Maths at St Nicholas

Infants Parent Workshop

Tim Unwin - MaST

The Project...

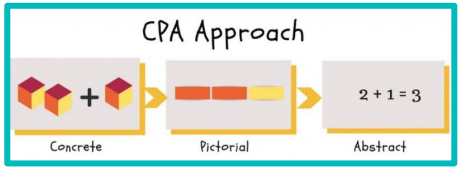
THE HOW

Mathematics Improvement Project (MaST project)

Catholic Schools Office, Diocese of Armidale

VISION: To raise student achievement in Mathematics in the Armidale Diocese through a system approach, based on high impact instruction and gradual release of responsibility, to improve the learning experiences for our students in Mathematics.

AIM: To raise student achievement in Numeracy and Mathematics through a system approach based on high-impact instruction and gradual release of responsibility, to improve learning experiences for our students in Mathematics.



Strengthen mathematical knowledge

KNOW YOUR CONTENT

A DEEP FOCUS ON MATHEMATICAL KNOWLEDGE AND SKILLS BEYOND THE CONTENT IN THE SYLLABUS

Strengthen curriculum knowledge

KNOW YOUR SYLLABUS AND PROGRAM EFFECTIVELY

A DEEP UNDERSTANDING OF THE K-10 SYLLABUS ACROSS ALL STRANDS AND ALL STAGES TO SUPPORT PLANNING FOR A RESPONSIVE AND DIFFERENTIATED LEARNING ENVIRONMENT

Strengthen pedagogical knowledge

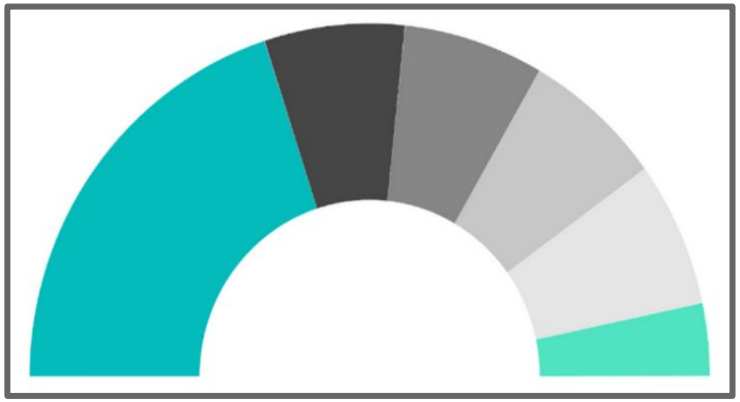
STUDENTS LEARN THROUGH A GRADUAL RELEASE OF RESPONSIBILITY

EFFECTIVE MATHEMATICS TEACHING & LEARNING INCORPORATING THE GREAT MATHEMATICS SEQUENCE, SUPPORTED BY POWERFUL ASSESSMENT & FEEDBACK WITH PLTs FOCUSING ON REFLECTION

