know in what direction our school should head, I only knew that we wanted to improve our results in the quantitative questions of the AST examinations.

Jane and I try to explore many possible directions. We started off by looking at going back to basics and restricting the use of calculators; however, that was not a direction that the mathematics department was keen to pursue.

As time is always an issue in the mathematics classroom, we were restricted to only helping our weaker mathematics students.

I started working in the classroom with two Year 8 maths teachers. We worked on the remediation of arithmetic skills and we began to see some improved results.

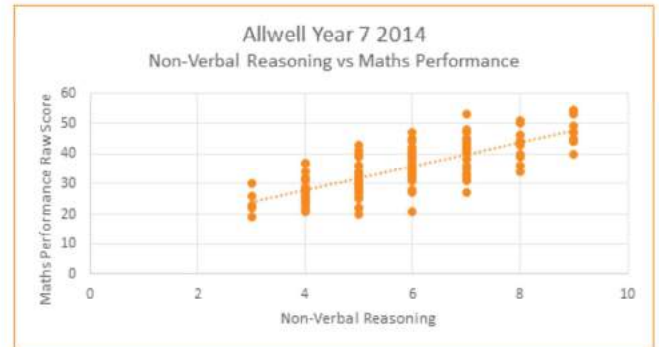
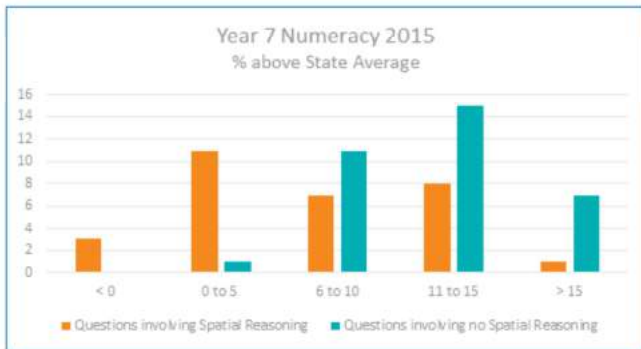
## Year 7 Language Activities



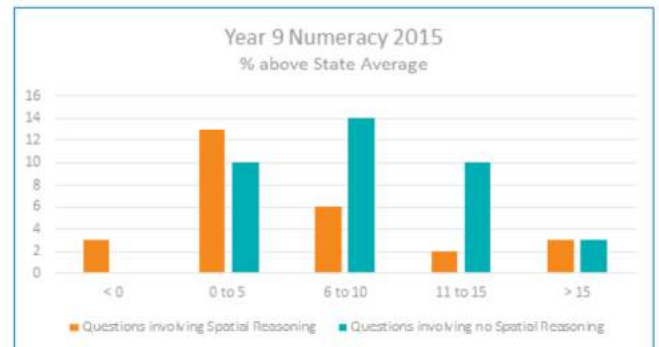
At the same time, we began to focus on Language in Numeracy with Year 7 mathematics classes.

The teachers and students were happy to participate in these activities; however, both these approaches, although important, seemed like band-aid solutions and not something that we would see any long term effective in the wider school community... let alone addressing our long term goal.

## As a school we do quite well in the NAPLAN testing.



However, if you dig a little deeper it becomes apparent that our girls perform relatively poorer on questions involving **spatial reasoning**.

