While we are waiting think about…

A positive experience that stands out for you as a student in a mathematics classroom.

An experience that was not so positive for you as a student in a mathematics classroom.

Was learning mathematics an enjoyable experience overall for you?
Getting to know
the Alberta Mathematics Curriculum
Background and Conceptual Framework
A session for parents
Session Outcomes

Participants will understand ...

• Why did the mathematics curriculum change in Alberta?

• What are the big changes?

• What do these changes mean for your child's mathematics learning?
Changes lead by Research

- In order for a child to learn mathematics we know that the child must construct understanding of the concepts in their own way.
- Children need many opportunities to explore concepts in order to make sense of them.
- Teaching by telling how to do math is least productive for most learners.
• For children to store information in long term memory they need to make many connections between facts and ideas.
• Critical to learning is efficacy – the belief that one can learn mathematics with effort.
• Children need to struggle with ideas. Show and tell will not lead to lasting learnings.
Changing Focus

Conceptual Understanding
More depth, less breadth
Relationship among important mathematical ideas
Why certain procedures work

Personal Strategies
Construct meaningful formulas and procedures

Algebraic Reasoning
Learning to model, relate and generalize begins in primary

Number Sense
Fluency: accuracy, efficiency and flexibility
Benchmarks and referents
The Seven Math Processes permeate teaching and learning

Communication
Connections
Mental Math and Estimation
Problem Solving
Reasoning
Technology
Visualization

‘filters for understanding’

The Alberta K-9 MATHEMATICS Program of Studies with Achievement Indicators

Background and Conceptual Framework
Mental Math and Estimation

Use mental math to find these differences.
As you solve each question, keep track of the processes you are using.

\[ 35 - 16 = \quad 92 - 56 = \quad 1001 - 692 = \]
### Mental Math and Estimation

<table>
<thead>
<tr>
<th>Grade 3: Number</th>
<th>Grade 4: Number</th>
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<tbody>
<tr>
<td>Describe and apply mental mathematics strategies for subtracting two 2-digit numerals, such as:</td>
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<td>• taking the subtrahend to the nearest multiple of ten and then compensating</td>
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<td>• thinking of addition</td>
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<td>• using doubles.</td>
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<td>[C, ME, PS, R, V]</td>
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<td>Demonstrate an understanding of addition of numbers with answers to 10 000 and their corresponding subtractions (limited to 3 and 4-digit numerals) by:</td>
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<td>• using personal strategies for adding and subtracting</td>
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<td>• estimating sums and differences</td>
<td></td>
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<tr>
<td>• solving problems involving addition and subtraction.</td>
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<td>[C, CN, ME, PS, R]</td>
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Why emphasize Mental Math and Estimation

Types of Calculations Used in Everyday Life

• 200 volunteers recorded all computation over a 24-hour period
• 84.6% involved some form of mental math
• Only 11.1% involved a written component
• Almost 60% of all calculations required only an estimate rather than an exact answer

What mathematics do adults really do in everyday life?
Mental Math and Estimation

Mental mathematics is the cornerstone of all estimation processes.

Draw a number line like this one.
Place the fractions \( \frac{3}{8} \) and \( \frac{4}{7} \) on the number line.
Explain to a partner how you decided where to place each fraction.
**Benchmarks and Referents**

*Benchmark:* something (for example a number) that serves as a reference to which something else (another number) may be compared.

**Glossary: Alberta Online Guide**

- Place given numerals on a number line with benchmarks 0, 5, 10 and 20
- Order a given set of decimals by placing them on a number line that contains benchmarks, 0.0, 0.5, 1.0.
- Using 0, ½, 1 to compare and order fractions
- Estimate the quotient of two given positive fractions and compare the estimate to whole number benchmarks
- Estimate the square root of a given number that is not a perfect square using the roots of perfect squares as benchmarks.
Benchmarks and Referents

Referent: a personal item that is used to estimate.

- Known quantities: five-frame ten-frame
- Using 10 and 100 as a referent for estimating quantities
- Real-life referents for measurement units: cm, m, mm, g, kg, mL, L, cm², m², cm³, m³, minute, hour

1 mm is about the thickness of a dime
1 L is like the small milk container
50 g is the mass of a chocolate bar

To estimate the length of my eraser, I use my referent for a cm, the width of my baby finger, and mentally iterate it.
• The focus of mathematics learning is for the students to learn through problem solving
What does this look like in the classroom?

