

Developing Mental Math in Early Learning-Kindergarten 2015

Rationale for Developing Mental Math Skills

This document was put together in order to explain the significance of and discuss how we can use mental math in our Early Learning Kindergarten classrooms.

We know that young children come to school with so much background knowledge. They have been playing with concepts for years as they test theories in a variety of authentic situations in their lives. Every child must have daily opportunities with mental math.

Mental math is important for our youngest learners because it is the math that they are most likely to use in the real world. It supports children in developing number sense and in their understanding of relationships between numbers.

We know that children need to have many opportunities to work with concrete and pictorial representations before being exposed to symbolic representation.

The focus for mental math in Early Learning-Kindergarten is to provide children with opportunities to develop mental flexibility.

Quotes that highlight the importance of math in Early Learning-Kindergarten

“Young children love to think mathematically. To develop the whole child, we must develop the mathematical child.”

Clements and Sarama, p.2

“Students who can work flexibly with numbers...are more likely to develop efficient strategies, accuracy, and a strong foundation for understanding a variety of algorithms.”

A Guide to Effective Instruction in Mathematics, volume 5, p. 35

“Although children are sensitive to quantity, interactions with others is essential to learning subitizing, it does not develop ‘on its own’.

Baroody, Li, & Lai, 2008

“Students’ facility in using basic math facts often has a significant effect on their confidence in themselves as mathematicians. This confidence can be diminished if teachers pay excessive attention to memorization and speed and spend too little time helping students to understand the relationships and patterns in basic facts.”

A Guide to Effective Instruction in Mathematics, volume 5, p. 12

Resources Available to Support Mental Math Minilessons

- *How Children Learn Number Concepts*, by Kathy Richardson (Spectrum)
- *A Guide to Effective Instruction in Mathematics K-3 Number Sense and Numeration*
- *Number Talks: Helping Children Build Mental Math and Computation Strategies*, by Parrish (Spectrum or Pearson)
- *Number Sense Routines: Building Numerical Literacy Every Day in Grade K-3*, by Shumway (Pembroke Publishers)
- *Games for Early Number Sense* by Fosnot (Pearson)
- *It Makes Sense! Using the Ten Frame Chart to Build Number Sense*, by Conklin and Sheffield (Scholastic or Spectrum)
- *Reasoning with the Rekenrek*, by Andrews (Spectrum)
- *Fosnot Mental Math Minilessons for Early Addition and Subtraction* (Pearson)

Goals

- Children will recognize some quantities without counting
- Children will use a variety of tools: dot cards, five frames, ten frames and rekenreks (in this same sequence)
- Children will work with the concept to 10 once the concept of 5 is consolidated
- Children will compose and decompose numbers to 10 (e.g., 5 is 1 and 4 and that it is also 2 and 3; 8 is 6 and 2; 3 and 5 makes 10)
- Children will make connections between different representations (e.g., identify that 3 on a dot card is the same as 3 on a five frame)
- Children will use terminology such as more, less, fewer, the same as when referring to a group of objects
- Children will look at two groups of objects and be able to identify which set has more
- Children will know one more than and one less than

Mental Math Minilessons in Early Learning-Kindergarten

- Gather children in the meeting area for 5-10 minutes daily in whole group or small groups (routinely everyday)
- Have a specific goal by addressing curriculum expectations; the educator plans for tomorrow based on what happened in today's minilesson (assessment for learning)
- Use the following visual quantity representations: dot cards, 5 frame, 10 frame, ten wand (using 10 snap cubes), rekenrek
- Allow ELK children to have their own tool (e.g., dot cards, 5 frame, 10 frame, ten wand, rekenrek) when appropriate
- Provide time, when appropriate, for turn and talk to build on children's level of engagement and to support thinking
- Ensure that children are sharing their thinking with their classmates

- Use a thumb up/thumb down signals to indicate agreement, to indicate understanding
- Focus children’s thinking using questions, such as “How did you see it?” Have children explain how they saw the quick image.

Curriculum Expectations for Mental Math

NS1.5 recognize some quantities without having to count, using a variety of tools (e.g., dominoes, dot plates, dice, number of fingers) or strategies (composing or decomposing numbers, subitizing)

***Teaching Tip:** When a child rolls a die and says “5” immediately after rolling that number, this tells us that the child knows that number from the arrangement of the dots on the die. We want to encourage children to see quantities. If we ask children to count, when they know a quantity, we are in fact asking the children to take a step back in their learning since subitizing is a more efficient strategy to use in comparison to counting.*

NS1.7 demonstrate an understanding of number relationships for numbers from 1 to 10, through investigation

***Teaching Tip:** When we think of relationships between numbers in essence we are thinking about composing and decomposing numbers. We expect our children to be able to know as many different ways to compose and decomposed each number from 1-10.*

NS1.11 investigate addition and subtraction in everyday activities through the use of manipulatives (e.g., interlocking cubes), visual models (e.g., a number line, tally marks), or oral explanation (e.g., dramatization of songs)

Note: Number sentences are not an expectation in ELK.

Developing the following related curriculum expectations will support the development of mental strategies:

NS1.1 investigate the idea that quantity is greater when counting forward and less when counting backwards

NS1.2 investigate some concepts of quantity

NS1.8 use ordinal numbers in a variety of everyday contexts

NS1.9 use, read, and represent whole numbers to 10 in a variety of meaningful contexts

Planning for mental math in Early Learning-Kindergarten

There is a progression in the planning which is very intentional. Children need to have opportunities to work with small quantities (0-4) before moving on to larger quantities (5-10). We need to continue to work with a quantity of 10 throughout the two-year program.