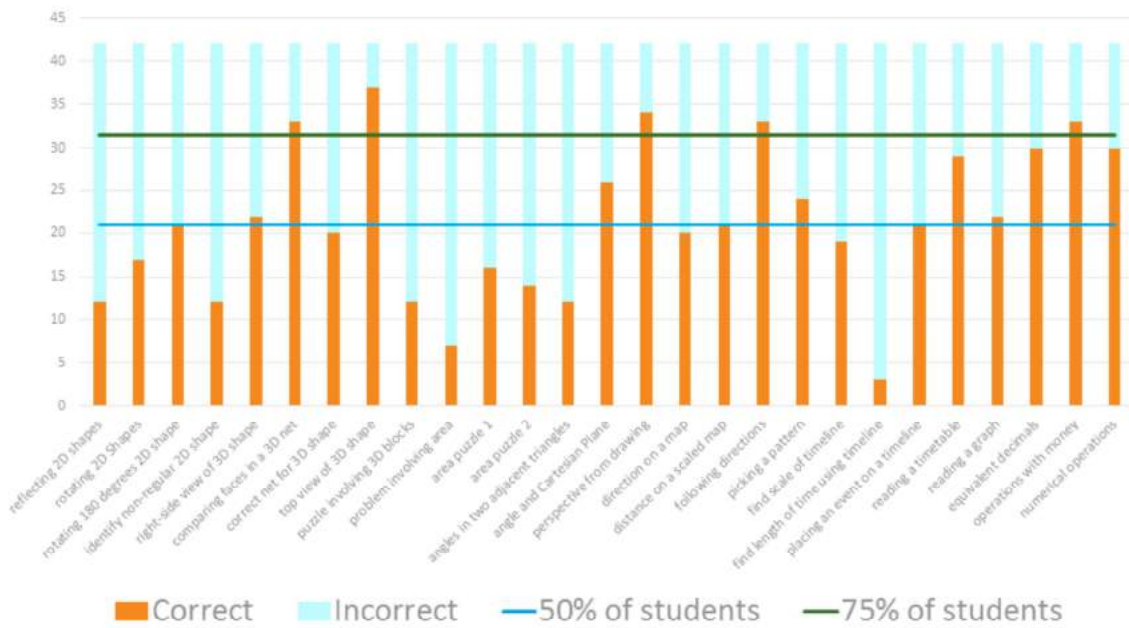


I started to reanalysis data collected and I discovered a relationship between our students' performance and spatial reasoning.

Furthermore, many questions in the quantitative section of the Year 12 AST examinations involve spatial reasoning.

The direction the school should be following became clearer with every data set I analysed.

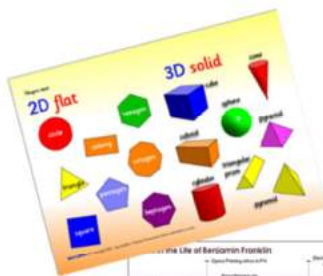
## Spatial Reasoning Questions given to Year 8 Intermediate Mathematics Classes



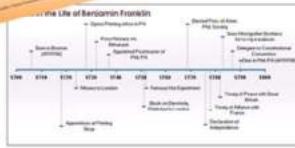
I continued to work with my targeted teachers but this time the emphasis is on spatial reasoning.

Data I had collected showed that in general, spatial reasoning skills were weak in these lower ability classes.

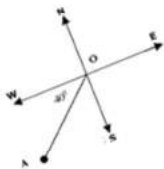
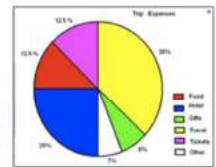




**Spatial thinking is malleable and can be improved through education and experience.**  
 Ontario Ministry of Education, 2014



**Spatial thinking is not an add-on to an already crowded school curriculum, but rather a missing link across that curriculum. Integration and infusion of spatial thinking can help to achieve existing curricular objectives.**



National Research Council, 2006



Inspired, I researched further and found that spatial reasoning is not only important for success in Numeracy but also vital for success in all areas of Mathematics (Cheng and Mix, 2012).

Spatial Reasoning is a combination of many skills. As a result, a student can demonstrate relative weaknesses in one area while showing a strong ability in another. However, spatial reasoning can be taught.

Teaching spatial thinking should be part of normal classroom teaching, integrated into what teachers already do.

I became convinced that this was an area in which we could improve.

Research also showed that improving teachers' comfort level with teaching and learning of spatial thinking skills may directly improve students' ability to solve problems involving spatial reasoning.



**Numeracy has its roots in Mathematics  
but is not exclusive to Mathematics.**

ACARA states... students become numerate as they develop the knowledge and skills to use mathematics confidently across other learning areas at school and in their lives more broadly.

When teachers identify numeracy demands across the curriculum, students have opportunities to transfer their mathematical knowledge and skills to contexts outside the mathematics classroom.

Numeracy has its roots in mathematics but is not just the domain of mathematics. It was important to spread the message.