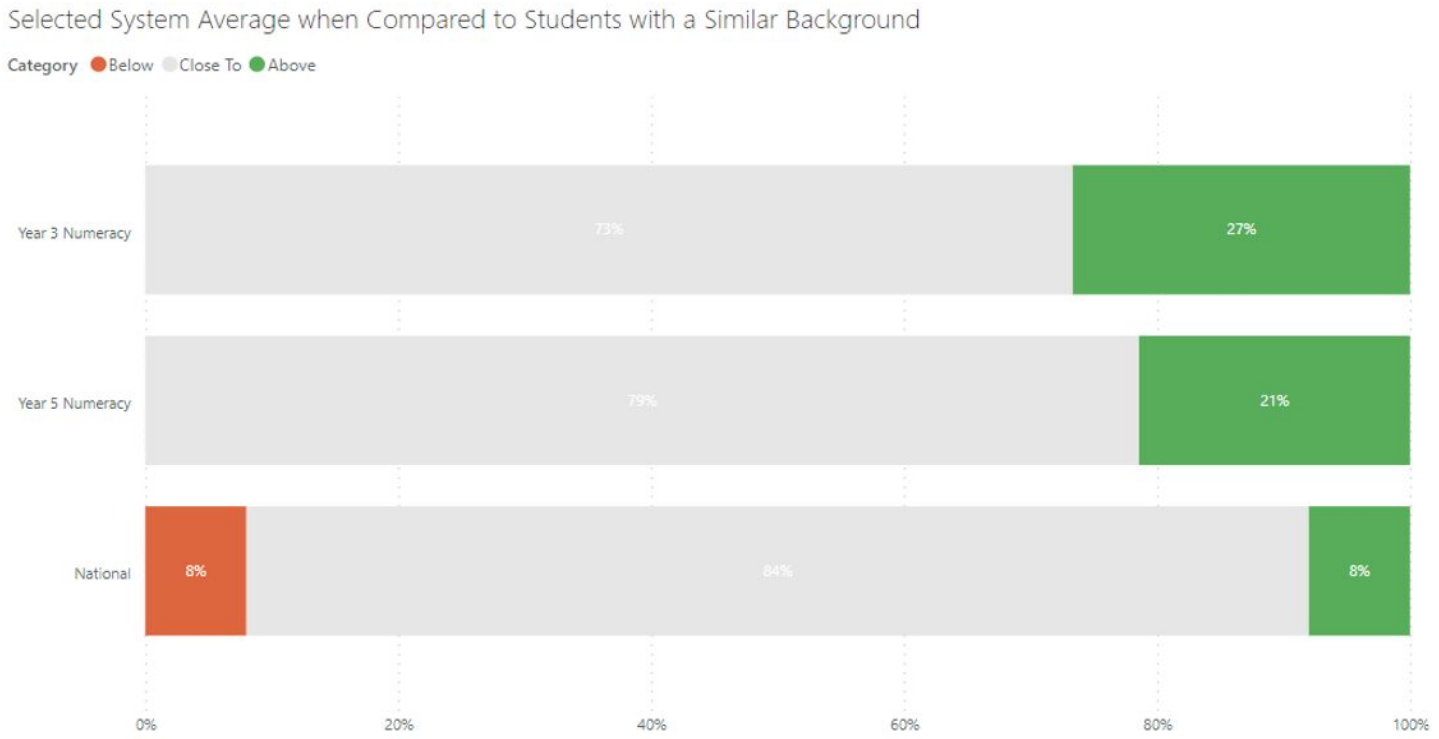
MATHEMATICS SPECIALIST TEACHER (MaST)

- Is selected according to their skills & knowledge of Mathematics and effectiveness in leading the Project in their school;
- Enhance mathematics teaching and learning in the school by developing and sustaining a culture of continued improvement in the teaching and learning of Mathematics;
- Build teacher capacity by implementing the Great Maths Learning Sequence;
- Models lessons and co-teaches in the classroom;
- Complete regular Learning Walks with the leadership team;
- Lead PLTs and disseminate information and knowledge from Professional Learning.
- Unpack each mathematics unit of work to ensure teachers have a deep understanding of the content and skills to be learnt in the targeted outcomes.
- Analyses data with staff and apply the analysis to direct learning.

BREAKDOWN OF MAST ALLOCATION PER WEEK



CSO Armidale Outperforms Students with Similar Backgrounds in NAPLAN Year 3 Numeracy and Year 5 Numeracy



WALT and WILL

WALT: Have an understanding of the C-P-A model and its impact on student understanding

WILL: I can identify strategies for using the C-P-A model with my child.

The CPA Approach

FOR TEACHING MATHEMATICS

Concrete

Use of physical objects or manipulatives

Hands on approach to help meet different learning styles

Known as the "doing" stage.

Pictorial

Drawings or visual representations

No longer needs physical objects to problem solve but benefit from visuals.