A problem solving lesson would:

- Start by having the teacher present a problem
- Allow for students to work in groups to find a solution
- Students present ideas
- Teacher summarizes ideas with the students and questions the students
You work for the ABC Toy Company.

Your job is to discover all the different shaped boxes that could be used to ship exactly 24 cubes.
Making Boxes

How many different boxes are there?

How do you know you have found all the possibilities?

What changed as the shape of the box changed? What stayed the same?
Making Boxes

Describe ways to determine the surface area of any right rectangular prism.

Which box uses the least amount of packaging material? Why?
Analyzing the Processes Problem Solving

Learning through problem solving should be the focus of mathematics at all grade levels.

- Alberta Program of Studies

The Alberta K–9 MATHEMATICS Program of Studies with Achievement Indicators

Background and Conceptual Framework
Students will demonstrate understanding of division of a three-digit number by a one-digit number.

- Our community had 326 players register for minor soccer. There will be teams of 7 players. How many teams can be made?
Math Processes: Visualization

Visualization “involves thinking in pictures and images and the ability to perceive, transform and recreate different aspects of the visual-spatial world.”

- Thomas Armstrong

Are these two shapes congruent?
Math Processes: Visualization

Visualization is fostered through the use of concrete materials, technology and a variety of visual representations.

- Alberta Program of Studies
Subitizing Quantity

- By the end of grade one we want children to be able to visualize quantities to ten.
Math Processes: Technology
Calculators As Tools for Thinking

Technology contributes to the learning of a wide range of mathematical outcomes and enables students to explore and create patterns, examine relationships, test conjectures and solve problems.

- Alberta Program of Studies

Number Patterns

Type in the number 0.3. Press “+ 0.05” and then “=“. Keep pressing the “=“ sign. What do you notice?

Type in “0.57” and then press “+ 0.05“ and then “=“.
Shut your eyes and keep pressing the “=“ sign until you think you have a number greater than 1.
Technology contributes to the learning of a wide range of mathematical outcomes and enables students to explore and create patterns, examine relationships, test conjectures and solve problems.

- Alberta Program of Studies

### What’s My Number

**Partner 1:**
Pick a number between 1 and 9.
Divide this number by itself using the calculator:
Example: $5 \div 5 = 1$
Do NOT clear the calculator. Give it to your partner.

**Partner 2:**
Try to find your partner’s number.
Press any number from 1 to 9 and then press “=“.
You just divided the number you pressed by your partner’s number.
The Nature of Mathematics permeate the curriculum strands

Change
Constancy
Number Sense
Patterns
Relationships
Spatial Sense
Uncertainty

“underlying big ideas”
Determine if these equations are true or false without calculating the actual sum or difference – Use relational thinking!

37 + 56 = 39 + 54
33 – 27 = 34 - 26
471 – 382 = 474 - 385
674 – 389 = 664 - 379
583 – 529 = 83 - 29
The Nature of Mathematics

Number Sense

Key Idea

Number Sense is not directly taught or an innate ability. It is developed by providing rich mathematical experiences.
The Nature of Mathematics

Number Sense

Rote Memory vs. Automaticity

- committing isolated facts to memory one after another
- drill and practice

- relies on thinking, using relationships among the facts
- focusing on relationships
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The Alberta
K–9 MATHEMATICS
Program of Studies with Achievement Indicators

The Power of Thinking Strategies

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The Alberta K–9 Mathematics
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#### Program of Studies with Achievement Indicators

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- Count On
- Doubles
- Near Doubles
- Names of 10
- Nine strategies
- Making 10
- Skip count by 2
- Number in Middle
- Commutativity

The Alberta K–9 Mathematics Program of Studies with Achievement Indicators
Using relationships to learn Multiplication facts

- The most difficult for children to learn is $7 \times 7$
- How could I get this from other facts?
- If I knew $2 \times 7$, I could know $4 \times 7$ and also $8 \times 7$ and one less $7$ is $7 \times 7$
- If I know $3 \times 7$, what is $6 \times 7$? And so one more $7$ is $7 \times 7$
- If I knew $10 \times 7$, I would know $5 \times 7$ and then two more $7$’s is $7 \times 7$
The Nature of Mathematics

