Fluency in the F-4 Mathematics Curriculum

Denise Neal, April 2012

Activity 1: Chatterbox

Talk to a partner about your understanding of the word fluency. What might parents in your school think it means? What might students think it means?

Fluency

"The more mathematics we learn, the easier mathematics becomes. The more mathematics available at automatic recall, the less of a load on our working memory."

Teaching Mathematics Foundation to Middle Years, 2011, Siemon, Beswick, Brady & Clark

Fluency: ACARA, 2011

- Students develop skills in choosing appropriate procedures, carrying out procedures flexibly, accurately, efficiently and appropriately, and recalling factual knowledge and concepts readily. Students are fluent when they calculate answers efficiently, when they recognise robust ways of answering questions, when they choose appropriate methods and approximations, when they recall definitions and regularly use facts, and when they can manipulate expressions and equations to find solutions.

Automaticity vs mechanical practice

Skemp (1986) contrasted mechanical with automatic skills practice. With mechanical practice, students have limited capacity to adapt the learnt skill to other situations. With automatic practice, built on understanding, students can be procedurally fluent while at the same time having conceptual understanding.

http://www.acer.edu.au/research/publications/aer/aer-59-teaching-mathematics-using-research-informed-strategies

Fluency and cognitive load

Pegg (2010) presented a clear and cogent argument for the importance of developing fluency for all students. Pegg explained that initial processing of information happens in working memory, which is of limited capacity. He focused on the need for teachers to develop fluency in calculation in their students, as a way of reducing the load on working memory, so allowing more capacity for other mathematical actions.

http://www.acer.edu.au/research/publications/aer/aer-59-teaching-mathematics-using-research-informed-strategies

From Mike Askew

It’s important for pupils to be fluent in aspects of mathematics, and judicious use of practice can help develop fluency and strategies.

It’s not a case of practice *or* problem-solving, understanding *or* rapid recall, but practice *and* problem-solving, understanding *and* (appropriate)rapid recall.

Some advice from Mike….

1. **Keep it simple- simple activities work best- not ones which require complicated game rules**
2. **Involve everyone- some activities exclude students who need the practice**
3. **Make it snappy- short and often, not all day!**
4. **Help children monitor their progress- personal bests, not class league tables!**

Year F

At this year level:

- *Understanding* includes connecting names, numerals and quantities
- *Fluency* includes readily counting numbers in sequences, continuing patterns, and comparing the lengths of objects
- *Problem Solving* includes using materials to model authentic problems, sorting objects, using familiar counting sequences to solve unfamiliar problems, and discussing the reasonableness of the answer
- *Reasoning* includes explaining comparisons of quantities, creating patterns, and explaining processes for indirect comparison of length

Year 1

At this year level: Understanding includes connecting names, numerals and quantities, and partitioning numbers in various ways

- *Fluency* includes counting numbers in sequences readily forward and backwards, locating numbers on a line, and naming the days of the week
- *Problem Solving* includes using materials to model authentic problems, giving and receiving directions to unfamiliar places, and using familiar counting sequences to solve unfamiliar problems and discussing the reasonableness of the answer
- *Reasoning* includes explaining direct and indirect comparisons of length using uniform informal units, justifying representations of data, and explaining patterns that have been created

Year 2

At this year level:

- *Understanding* includes connecting number calculations with counting sequences, partitioning and combining numbers flexibly, identifying and describing the relationship between addition and subtraction and between multiplication and division
- *Fluency* includes counting numbers in sequences readily, using informal units iteratively to compare measurements, using the language of chance to describe outcomes of familiar chance events and describing and comparing time durations
- *Problem Solving* includes formulating problems from authentic situations, making models and using number sentences that represent problem situations, and matching transformations with their original shape
- *Reasoning* includes using known facts to derive strategies for unfamiliar calculations, comparing and contrasting related models of operations, and creating and interpreting simple representations of data

An activity

Year 3

- *At this year level:*
- *Understanding* includes connecting number representations with number sequences, partitioning and combining numbers flexibly, representing unit fractions, using appropriate language to communicate times, and identifying environmental symmetry
- *Fluency* includes recalling multiplication facts, using familiar metric units to order and compare objects, identifying and describing outcomes of chance experiments, interpreting maps and communicating positions
- *Problem Solving* includes formulating and modelling authentic situations involving planning methods of data collection and representation, making models of three-dimensional objects and using number properties to continue number patterns
- *Reasoning* includes using generalising from number properties and results of calculations, comparing angles, creating and interpreting variations in the results of data collections and data displays