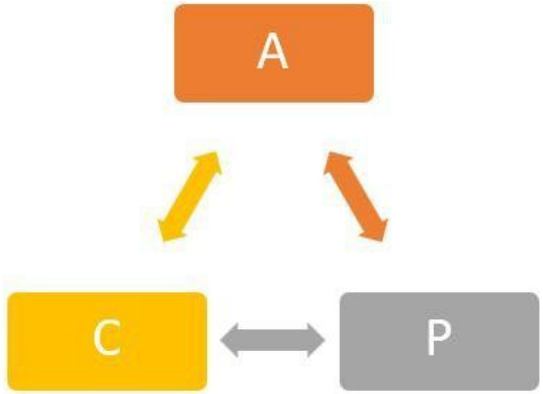
Known as the "seeing stage"

Abstract

Involves solving problems using only numbers

Mathematical symbols are used to solve such as +,-,x,÷

Known as the "symbolic" stage



CPA - Who came up with it?

Bruner's theory states that there are three means of representing tasks:

- "enactive representation" (that requires objects and actions);
- "iconic representation" (which requires sketching, interpreting and building on images); and,
- "symbolic representation" (which is symbolic or language-based).

Another popular education term is "scaffolding" which Bruner coined while developing the three-stage process we've come to know as the CPA approach. The principle behind "scaffolding" is that when designing a teaching and learning sequence the teacher provides very carefully planned assistance to learners, removing support as children progress through their learning.

Concrete → Pictorial → Abstract

What the research says

1) Student motivation has increased during learning with the CPA approach,

2) The performance of problem-solving in students subjected to learning with the CPA approach is better than the performance of problem-solving in students subjected to learning with conventional approaches, and

3) Students' problem-solving performance has improved after being subjected to learning by the CPA approach.

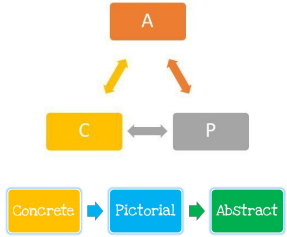
Concrete-Pictorial-Abstract Approach on Student's Motivation and Problem Solving Performance in Algebra

https://www.researchgate.net/publication/343043163_Concrete-Pictorial-Abstract_Approach_on_Student's_Motivation_and_Problem_Solving_Performance_in_Algebra

Concrete phase

Concrete learning is the most physically active part of learning and involves students playing and working with mathematical equipment to explore a new concept or solve problems.

It allows students to use equipment they are familiar with and that generally give a sense of quantity, shape or area tied closer to real-life than pictorial or abstract representations.



Concrete

Holly and Charlie share a piece of square paper equally. In what ways can they do this?

Use your piece of paper to find different ways to represent one half.

Concrete phase - selection of appropriate materials

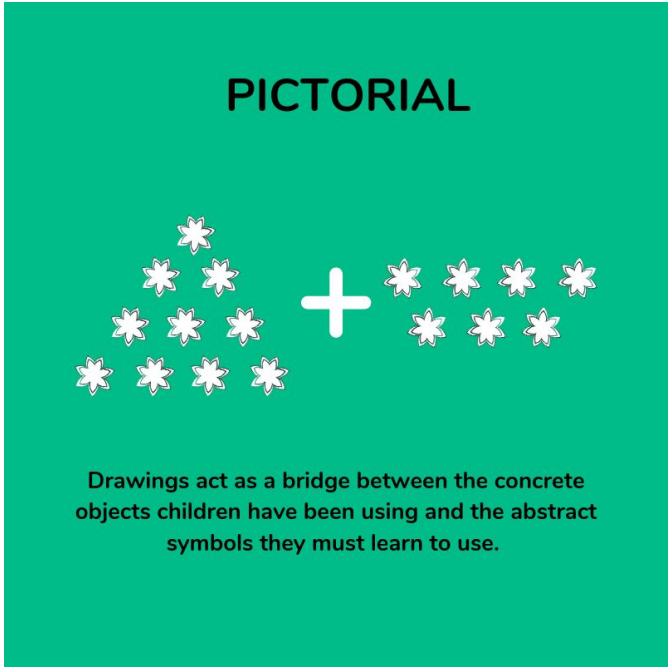
When designing learning tasks with concrete equipment is to provide children with the broadest range of apparatus practicable to allow them to approach the new concept in many and various ways.

By providing children with such a range of concrete objects, they will then have a broader and deeper foundation of the new concept to rely upon when moving on to the pictorial and abstract phases of the relevant learning objective.