Quantity to 3

- Begin by naming very small collections of items (1-3). Naming collections helps build connections between quantity terms (how many) and number words
- Introduce dot cards with quantity to 3

Quantity to 5

- Introduce dot cards (before five frames, ten frames and rekenreks)
- Ask: What do you see? How do you see it? And/or How many do you see? How do you know?
- Introduce five frames
- Show five frames and dot cards together (so that children can see connections between the quantity on a dot card and the quantity on a five frame)
- Use finger plays to work on the concept of 5 (e.g., 5 Little Monkeys)
- Play concentration games with cards that have different arrangements for each number and a rule that you can only “peek” for two seconds
- Challenge children to say the number that is one more than or one less than a quick image on a dot card. They might also respond by showing a numeral card or writing the numeral. Or, they can find the arrangement that matches the number you show. (Clements & Sarama, p.15)

Teaching Tip: *Did you know that a five and a ten frame could be used two different ways? It can be read vertically or horizontally. Show children both orientations of the five and ten frames to build a deeper understanding.*

Quantities to 10

- Continue to use dot cards
- Use games with dot cards that show different arrangements of dot numbers (linear dot formations are easier for children in comparison to a sporadic arrangement of dots)
- Provide experiences with the number 5 to consolidate an understanding of 5 as an anchor for the numbers below and above it
- Use a five frame to introduce quantities of 6-10- children will see the need for a second row, hence a ten frame (e.g., Quantity 7: they will see 7 as a full five frame and 2 more)

- Introduce a ten frame to work with quantities from 1-10
- Give each child cards with 0 to 10 in dots in different arrangements. Have children spread the cards in front of them. Then announce a number. Children find the matching card as fast as possible and hold it up. Have them use different sets of cards, with different arrangements, on different days. Later, hold up a written numeral as their cue. Adapt other games with these card sets (Clements & Sarama, p. 13)
- Use bead strings (to 10) with two colours of beads (one set of 5 grouped together followed by the next set of 5 coloured beads). We can use bead strings as a part of whole group lesson and incorporate throughout the learning environment as well. I wonder if children will think of their own games using the bead strings if they are available to them in their play.
- Use a rekenrek only focusing on quantity to 10. We can focus on showing quantity up to 10 with the one rack or both racks. This is a great tool for playing with a variety of combinations to 10. Use the Rekenrek book available in each school to see guiding questions.

Note: If you want to see samples of dot card arrangements, refer to these two resources (which are in all schools)

- The Guide to Effective Instruction in Math, Number Sense and Numeration (QK.BLM2)
- Number Talks (p. 71-81)

Teaching Tip: We can introduce a game that has varying degrees of difficulty to match all learners playing the game. For example, a concentration game that has dot cards and five frames in one colour that focus on subitizing to 3; another set of dot cards and ten frames to 10. This provides multiple entry points for the children.

Ways to incorporate mental math into daily transitions

- Use a drum to signal children to line up. Hit the drum with a specific number of beats. Have the children hold up the corresponding fingers to match the rhythm. You can also have children think about one more or one less than (the actual drum beat) by holding up fingers to reflect one more or one less.
- Use dot cards or dot plates in line. Ask children to hold up the corresponding number to match the dot plate that is held up for them. Show a variety of dot arrangements. Children could also create their own set of dot plates. I wonder how they would organize their own dots. This could also be brought back to a meeting to discuss how the arrangement of dots might help or hinder the way we see quantity.

Materials to support Mental Math in Early Learning-Kindergarten

- Dot cards/dot plates
- 5 frames & 10 frames
- Bead strings
- Ten wand (10 snap cubes together; 2 sets of 5 in two different colours so that children can see each 5 in the ten wand)
- Rekenrek (working with quantity to 10 (in one row or two))
- Dice & Dominoes: Should be available and a part of everyday play in a variety of centers around the room
- We can be very intentional to include rich, open-ended materials throughout the room to provoke math thinking. This way, the math learning and thinking is not restricted to one area or time. It is embedded throughout the day.

Terminology

Concrete Representation:

When we ask a child to solve problems using their fingers or objects (such as manipulatives), we are asking them to show us their thinking through a concrete representation. This is a focus in Early Learning-Kindergarten.

Pictorial Representation:

When a child chooses to draw or sketch their response to a problem, they are showing us a pictorial representation.

Symbolic Representation:

The use of a symbol (+ - =) to represent a function. In Early Learning-Kindergarten we use words to represent the actions that we want children to understand. For example, “3 and 2 more is 5.” The “and” represents the addition symbol; “is” represents the equals symbol. Numerals are also symbols; this form of representation is encouraged in kindergarten in conjunction with a concrete or pictorial representation to develop understanding.

The Equal Symbol:

We understand the language of “equal to” but do children? Children grapple with this concept in and around the class through play yet they may continue to have misconceptions. If they are shown the symbol too early, they may not realize that whatever is to the left of the equal symbol is the same as the information on the right.

For example, 3 and 2 is the same amount as 1 and 4

We want children to understand that these two combinations hold the same value or represent the same quantity.