Number Sense

Developing fluency with the basic facts

Concrete understanding

“Direct Modeling”

Developing strategies

“Mental Counting Strategies”
“Basic Facts”
“Derived Facts”

Automaticity

The Alberta K–9 MATHEMATICS Program of Studies with Achievement Indicators

Background and Conceptual Framework
The Nature of Mathematics

Number Sense

Key Idea

Students use and develop number sense as they create personal procedures for adding, subtracting, multiplying and dividing.
Personal strategies for subtraction

• Last year we went on a trip by train. We travelled 1247 km during the two day trip. The second day we travelled 593 km. How far did we travel the first day?
Number Sense

Compose and Decompose Numbers

Being able to see the forest
Focus on big ideas

Computational Fluency
• Accurate
• Efficient
• Flexible

More than ‘one right way’

Increased confidence
The Nature of Mathematics

Patterns

Mathematics has been called the ‘science of patterns’.

Through the study of patterns, students come to interpret their world mathematically and value mathematics as a useful tool.

Working with patterns enables students to make connections both within and beyond mathematics.
The Nature of Mathematics

Patterns: Pre-Algebra to Algebra

Grade 1: Concept of equality and record using equal symbol
Grade 2: Concept of not equal and record using not equal symbol

The Alberta K-9 Mathematics
Program of Studies with Achievement Indicators
The Nature of Mathematics
Patterns: Pre-Algebra to Algebra

Grades 3 and 4: Solve one-step equations using a symbol
Grade 5: Equations using letter variables
The Nature of Mathematics
Patterns: Pre-Algebra to Algebra

6 = n
6 + 2 = n + 2

Grade 6: Preservation of Equality
The Nature of Mathematics
Patterns: Pre-Algebra to Algebra

Grades 7 to 9: Algebraic Manipulation

\[ 8 = 2n + 2 \]
\[ 6 = 2n \]
\[ 3 = n \]
The Nature of Mathematics

Spatial Sense

Spatial sense enables students to communicate about shape and objects.

Spatial sense enables students to create their own representations of mathematical concepts.

Like number sense, spatial sense is not innate. It can be developed through meaningful learning experiences.
A pentomino is a shape made up of 5 squares. The squares must touch along complete sides, forming a closed figure.

This is a pentomino

This is NOT a pentomino

How many different pentominoes can you create?

Record all the shapes you made on grid or dot paper.
The Nature of Mathematics
Spatial Sense

Did you find all 12 possibilities?
The Nature of Mathematics

Uncertainty

Chance and Uncertainty
now begins in Grade 5...

Data Analysis
now begins in Grade 2...

The Alberta
K–9 MATHEMATICS
Program of Studies with Achievement Indicators
Grade 4 Specific Outcome #8

Demonstrate an understanding of fractions less than or equal to one by using concrete, pictorial and symbolic representations to:

- name and record fractions for part of a whole or a set
- compare and order fractions
- model and explain that for different wholes, two identical fractions may not represent the same quantity
- provide examples of where fractions are used

[C, CN, PS, R, V]
Instructional Focus

According to the Alberta Program of Studies, how do students learn? How is this different from traditional views of learning by transmission that most of you experienced?

What would a typical mathematics lesson look like in this new view of teaching and learning mathematics?

What implications does this type of instructional focus have for the role of teachers and students a mathematics classroom?

How do parents support these changes?
Goals for Students

The main goals of mathematics education are to prepare students to:

- use mathematics confidently to solve problems
- communicate and reason mathematically
- appreciate and value mathematics
- make connections between mathematics and its applications
- commit themselves to lifelong learning
- become mathematically literate adults, using mathematics to contribute to society.

Students who have met these goals will:

- Gain understanding and appreciation of the contributions of mathematics as a science, philosophy and art
- exhibit a positive attitude toward mathematics
- engage and persevere in mathematical tasks and projects
- contribute to mathematical discussions
- take risks in performing mathematical tasks
- exhibit curiosity.
Reflection

What can parents do?

You know your child best, but for most students parents need to:

• Help them see that math is all around us. Read math-related literature books with the children.

• It is critical to always encourage children by telling them that they can have success with good work habits.

• Ask them regularly what they are learning in math class and allow them to share their ideas.

• Keep close contact with the teacher because early intervention works!