At the end of last year I began meeting with different faculties and all could see the part that their faculty played in teaching and modelling spatial reasoning skills.

Unfortunately, the break over Christmas meant that many of our teachers came back to school energised and ready to devote their efforts but had forgotten about spatial reasoning. To complicate matters, the school was also going through registration. Busy school, busy teachers...no time.

There are always exceptions to the rule. For those who saw the benefit last year, they continued to emphasise spatial reasoning skills. For some in the Geography department, they have taken Spatial Reasoning on their own journey looking at Global Positioning and Tracking Systems and how they can aid spatial learning.

But for many spatial reasoning remained a dormant thought that could be implemented if they remembered. As a coach this was very frustrating. Some teachers had come on board but most were disinterested. It was important to set up an ongoing working model.



## TQI HOURS



In Term 3 I delivered a two hour PD session which I had TQI approved. I did this as an added incentive. The format of the PD was developed so that the whole two hours wasn't compulsory.

The first hour was during a regular Monday staff meeting. This hour was more an information dumping lecture-like delivery with some time for individual or group reflection. This was intended to get the relevant information out to the whole teaching staff. The final hour could be completed by attending a workshop on either the following two Monday afternoons.



During the first session, we explored what numeracy means and in particular, spatial reasoning. Teachers were asked, and prompted with examples, to think about how spatial reasoning occurs in their subject area and in their classrooms.

Timing

Representing data

Positional awareness

Timeline of events

View a scene

3D modelling

Visual connections

**How does spatial reasoning fit into your subject area?**

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We found that Numeracy is present in every subject.

We also discussed the need to be conscious of Spatial Reasoning and comfortable with it...then as teachers we can help our students to be confident with it.

This is particularly important because we teach girls.



## GIRLS AND SPATIAL REASONING



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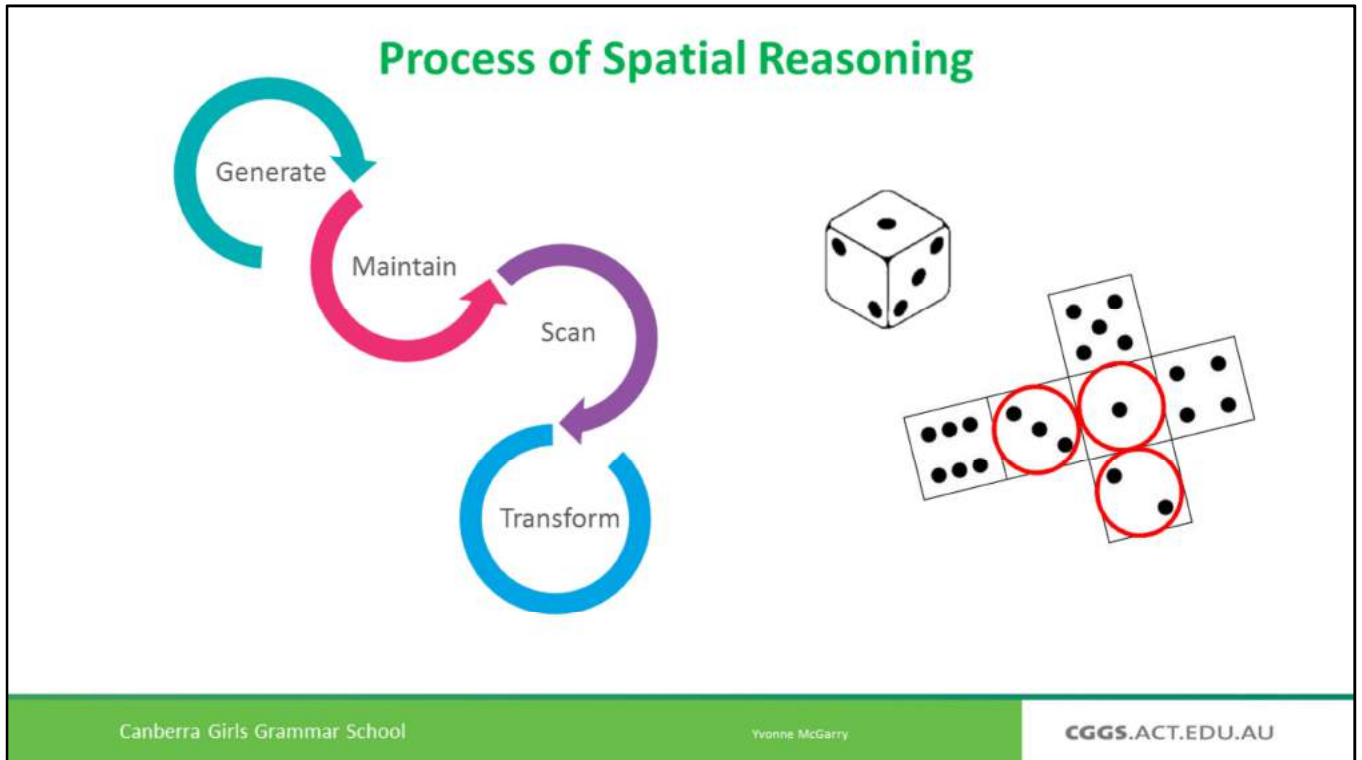
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Women generally score lower than men on tests of spatial reasoning... particularly measures of spatial visualisation and mental rotation.