An activity

Year 4

- *At this year level*:
- *Understanding* includes making connections between representations of numbers, partitioning and combining numbers flexibly, extending place value to decimals, using appropriate language to communicate times, and describing properties of symmetrical shapes
- *Fluency* includes recalling multiplication tables, communicating sequences of simple fractions, using instruments to measure accurately, creating patterns with shapes and their transformations, and collecting and recording data
- *Problem Solving* includes formulating, modelling and recording authentic situations involving operations, comparing large numbers with each other, comparing time durations, and using properties of numbers to continue patterns
- *Reasoning* includes using generalising from number properties and results of calculations, deriving strategies for unfamiliar multiplication and division tasks, comparing angles, communicating information using graphical displays and evaluating the appropriateness of different displays

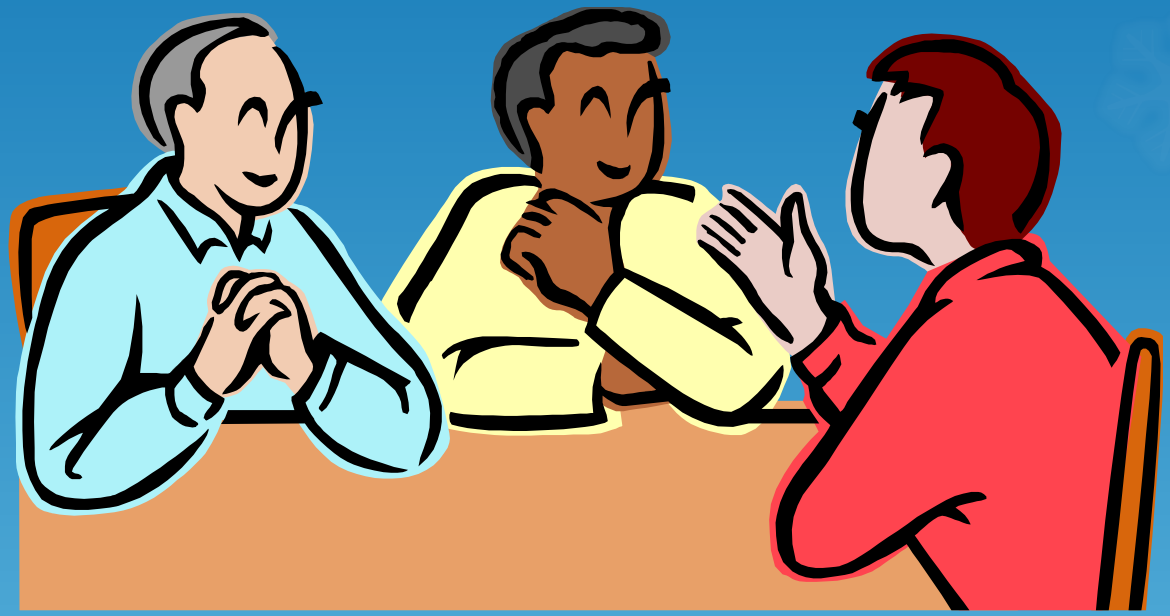
An activity

An activity

What does it look like?

Grade23numeracyetag.mpg

Think, pair, share…..



What aspects of fluency did you observe? What teaching and learning will have preceded this? What type of classroom environment will have lead to this?

Classroom environment

- Adopt pedagogies that foster communication and both individual and group responsibilities, use students' reports to the class as learning opportunities, with teacher summaries of key mathematical ideas.

Pedagogy- Teaching and Learning ACARA, 2010

Choosing engaging experiences as contexts for a variety of tasks assists in making mathematics inclusive, and these tasks can be effectively differentiated both for students experiencing difficulty and those who complete tasks easily. The proficiency strands apply expectations of the range and nature of how mathematical content is enacted, and can help focus teaching.

Pedagogy- Peter Sullivan 2011

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http://research.acer.edu.au/aer/13/

What about assessment?

Consider some of the practices we see in some classrooms- many teachers continue to test without teaching?

Is there a place for “automatic response”?

What are the alternatives?

How do we provide feedback to students on their fluency? How does feedback help students understand that building fluency actually helps them work more efficiently with all aspects of mathematics.?

Reflection

What does fluency now mean for you? How will you explain it to parents, colleagues and students?

What might you try in your school tomorrow to enact this part of the Australian Curriculum?

Thank you

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