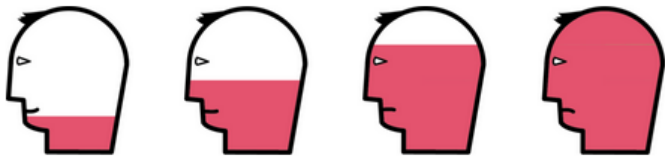


# The Role of MEMORIZATION

Memorization needs to occur *meaningfully* using both procedural and conceptual knowledge.



## Cognitive Load and Math Fluency:

Math problems require the simultaneous use of an array of executive functions: working memory, inhibition and shifting<sup>1</sup>. Effective and efficient math instruction builds students' automaticity offering students a reduction in mental strain.

## Accuracy:

The student's ability to obtain the correct answer<sup>2</sup>. A student may have a strong conceptual understanding but lack efficiency.



## Speed:

Measures the amount of time to do a task<sup>1</sup>. A student may have a strong procedural understanding but lack little effect.

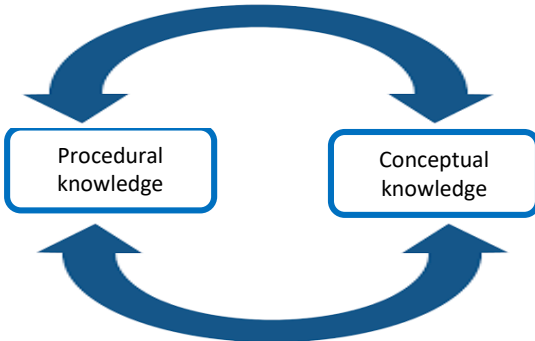
## Key Terms

**Meaningful Memorization:** Having deep conceptual understanding in phase 1 and 2 will lead into a rich and well-interconnected web of factual procedural knowledge<sup>3</sup>

**Procedural Knowledge:** The step-by-step procedure to execute in order to solve a math problem<sup>4</sup>

**Conceptual Knowledge:** Knowledge and understanding of the principles that govern a domain of math<sup>4</sup>

## The Iterative View<sup>4</sup>



## What Is The Iterative View?

Researchers now believe there is a bi-directional relationship between procedural and conceptual knowledge.<sup>4</sup> This view states that knowledge increase in one area can lead to an increase in the other area which can then lead to an increase in the first area and so on.<sup>4</sup> Thus, procedural and conceptual knowledge develop iteratively.<sup>4</sup>

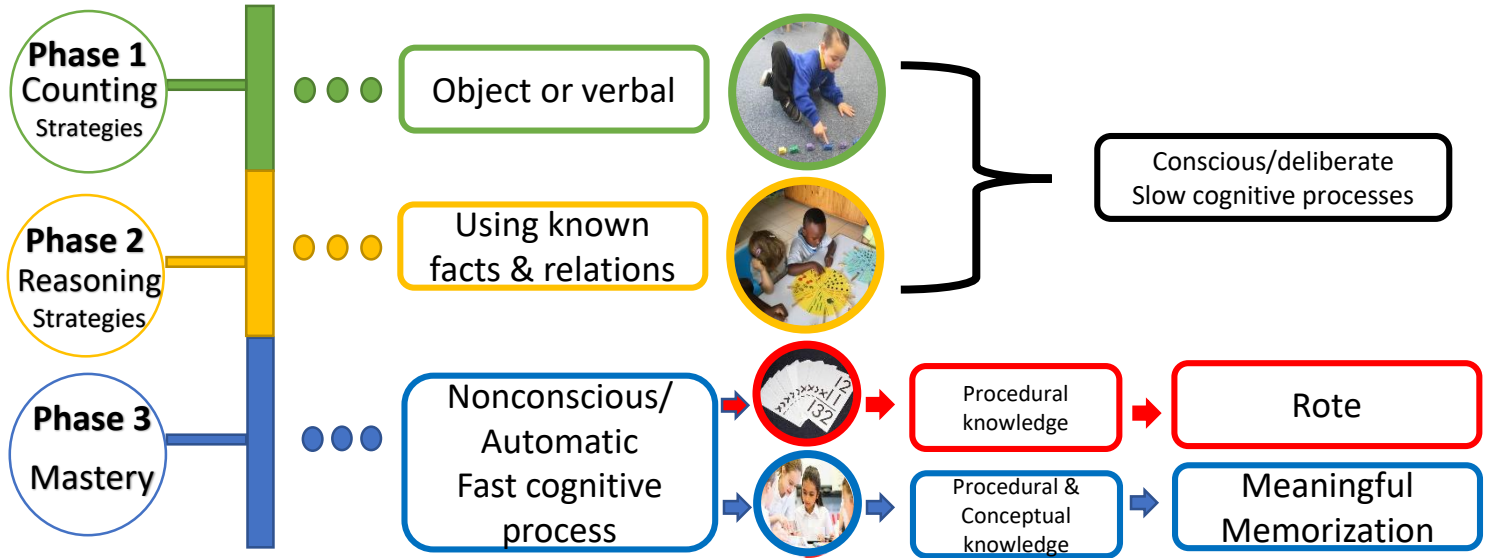
## Think Basketball

To play basketball well, players must be both fast and accurate. To gain these skills players must first understand the proper techniques and practice them. Math is no different. Students must first understand basic math concepts and practice them to perform well in mathematics.



# The Role of MEMORIZATION

## The Phases Children Progress Through to Memorize Basic Combinations<sup>3</sup>



## What types of math should be memorized and, by which grade?

### Addition/Subtraction

- Single-digit combinations by grade 2<sup>5</sup>
- Needed for proficiency in multi-digit +/- and base-10 understanding



Play **Tens Go Fish** for addition/subtraction facts fluency<sup>6</sup>

### Multiplication

- Single-digit facts by grade 4<sup>7</sup>
- Needed for proficiency in multi-digit multiplication, division, comparing fractions, order of operations, and algebra



Play **Four in-a-Row** for multiplication facts fluency<sup>8</sup>

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- <sup>4</sup>Rittle-Johnson, B., Siegler, R. S., & Alibali, M. W. (2001). Developing conceptual understanding and procedural skill in mathematics: An iterative process. *Journal of Educational Psychology, 93*(2), 346-62
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