One's spatial intelligence is a product of one's environment. From an early age, boys play with more spatial toys than girls do and spatial toys are often marketed explicitly to boys.

It is important for our teachers to find opportunities for our students to build spatial reasoning skills.



During the workshops, the focus was on more practical ways to support building spatial reasoning skills.

- Generating a representation from long-term memory or creating an image from words or an idea or a stimulus.
- Maintaining a representation
- Scanning a representation, working to focus attention on some of its parts.
- Transforming a representation into a new view.

e.g. rotating, shrinking, folding or compressing.

Space and scale are easier than rotations or change in perspective.



## TEACHING SPATIAL REASONING

Model it

Don't assume it

Reveal it

Encouraging it

Perform it

I introduced five ways in which we could help to teach spatial reasoning skills in our classrooms...

## Numeracy Planning Tool

What is the Numeracy/Spatial reasoning component?

What language do I need to be conscious of, relate to or introduce?

**Don't Assume it**

What prior knowledge do your students require?

**Perform it**

Is there an appropriate "hands-on" task (remember it could be physical or virtual) or could you use gestures to help make visual connections?

**Reveal it**

Can a 2D visual representation be made? (e.g. diagram, timeline, map, graph, mindmap, etc.)

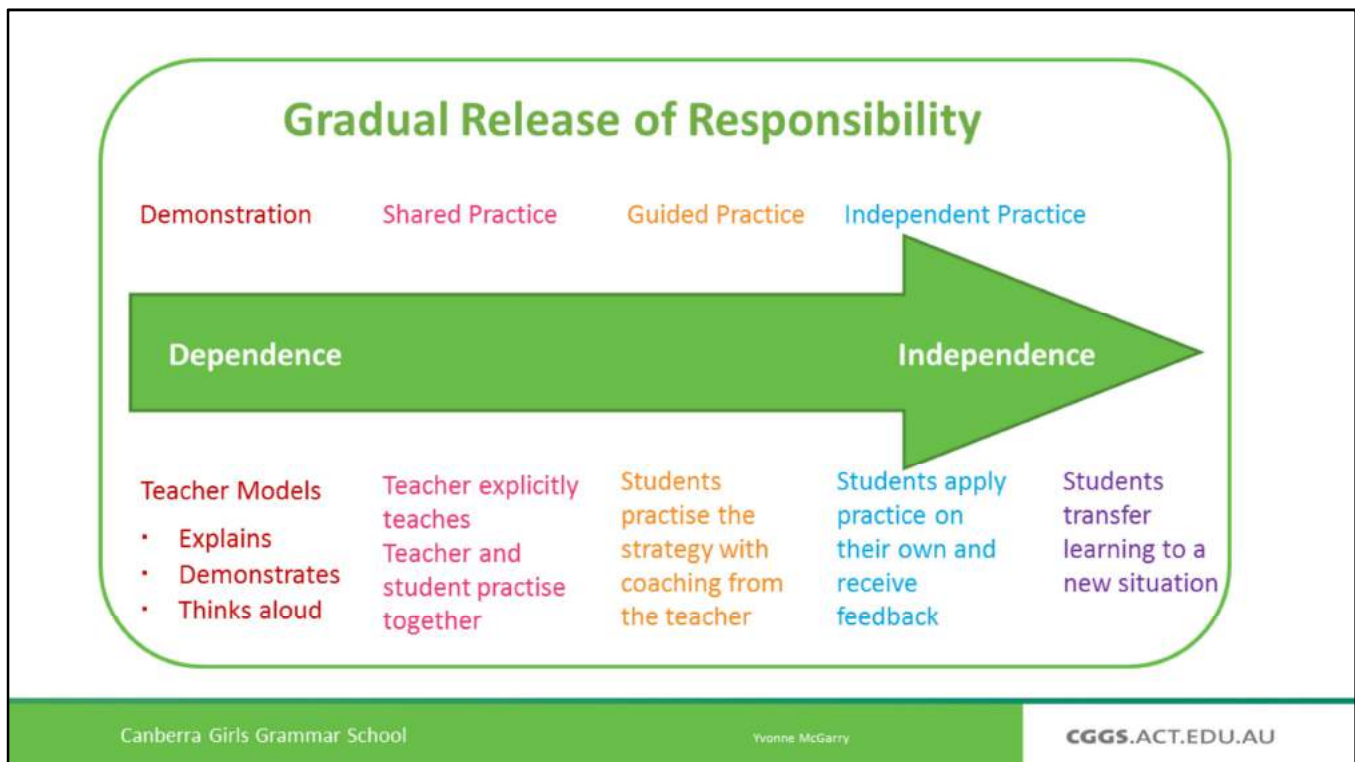
**Encourage it**

How will you encourage spatial thinking? (e.g. environment, expectations, etc.)

**Model it**

How will you show what is expected, needed or wanted from your students? (General release of responsibility model)