Pictorial phase

Here, we encourage students to move from manipulating concrete mathematical equipment to sketching representations and then on to familiar drawn models, such as bar models and part-whole models.

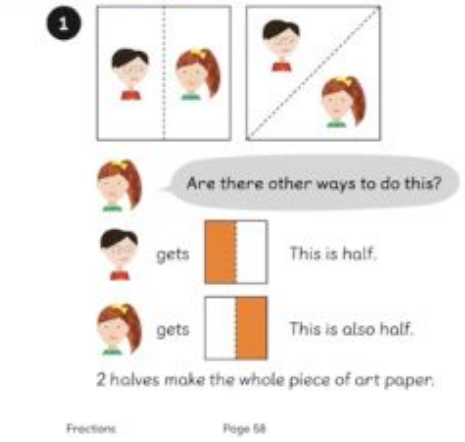
By moving through various forms of pictorial representation, often blended with concrete equipment or abstract representations, students are able to draw and reinforce the conceptual links between physical objects, sketches, jottings and abstract mathematics.



Demonstration

Holly and Charlie share a piece of square paper equally. In what ways can they do this?

Pictorial - Draw diagrams of the different ways the paper can be shared equally. Discuss with a partner how you know that each representation is correct.

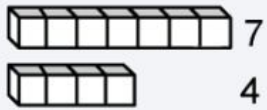


Concrete → Pictorial → Abstract

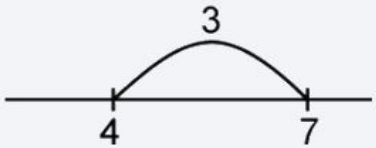
- Create, model and solve word problems, using number sentences
- Represent the difference between two numbers using concrete materials and diagrams

Example(s):

Concrete materials: The difference between 7 and 4 represented by blocks.



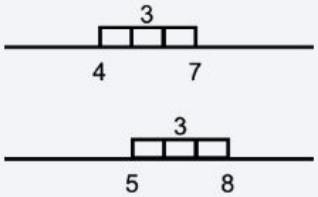
Diagrams: The difference between 4 and 7 shown as a 'jump' of 3.



- Represent a constant difference between pairs of numbers

Example(s):

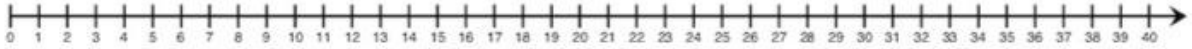
The difference between 4 and 7 is the same as the difference between 5 and 8.



Model 1

Model 2

My numbers



Number line

Abstract phase

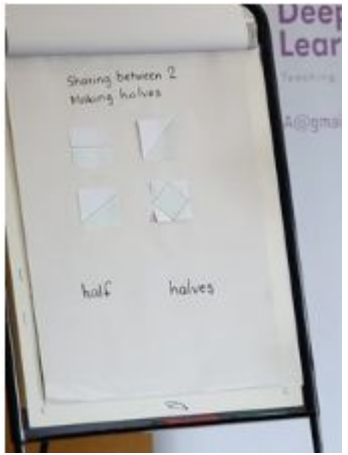
Abstract is the “symbolic” stage, where students use abstract symbols to model problems.

Students will not progress to this stage until they have demonstrated that they have a solid understanding of the concrete and pictorial stages of the problem.

The abstract stage involves the teacher introducing abstract concepts e.g. mathematical symbols. Students are introduced to the concept at a symbolic level, using only numbers, notation, and mathematical symbols e.g. +, –, x, ÷, to indicate addition, subtraction, multiplication or division.

Abstract

Holly and Charlie share a piece of square paper equally. In what ways can they do this?



Although C-P-A is presented as three distinct stages, a skilled teacher will go back and forth between each stage to reinforce concepts.

How can we foster this with children?

- Provide opportunities for use of concrete and pictorial representations
- Start simple, build the skill and breadth of a concept - bigger is not always better
- Ask for reasoning and justification e.g. *How did you know?*
- Think about what we're encouraging *"I really like the way you explained/showed your thinking"* vs *"That is a clever answer"*

Task: How many different ways can you represent 12?

Representing 12

Concrete

Pictorial

Abstract