and I devised a planning tool to help teachers identify and plan to teach spatial reasoning skills in their classrooms.



Attendance at the PD sessions was good and the feedback I received was very positive. As a result of these PD sessions, I have teachers from many faculties that I am now coaching.

Many of these new recruits have exclaimed that they had never really appreciated how their students struggle in this area. Through their own observations they have come to realise the importance of teaching and practising these skills. As well as a teacher's initial observations of the spatial reasoning abilities of their students, they are encourage to form a pre-test and post-test of skills they wish to teach. This provides the teacher with more concrete data of the difference they are making in improving their students' spatial reasoning skills.

I coach mostly through using the gradual release of responsibility model, with teachers at different points along the scale.

My intension is to have at least one numeracy "expert" per faculty to keep the program going.

## For success to be realised...

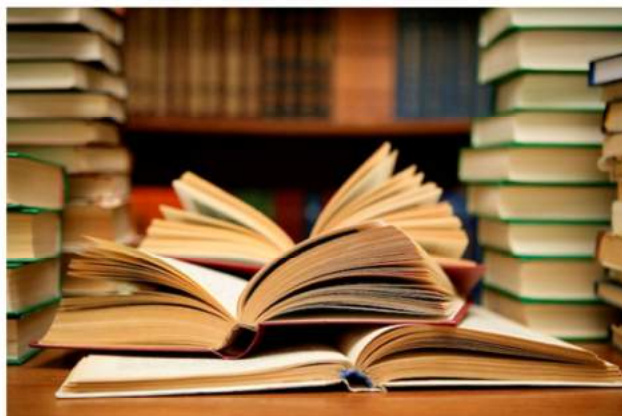
- ✓ The project must be worthwhile and achievable
- ✓ Overall school policy and support for such a program is important
- ✓ Individual teachers must be motivated
- ✓ That it is a journey together and a coach doesn't have all the answers all the time
- ✓ If at first you don't succeed... try, try again



As the journey comes to an end, I have been reflecting on what I have learnt as a coach.

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*Allwell Ability Tests* administered by Academic Assessment Services (formerly Robert Allwell and Associates)

*National Assessment Program Literacy and Numeracy (NAPLAN)*, developed by Australian Curriculum, Assessment and Reporting Authority.